Part I - General Questions

Which is better? Canon or Nikon or Sony or Pentax, etc?

This is a religious question, and most people have strong feelings about it that mainly depend on whichever system they've bought into already. However, it's complicated by the fact that there are definitely strengths and weaknesses of each system.

Note that I say *system* here - I believe it's far more important to consider all the elements of a given camera system (lenses, flash units, etc) than a specific camera model. You often see posts online from people agonizing over whether they should buy the Canon 30D or the Nikon D200 or the Sony Alpha or whatever, but I think they're missing the point. Unless you really really love a specific camera model for some reason, or just want to buy a single camera and lens, it's wiser to consider the features available to you in the whole system.

So I think the question only becomes meaningful when you ask, "which manufacturer makes a system which best suits my particular photographic needs?"

Now since this is meant to be a beginner FAQ for users of Canon EOS cameras I'm not going to get into a long discussion about the merits of drawbacks of each manufacturer. But I will mention a few points to consider.

- Do you want to buy a new film and a new digital camera which can use the same lenses? If so, Canon, Sony and Pentax are currently your choices. (Sony support the lens format developed by Minolta for their film cameras) Nikon have dropped nearly all their film-related cameras and products. Of course, you can still buy tons of incredibly good second hand Nikon cameras and lenses, so this may not be a huge issue for the time being.
- Do you want to be able to use both manual-focus and auto-focus lenses on the same camera? If so, many modern Nikon cameras (though not their cheaper models) fit the bill. Canon's old manual-focus system (eg: the FD-mount series of cameras) is not compatible with its auto-focus system (the EOS series of cameras).
- Do you want to buy affordable fast and quiet lenses with ultrasonic motors or image stabilization? If so, Canon is your better choice. Nikon sell lenses containing such technology but only really expensive ones. Sony take a different approach and include image stabilization in the camera body rather than the lens.
- Do you have specialized requirements such as the need for interchangeable finders or fully compatible macro bellows or high-capacity film backs? If so, Nikon is probably a better choice.
- Do you want a really lightweight camera? Canon's low-end SLR gear is some of the lightest around.
- Do you have a good friend or relative with lots of camera equipment? If so, and they're willing to lend you it from time to time, you should probably get the same system that they use. They can also be a valuable resource when you have questions and problems.
- Do you want to start out with cheaper products and slowly build up the system with time? If so, Canon's a good choice since they sell cheap, midrange and expensive gear that's all compatible.

And of course there are many other things to consider. If you're interested to know some of the reasons that I personally chose the Canon EOS system, have a look at my article on the topic.

Really, though, it comes down to personal choice. Make a list of the type of features you need to suit your photographic requirements and work out a basic budget. Go to a camera store. Check out the various cameras and lenses that fit that budget and decide if they feel right for you. Play with the camera controls - do they make sense to you? Does the camera grip feel comfortable? Does the maker offer the equipment you want at prices you can afford?

What does "EOS" mean?

Canon's line of auto-focus-capable SLR cameras is sold under the name EOS. This stands for "electro-optical system" but is also meant to be a reference to Eos, a Greek goddess of the dawn. Some people pronounce it like the goddess (ee-oss) and others as separate letters (ee-oh-ess).

Note also that the company itself is Canon with one N. In its very early days it was named Kwanon, after the Buddhist goddess of mercy. However the company soon changed to Canon (a general law or principle).

What does "EF" mean?

Lenses built by Canon for use with their EOS series of cameras are technically known as EF-series lenses. This acronym stands for "electro-focus." Older Canon lenses which are not marked EF, such as FD and FL series lenses, are not compatible with EOS cameras.

Compatibility is very straightforward - if it's an EOS camera then an EF lens will fit. However, there is one complication. In 2004 Canon introduced a new EF lens mount variant for certain digital EOS cameras only. This variant is known as EF-S. An EF-S mount camera can accept both EF and EF-S lenses, but all other EOS cameras take only EF lenses. Newer consumer and midrange EOS digital cameras can use both EF and EF-S lenses.

There are four other minor points of note here. Mainly of interest to completists, but there we go.

- First, Canon sell expensive specialized TS-E and MP-E lenses which, while technically not EF lenses since they lack auto-focus motors, are nonetheless designed for EOS cameras.
- Second, while Canon auto-focusing lenses are technically known as EF you will sometimes see them referred to as "Canon auto-focus" lenses. Third-party lensmakers may or may not use the EF specification - they might simply refer to their lenses as being "For Canon EOS" or "Canon auto-focus compatible."
- Third, Canon briefly sold a camera with an EF lens mount which lacked auto-focus circuitry. This camera, the EF-M, could accept all EF lenses but you had to focus them manually.

- Finally, just to confuse things further, in 1973 Canon released a manual-focus camera which was called the Canon EF. It predates the EOS system by 14 years and it cannot use EF lenses.

What does "SLR" mean?

All Canon EOS cameras are SLRs, which stands for "single lens reflex." Very simply an SLR is a camera in which there is only one lens, which is used for both picture-taking and viewfinding. When you peer through the viewfinder at the back of the camera you're looking directly through the main picture-taking lens, so you can see pretty well exactly what's going to be in the final picture. There isn't a separate viewfinder lens on the front of the camera like on a point and shoot camera.

The word "reflex" in there refers to a mirror used to reflect light from the lens up into the viewfinder. SLRs also have glass pentaprisms or pentamirrors on the top, which explains the protruding section on top of the camera.

What is the history of EOS cameras?

While today Canon and Nikon are considered the big two Japanese 35mm SLR manufacturers, and thus the world, this was by no means always the case. German camera makers dominated the global camera market for the first half of the previous century, with many local players selling products successfully in generally less prestigious markets. Then, in the 1950s, Nikon became the 35mm frontrunner with a host of smaller firms - Pentax, Minolta, Canon, Olympus, Miranda, Ricoh, etc - following on behind. Canon made some breakthroughs with their F1 and A1 cameras in the 1970s, but by the 1980s they were definitely lagging and Minolta (now sadly gone from the camera market) were making considerable inroads.

Canon's first step to pull itself ahead in the SLR market came with 1986's innovative T90, a manual-focus camera designed in collaboration with the noted German industrial designer Luigi Colani. The T90's curved organic shape, heavy reliance upon computer automation and intuitive user interface set the direction for the entire Japanese SLR industry for the next 10-15 years.

The company realized, however, that the future of photography lay in autofocus. Their early experiments - such as the T80, which shipped with somewhat clumsy auto-focus lenses adapted to the FD manual-focus lens mount - weren't particularly successful, so Canon took the risky and unusual step of abandoning their FD mount altogether. In 1987 they released the first cameras and lenses of the EOS system.

EOS cameras were utterly incompatible with Canon's previous products; a move which obviously alienated legions of Canon FD owners. The risk was calculated, however. EOS cameras with their EF lenses did not rely on any mechanical linkages between body and lens. Unlike all other camera makers Canon chose to house both the auto-focus motor and the aperture diaphragm motor in the lens barrel itself.

This gamble paid off when Canon were the first maker to release lenses containing fast and silent focussing ultrasonic auto-focus motors. Canon's comprehensive line of USM lenses, along with the professional-quality EOS 1 and 1N camera bodies, helped Canon firmly establish themselves as a strong favourite of professionals. Massive

sales of their low-end EOS cameras also allowed the company to enter markets in which Nikon, with a traditional emphasis on mid to high-end cameras, could not compete.

The EOS lineup branched out to encompass digital image sensors in the mid 1990s. First Canon teamed up with Kodak to release a number of EOS 1 series pro bodies combined with large digital add-on gear. Then, in October 2000 Canon introduced the D30, its first fully homegrown digital SLR camera. Canon now sell a wide range of digital EOS SLRs, covering the familiar consumer/advanced amateur/pro ranges, and are the largest DSLR maker in the world, with Nikon close behind.

What is 35mm film?

Most Canon EOS film cameras use 35mm film, which is photographic roll film exactly 35mm (about 1.4 inches) in width. The film is punched with sprocket holes on either side, so the useable image area of 35mm film is 24mm by 36mm in size.* The film is wound onto spools and the spools sealed up inside metal (occasionally plastic) lightproof canisters. Typically there are either 24 or 36 full size still frames (pictures) on a roll of 35mm film.

35mm film, occasionally referred to as 135 film after the original Kodak product code number, is by far the most popular film format in use today for still photography. It's considered a small format since the negatives are fairly small in size. Other formats used include APS (a consumer film format - see below), 110 (now-obsolete Instamatic film cartridges popular in the 1970s), medium format (6 cm wide film used by portrait and landscape photographers) and large format (big sheets of film in varying sizes, used by some artists).

Canon sell both SLRs and point and shoot cameras - most of which use 35mm film and some which use APS film. They do not support any other film format.

* Technical note - the 24mm x 36mm area assumes three things. First, that the useable width of the film excludes the sprocket hole area. Second, that you're using a 2:3 aspect ratio of height to width. And third, that the width of the film is used for the shorter of the two dimensions. Basically every 35mm film camera sold today uses this image area standard defined by the original Leica cameras of the 1930s, though in the past cameras were made which used smaller film areas by using the width of the film for the longer of the two dimensions. Such "halfsize" film cameras, including the Olympus Pen and Canon Demi, were around mainly in the 1960s and could pack twice as many photos onto a roll, albeit at lower image quality. And in fact motion picture cameras, which first used the 35mm film standard, actually use what is considered a "halfsize" frame format by still photo standards. But enough trivia.

Should I get an APS camera?

In a word, no.

APS - Advanced Photo System - will probably be the last film format ever invented. It was released in 1996 by Kodak and a consortium of major manufacturers, including Fuji, Agfa, Konica, Nikon, Canon, Minolta and Pentax. It packed a number

of technological advancements, such as the ability to record shooting data to film using a magnetic recording layer on the film surface. More importantly, the cartridges were slightly smaller than 35mm canisters, thus permitting the creation of tiny and cute little cameras. The system was also designed to be as idiot-proof as possible, with simple drop-in film loading. APS cartridges were fully sealed and the film was never removed all the way, so users never handled the negatives.

Why do I not recommend APS? Well, first of all the size of the negative is smaller than that of 35mm film. Thus the image quality is, all things being equal, lower. If you're making small (4"x6" or so) prints then this difference doesn't much matter. But what if you get that amazing photo that you want to enlarge? If you shot it with APS then it'd look rather grainy blown up which would be really disappointing. Second, it costs more to process and print APS film than 35mm film. So you pay more for lower quality. Doesn't sound like much of a win to me. And third, APS sales are dwindling rapidly to nothing as digital takes over. So what little support there is for the format will soon be gone. As it is there isn't a huge variety of type of film sold in the APS format - you can't easily find slide or black and white film, for instance.

Therefore APS cameras are fine only if you value a small camera size and slight convenience over image quality, flexibility and developing costs. I feel you're better off with 35mm if you want to shoot film. Standard 35mm film has been around for decades and has proved to be a good tradeoff between convenience (medium and large format film, while offering high image quality, is cumbersome) and quality (35mm offers decent image quality).

This question is relevant to an EOS FAQ because, in addition to a number of currently available APS point and shoot cameras, Canon also used to sell two EOS cameras which could use APS film - the EOS IX (and the ECF-equipped IX E in Japan) and the less expensive EOS IX 7 (international) / IX Lite (North America) / IX 50 (Japan). By all accounts they're quite decent APS cameras and they're fully compatible with all EOS lenses and accessories. Note, however, that you do get a focal length multiplier effect when you use EOS lenses with these APS cameras.

Should I buy a film camera or a digital camera?

When I first wrote this FAQ, film had not yet been dealt the crushing body blow from digital that it has now received. But now, with more and more manufacturers either pulling out of the film market or collapsing altogether, it's clear that digital has won. However, that does not mean that film is completely useless. Here's my take on the issue. Remember that you'll get a different answer from every person you ask.

First, neither film or digital is absolutely better than the other. Which is better depends entirely on your needs, budget and so on.

Next, it's obvious that film is doomed as a *consumer* technology. Digital is more convenient and is becoming cheaper and more accessible for ordinary consumers every day. It also has what marketers like to call more mindshare - even tech-shy grannies are buying digital cameras these days. More and more camera retailers and makers are dropping out of the film market altogether. In fact, Nikon dropped a huge bombshell lately by discontinuing almost their entire film-related product lineup, and Konica Minolta have disbanded and sold their technology to Sony. That doesn't mean, however, that film is going to disappear utterly. Just as vinyl records

are still used for specialized purposes today (namely DJing), film isn't going to vanish off the face of the Earth. However it will become increasingly expensive and uncommon and eventually only some artists and hobbyists will continue to use the antique chemical processes.

Having said that, it is the long term view. And film is still here today, for good reasons. Film is still relatively affordable, convenient and ubiquitous. The quality of film is excellent. Equivalent high-quality digital exists, but still requires an investment in an expensive camera. So at this point in time each medium has its own strengths and weaknesses. Here are some points.

Cost.
Film has low startup costs (film cameras are fairly cheap) but high consumable costs (developing and printing film is expensive). By contrast digital has high startup costs (digital cameras with interchangeable lenses still cost several times the price of equivalent film cameras, plus you really need to buy a decent personal computer if you haven't got one already) and lower consumable costs (if you don't print your pictures you only need to buy storage media, and you can selectively print out only the photos you want).

So. If you plan on taking a large number of pictures, digital may be cost-effective. For more casual or occasional usage film may actually still be cheaper at present.

Quality.
Film has long been superior to digital, but this is no longer necessarily the case. High quality digital cameras (depending on who you talk to, this usually means 10 megapixels or more, given decent lenses) can produce sharp grainless images fairly comparable to those produced by 35mm film. Purists will sniff and say that digital film has an artificial look that film lacks, just as LP aficionados dislike CDs for the same reason. But for most of us digital has reached the point where we can't tell the difference.

Unfortunately, high-quality digital cameras with interchangeable lenses are still pretty expensive. At some point the cost of digital imaging will be lower than film, but for the time being film is the route to affordable quality. And if you want to blow away most digital cameras in terms of image quality you can still pick up an old medium format film camera.

Convenience.
Digital wins this hands down in most cases. Digital cameras usually have preview screens so you can have a rough idea of whether or not your picture turned out a second after you've taken it. Digital images are available immediately - there's no need to take the film to a lab. Digital images can be emailed around the world or put onto a Web page in seconds, without the need for scanning. Naughty home photos can be taken without the embarrassment of lab technicians looking at your stuff and posting them to the Internet. And so on.

Of course, this all assumes you have a personal computer capable of handling photographic digital images handy. If you don't then suddenly film becomes considerably more convenient.

Freedom and experimentation.
One of the most valuable aspects of digital is the sense of freedom it can give to photography. Shooting in digital is essentially free once you've bought the camera, and large-capacity memory cards capable of storing hundreds of shots are readily available. So you can just go out there and shoot shoot shoot, trying every new thing that strikes your fancy, without worrying about developing costs or having to carry dozens of rolls of film with you. Some may argue that this leads to a certain sloppiness - photographers had to be incredibly careful about what pictures they took when taking a photo meant exposing a huge glass plate or a frame of a roll of 6 exposure film that cost a typical month's salary. Which is true, but nobody's arguing that digital is the ideal medium for slow, carefully-composed landscape shots here. The requirements for, say, candid photography are quite different. The other day I shot 90 photos of some swans paddling outside my window; something I never would have done in the days of film. But with digital I could shoot a pile of snapshots knowing I'd have maybe one or two keepers out of the lot and not worry about the expense.

Specialized issues.
There are many other complex issues which may or may not factor into your decision making. For example, most affordable digital cameras today have image chips smaller than the image area of 35mm film. This means that wide-angle lenses behave like less wide lenses, which could be a problem if you do a lot of wide angle photography. Long time exposures are another problem - film is much better for astrophotography and other types of photography for which long exposures are the norm. Most digital cameras have problems with random noise appearing on long (longer than a few seconds) pictures, though Canon's latest noise-reduction algorithms are a vast improvement. On longer trips, digital cameras require more support infrastructure than you might initially think. You need power to recharge batteries, you need to carry portable laptop computers or picture wallets, etc, which can be a problem when travelling, especially in more remote regions. A traditional all-mechanical camera can often still be used even without battery power

So. Whether film or digital is your better option depends on the type of photography you do and how much money you have available. Remember that digital SLRs with interchangeable lenses are still fairly costly - lightweight point and shoot digital cameras with non-removable lenses are a much more affordable choice for casual digital photography.

Why aren't cameras and lenses from different manufacturers interchangeable?

Each camera maker wants to lock you into their system. They don't want to see sales lost to people buying other makers' products. So they design their own lens mount systems which other makers don't or can't use. This also lets the manufacturer unilaterally alter the lens mount design to add new features without the need to consult with a committee or other makers.

This is why a Nikon F lens cannot fit a Canon EOS camera. And why a Pentax K lens can't fit a Sony SLR camera body. Of course, some third party makers build lenses which fit different camera systems, but they do so only by producing different versions of each lens for each camera system.

In the 1960s and 70s many makers used 42mm screwmount lenses of the type popularized by the Asahi Pentax Spotmatic camera. Back then lenses lacked complex computerized autofocus systems and the like, so it was comparatively easy to make them. That's probably the closest the world has ever come to a universal lens mount system. Interestingly, the dream of a universal lens mount is not completely dead - in 2002 Olympus and Kodak collaborated on the creation of a new standard for interchangeable lens digital cameras, which they call Four Thirds. So far Olympus, Kodak, Fuji, Panasonic, Leica, Sanyo and Sigma have agreed to make and sell products which adhere to this standard. Notably absent from this list are Canon, Nikon, Pentax and Sony.

Now, naturally things aren't quite as cut and dried as all that, since lens adapters do exist. Such adapters are machined metal rings which allow lenses for one camera system to fit onto a body of another camera system. Unfortunately such adapters only permit non-EF lenses to be physically attached to EOS bodies - they don't let autofocus and auto-aperture mechanisms work, for example. For more information on these and other drawbacks of lens adapters please consult my article on the subject.

I have an EOS film camera and accessories. Can I use this stuff with an EOS digital camera?

That depends. Most things will work, some things won't, and some things will work but in a slightly different fashion.

Lenses.
All Canon EF lenses will work with any Canon EOS digital camera. However, if you have an EOS digital camera with a subframe image sensor (ie: its image sensor is smaller than a frame of 35mm film) then pictures you take with that camera and lens will look cropped compared to the pictures you take with the same lens on a film camera body. For details have a look at the section on the cropping factor.

It's hit and miss whether your non-Canon (third party) EF lenses will work with your EOS digital camera, however. For example, older Sigma lenses will not work on newer EOS film or digital camera bodies, even though they work fine on older EOS film bodies. This is because their electronics are not compatible. Most Tokina and Tamron lenses should be fine, but there's no guarantee.

Flash.
All Canon Speedlite flash units of the EX variety (eg: 420EX, 380EX) will work fine with an EOS digital camera. However, if the flash unit's name ends with EZ or E then it will not work in a useful fashion on an EOS digital camera - it will not meter automatically. Third party flash units are a toss-up. Most are TTL only and thus will not work on an EOS digital camera. However, if your third party flash supports E-TTL flash metering then it should work, but again there are no guarantees.

Filters.
Filters can be used if they fit the lens in question. If the filter is too big for your lens you can adapt it using a step-up ring to make it fit. But if the filter is too small then obviously it isn't going to be of much use on a larger lens.

Miscellaneous accessories.
Some accessories will work and some won't. For example, let's say you have an RS60-E3 shutter release for your EOS 50 camera. It'll work fine on your EOS 350D camera since they use the same connectors. The Off-Camera Shoe Cord (OCSC) is another compatible accessory and will work fine with a digital camera, letting you attach a flash unit to your camera.

Other accessories won't be compatible. For example, if you have an RS-60T3 switch for your old EOS RT camera it won't work on any modern EOS film or digital camera since the T3 connector is no longer used by Canon. Another accessory that won't work is the TTL Hot Shoe Adapter 3, since it requires TTL flash and EOS digital cameras support only E-TTL flash.

I have a non-EOS digital camera. Can I use its accessories with an EOS digital camera?

As above, that depends. Only it depends more. Some things may be interchangeable; many things may not.

Memory cards.
EOS cameras nearly all use CompactFlash (CF) cards. So if your old digital camera uses CF you're all set. Some of the more recent high-end EOS 1 series digital cameras have two memory card slots - one CF card slot and one SD (Secure Digital) card slot, and so are compatible with both standards. All other cards - Memory Stick, SmartMedia, and so on - will not be usable on an EOS camera.

Lenses.
Lenses are probably not interchangeable. At best you may be able to adapt the lens for another camera through the use of an adapter ring, but if you did so you would lose autofocus focus abilities. This sort of lens adapting is possible, for example, with Nikon F lenses, is awkward for Pentax K lenses, and impossible for Four Thirds lenses. So it depends. For more information on adapting lenses to EOS cameras, take a look at my article on the subject.

Filters.
Same as in the previous section - if they'll fit then they'll work.

Miscellaneous accessories.
Again, it all depends. A simple USB A to mini B cable is going to work with any digital EOS camera that uses USB, but a proprietary data cable (such as the ones Nikon build for their cameras which use Nikon-specific connectors) will not be useful. Some Pentax cameras use the same type of 2.5mm connector for wired remote shutter release cables as low-end EOS cameras. And so on. Generally it's best to assume that most accessories won't work. But there's only one way to find out, and that's to try them!

Which is a better investment? A camera or a lens?

Frankly, neither. To me, cameras and lenses and other photographic equipment are tools to accomplish a job: that of taking great photographs. And Canon EOS gear is just commodity equipment - albeit pretty good commodity equipment - to that end.

It’s not like buying classic Leica camera gear or other stuff sold these days in the collectors’ marketplace as if they were paintings or stamps.

Having said that, it’s clear today that lenses are your best bet for useful EOS photographic equipment which holds up its monetary value over time. Film camera bodies have plunged in price now that digital rules the world. A top of the line film camera, worth as much as a good personal computer just a few years ago, is now traded on the used market for the cost of a good point and shoot.

Camera body pricing has had to change economic paradigms. Digital cameras now follow the computer equipment model in depreciating rapidly the moment they’re purchased. But EOS lenses continue to be resold at decent prices. An L class lens isn’t going to be worth more today than when it was bought, but neither will it plunge rapidly in value if it’s in decent condition.

So, given this fact of the new digital economy, if you’re concerned about money you’re best off buying an expensive lens and attaching it to a cheap camera rather than the other way around.

And not entirely coincidentally, this approach will also result in better photographs. Good optics are still good optics, but digital cameras are improving rapidly year by year. Witness all the people adapting classic German lenses from the 1950s or Japanese lenses from the 1960s and using them with the latest digital bodies - the glass is as good as it always was, and often competes with the best glass made today. It may just be less convenient, since newer lenses sport technological features such as autofocus and image stabilization.

Where can I get a manual for my camera?

If you bought a used camera sans manual or if you simply lost yours you have a number of choices.

Call Canon.
Canon will happily sell you another manual for a modest fee. Just phone the Canon office for your country and someone should be able to help you. Note that they may only be able to offer you a photocopy of the manual for older discontinued products. Calling Canon is definitely your best bet for finding manuals in languages other than English.

Look on Canon’s Web sites.
Canon have started posting electronic (PDF) versions of their new camera manuals online, which is great news. All their digital cameras, for example, have online manuals available. Unfortunately they haven’t posted manuals for their older products.

Check out the unofficial manuals.
At least two Web sites offer original unofficial manuals for certain EOS camera models for free download. One, PhotoNotes.org, is the site you’re looking at now. The other is EOSdoc.com.

Contact a used camera shop.
Many camera shops which specialize in used equipment also sell whatever camera manuals that wind up in their inventory. Two such shops with online presences include Craig Camera (which actually specializes in rare and obscure camera manuals) and KEH.

Buy a third-party book.
You can buy supplemental user manuals from camera shops published by third parties. (ie: not Canon) The names these books are sold under include Hove and Magic Lantern. These third party books are intended to be good companions to the original manual. Unfortunately they are of varying quality - some offer useful detailed information and others, even from the same publisher, are filled with generic fluff. You might want to see if your local camera shop carries the book you're interested in before buying it.

Look on eBay and other auction sites.
There seems to be a small cottage industry in scanning camera manuals and selling CD-ROMs to users. Technically this is, of course, a blatant violation of Canon's copyrights, but Canon apparently don't care and haven't taken legal action against these folks, so it's pretty easy to find such manuals on auction sites. Sometimes people will auction off genuine Canon manuals as well.

Experiment.
The tough way to go. Who needs a manual anyway? Most of Canon's equipment is reasonably easy to figure out, so just play with your camera until it seems to make sense.

What is a third party product?

A manufacturer of lenses, add-on devices such as flash units and so on that sells products designed for another camera system. For example, Tamron, Tokina and Sigma all manufacture third-party lenses designed to work with cameras made by Nikon, Canon, Sony and Pentax. According to this model the manufacturer of the camera system is the first party, the consumer (end user, or you) is the second party, and the manufacturer of the add-on accessories is the third party.

What is a grey market product?

Any merchandise which was not imported into a country by the manufacturer's authorized agent. Some camera retailers, for example, go to Japan and buy camera gear there and import it into the country themselves. This activity is legal but not usually sanctioned by the manufacturer. Since "grey market" sounds rather sinister some shops prefer calling the practice "direct import."

There are three issues with this. First, some manufacturers don't respect warranties on products bought grey market. In the case of Canon it depends if you have a film camera or a digital camera. In the case of film, Canon seem to honour international warranties, though usually only at service depots. Sadly with the advent of digital Canon have reversed this policy and restrict warranty service to the region of purchase. (eg: a camera bought in NYC can be serviced in Toronto, but not in Berlin) This is really frustrating for travellers and other professionals who may find themselves for some time outside their home region. Grey market products made by

other makers may only be serviced by the importer/retailer itself, and the quality and convenience of this service will of course vary. Second, some people may be concerned that a grey market product may be of lower quality than an officially imported one. This fear is normally unfounded. Grey market product may have different names and may have slightly different feature sets, but in the case of photographic gear they're usually all off the same assembly line, though sometimes different labels are slapped on at the end. Third, the product may not include manuals or software in a language you can understand - check to see first.

For more information on grey market products please check out my PhotoNotes Dictionary definition of the term.

Where should I buy my camera?

Camera shopping can be a pretty treacherous endeavour. Cameras are high-priced commodity items, so there can be a lot of sketchiness about the whole camera retail market. Here are your basic shopping options, though.

- Mail order. This is often the cheapest option, though the risks are obvious. First, you can't inspect the merchandise before buying, second, there are risks of shipment damage and third, returns and repairs can be a nuisance with some mail order outlets. You also don't have the opportunity to meet salespeople in person and evaluate their honesty and reliability.
- Small local camera shops. Such shops tend not to have the best prices owing to their high overhead costs and usually have small product inventories for the same reason, but small shops can also have very knowledgeable longtime camera salespeople. Not always, of course - sometimes they hire bored teenagers or surly wannabe photographers, like anywhere else. But good local shops can be a terrific resource. Plus by shopping at a local store you're putting money back into the local community.
- Big mall/main street camera shop chains or department stores. Prices are usually okay, salespeople are usually uninformed and unhelpful. Return policies are usually reasonable, though.
- Online auction sites. These can be cheap, but to say fraud is a serious problem on such sites (especially with reasonably expensive products like cameras) is an understatement. I have another article on this subject, if you're interested.
- Pawn shops often carry camera gear, though usually old junk that nobody wants. Remember that pawn shops offer a very limited return to the seller, so a) you probably won't find much highly marketable EOS gear and b) much of the stuff in the store is probably stolen.

  Another point to be aware of is that a disturbing number of camera shops in general are manipulative and dishonest operations. It's not just big energy, telecom and investment companies which hold the monopoly on corruption. The most common tactic is the old standby, bait and switch. Typical scenarios might go like this:

  > "Hello. I'm interested in the EOS 5D you have advertised in the paper."
  > "Sorry, sir. We just sold our last one. But I don't recommend it anyway

> as it's made in China. For a few dollars more, however, we'll be happy to sell you the higher-quality made in Japan version of the EOS 5D!"

or:

> "Hi. Do you have the used Digital Rebel you have advertised?"
> "We do, ma'am, but you don't want it anyway as it's got a plastic lens mount that breaks. You should buy a brand new EOS 30D instead - it's got a solid *steel* lens mount!"

Luckily you know that all EOS 5D bodies are made in Japan, that Digital Rebels never had plastic lens mounts and that plastic lens mounts aren't easily broken anyway, so you wouldn't fall prey to such scams. But this sort of thing is amazingly common, as is the trick of saying, "if you buy X we'll give you Y for free!" when accessory Y is always included with item X anyway. These scams can be pretty outrageous, like shops advertising a lens for a certain price then, when a customer asks to buy one, saying that the advertised price is for the "plastic" version of the lens rather than the "glass" version, which costs more. Or bizarre barefaced lies, such as claiming that the camera they sell won't work without an additional "processor" at extra cost.

Even if they're not this outrageously dishonest, salespeople can be aggressive and pushy, especially if they're trying to get you to buy something that earns them higher commission points (kickbacks) from the manufacturer regardless of whether or not it's actually the most appropriate product to meet your needs. Or they may insist on selling you a pile of overpriced accessories as a condition of selling you a camera or whatever at a reasonably low price. Or they may charge you unbelievably high shipping costs or put all kinds of unreasonable conditions for returning merchandise. PC World magazine have an interesting article detailing some of these horror stories, pointing out the huge number of scam retailers based in New York City, in case you'd like to learn more.

Having said all this, an honest and reliable salesperson can be a real pleasure to deal with. There was a local store I often frequented for just that reason. Their prices were higher than discount mail-order shops, but the sensible advice and patience of one of their salespeople made it worth it. I often saw people waiting around the counter just to deal with him rather than anyone else in the shop - I wonder if the store manager had any clue what a valuable asset he was.

Here are some other suggestions for buying camera gear.

- Research carefully. Check around for average prices before buying - prices can vary wildly, especially when it comes to used gear.
- Don't buy the first thing you see. Salespeople will push you to buy immediately, but remember that camera equipment is just commodity stuff. One camera model is identical to another; there's nothing special about it. If it turns out you missed a slightly good deal, oh well. Another one will be around the corner soon.

- If the salesperson is rude, aggressive, bored or completely clueless don't buy from them. They don't deserve your money and besides, bad attitude does not augur well when it comes to negotiating returns and repairs.
- Buy with a credit card. If there's a problem you can dispute the charge with your credit company. If you pay with cash you may not have the same sort of leverage.
- Consult the "Neighbor to Neighbor" section of Photo.net. This area is a place where people post their opinions of camera dealers around the world, and is a pretty valuable way to find the more honest and reliable camera shops out there. And of course if you've had a particularly good or particularly bad experience with a shop be sure to post your views so others can take heed!
- Be wary of prices that are too good to be true. They probably are. Sometimes you'll be lucky - I once bought a used EOS lens from a store that obviously had no idea that it was worth twice what they were charging - but it's wise to be cautious.

  In terms of North American mail order, US outlets B&H and Adorama in New York (about the only NYC-based firms without an evil reputation) and KEH in Atlanta have all established good reputations for fair pricing and honesty. I don't endorse them as such, but I can't complain about the service I've received from them - your proverbial mileage may, of course, vary.

  B&H generally have the best prices for new gear but don't have the biggest inventory of used EOS gear. Note that both B&H and Adorama are Jewish-owned businesses and thus observe Jewish religious events and not most Christian ones. So they're closed on Saturdays but open on Sundays. And when they say "we're closed for the holidays" they mean Passover, Yom Kippur, Succos and so on. Check their Web sites for specific dates if you need to order something time-critical and you aren't familiar with the Jewish calendar.

  KEH are the place to buy used EOS equipment on the Internet - their prices aren't the lowest, but they accurately describe the condition of their gear in my experience. They also have a pretty good inventory of EOS gear and have a decent returns policy. I bought a lens off them recently that was defective, and they paid for the return shipping, which was more than reasonable. So, although their prices are higher than a typical auction win, I think of any additional cost as something of an insurance policy. KEH's new equipment prices, on the other hand, are a bit high.

What should I look out for when shopping for second-hand equipment?

So. What about previously owned gear? Well, the attraction is obvious - you should pay a lower price than for brand new. Like a car, camera equipment depreciates in value the minute it leaves the shop, so why not get somebody else to take that financial hit? Or maybe you want to buy a useful product that the manufacturer has discontinued.

Of course, buying second-hand is also riskier. You have to be more aware and more prudent if you want to avoid ending up with a useless broken piece of junk.

I've bought a lot of second-hand equipment over the years, and here are some suggestions.

- Be conservative about where you buy. If you feel any doubt about a seller, trust your instincts. You owe the seller nothing, just as they don't owe you. A local camera shop visited by locals is probably going to be somewhat more sound than a guy selling stuff out of the back of a van.
- The premium you pay from buying from a reputable used camera shop may be worth the lower risk, or it may not. Only you can decide how risk-averse you in when it comes to financial transactions.
- Find out a fair price beforehand for the product. Don't spend more for a used product than you can pay new, for example. This may sound stupid but I spent some time once checking the winning bid prices for various auctions of used products that were still available on the marketplace. Many went for *over* the new price. Crazy.
- Do your research and ask detailed questions about the equipment. Make sure the seller provides useful information. If they can't answer your questions then they probably never used the product and so are less likely to know much about its condition.
- Ask the seller for a history of the product. Why are they selling it?
- Be wary of auction sites or used gear postings when online. Look into insurance options or buying in person. I'm not saying they're always a bad idea, but fraud is rampant online because it's so easy to commit. Have a look at my related article on buying from auction sites.
- Examine the gear before buying if you can. Quite often the physical state of the machine reflects how it was treated, and gear is less likely to fail if it was lightly used or well maintained.
- Look carefully for subtle signs of impact damage - a camera that was dropped isn't going to work as well. General scuffs and marks aren't a big deal except cosmetically, but dents and cracks may be.
- Pop in a working battery, make sure the various controls work, that the shutter operates normally.
- Check shutters for rips, black stick oil, creases or other problems. A tiny bit of wear on an older camera is fine, but shutters are fairly expensive to replace.
- Check lenses for fungus - spider-like growths on the lens interior. You can't get rid of the stuff - it's there forever, and it may get worse. Rotate the focus and zoom rings. Do they move smoothly? Do they catch or bind? Do they make ghastly scraping noises?
- Look for tide marks (lines left by drying liquid) and never buy anything that has been subject to liquid damage, since the risks are high. Rust or green copper corrosion are bad signs.
- Look inside all battery compartments for signs of corrosion. Remove the lens and take a look in the mirror box.
- Ask what comes with the gear. Do you get a manual? Any other stuff?
- Are there identifying marks on the gear? Is there a driver's licence number engraved on it? If so, does the seller have an explanation? If not, it may be hot (stolen) property.
- Does the seller seem unusually eager to sell or ready to dump the gear at a low low price? Do you feel like the seller is pressuring you hard? If so, once again, it may well be stolen.
- Finally, don't fantasize about how your life will be so much better if you buy this thing you're looking at. Consider less fun scenarios. What will you do if you get swindled and sold some broken piece of junk? Remember that, at the

end of the proverbial day, a piece of camera equipment is a generic commodity. It isn't some one-off fine piece of art or something. There'll be another lens or camera or whatever around the corner.

What does (some photography term) mean?

The field of photography is indeed filled with strange and arcane buzzwords. For that reason I've written a huge online dictionary which lists the vast majority of photographic terms you may encounter.

Choosing a camera.

Which Canon EOS camera should I buy?

This question is too vague to answer without knowing more about your needs and budget. It's like asking, "what car should I buy?" Obviously a person who needs a vehicle big enough to accommodate a wheelchair has different needs from a person who wants something to pick up groceries and drive the kids around, who has different needs from someone in a midlife crisis who wants something zippy and sporty, who has different needs from a university student on a tight budget and so on.

So the first thing you should do is sit down and make a quick list of the type of photography you want to do both now and in the future. Here are a few questions you can ask yourself.

Are you looking for a something small and compact for taking snapshots of family and friends?
If so I'd consider a small point and shoot rather than an EOS SLR. SLRs are much bulkier than a pocketable point and shoot. Small point and shoots are also less obtrusive. And higher-quality point and shoot cameras, particularly those with prime (non-zoom) lenses can offer quite reasonable picture quality. In fact, a high-quality point and shoot can take better pictures than an EOS SLR with a lousy lens. You lose interchangeable lenses with a point and shoot, but many people never really need to change lenses.

How much money do you want to spend?
Photography is an expensive field to get into, as artistic endeavours go. A writer can get by with a pencil and paper and a dancer with shoes, but a photographer needs to buy relatively costly camera gear first. Knowing your budget and sticking to it can help you define what options are available to you.

Have you considered the overall camera system first?
Assuming you want to do more with your photography than stick with a single camera and lens, I think it's wise to consider what other gear the same manufacturer makes. If you're interested I have some notes on why I personally chose the Canon EOS system when I moved into the world of autofocus cameras that addresses this point. For example, two major selling points of Canon EOS for me were that EOS equipment is readily available from camera rental shops and that Canon tend to build their new camera technology into midrange equipment quite easily, making the new features reasonably affordable.

Is weight a consideration?
Are you going to travel or go hiking? If so, Canon's low-end and midrange cameras have a serious advantage in that they're very lightweight.

Do you want to pursue photography as a serious hobby or career or do you just want to dabble in occasional picture-taking for fun?
If the former then investing in solid midrange and pro gear makes a lot of sense. But if your aspirations are a little less serious then lightweight inexpensive consumer gear is probably quite adequate for your needs.

Is there a specialized field you're interested in?
For example, do you want to take closeups of flowers or insects, which would require macro lenses or other closeup devices? High-speed sports photography, which requires a camera with a fast motor drive and long telephoto lenses? Bird photography, which requires very long telephoto lenses and fast autofocus? Portrait photography, which requires short telephoto lenses and often the ability to use studio flash? Documentary photojournalism, which typically requires versatile lenses which can work in low light?

Do you want a new camera or are you willing to consider a used model?
There are quite reasonable bargains to be found in the used marketplace. You will not get a warranty (Canon warranties are not transferrable from the initial buyer to a subsequent owner) but Canon products are generally well made. See the section below on used equipment.

Do you want film or digital?
With prices for digital cameras falling all the time it's easier than ever to get into the world of SLR digital, with its instant feedback, lack of film processing costs, convenience and flexibility. But film still offers some advantages, including high quality images with minimal initial investment and freedom from having to process everything on a personal computer.

Don't expensive cameras take better photos than cheap ones?

In the case of film, nope. No matter what commission-driven salespeople may try to make you believe, when it comes to film cameras the image quality of a photograph is basically determined by the quality of the lens, not the camera. (well, and lighting and the skill and aesthetic sensibilities of the photographer and so on) Unless the camera is broken in some way - perhaps if its internal components are misaligned or it's cracked and leaking light - the camera body itself doesn't matter. Many photographers jokingly refer to cameras as "light-tight boxes" to emphasize this point.

You can stick a great lens on a cheap consumer body and take great photos, or you can stick a crummy lens on a super-expensive top of the line pro camera and take crummy photos. If you have the budget for both a great camera and a great set of lenses, by all means go for both. High-end cameras are full of convenient features, give you far more control and can do things that cheaper cameras can't do, like autofocus really rapidly and shoot at high speeds. But if your budget is really tight, always go for the lenses.

In fact, if your budget is really tight and you don't really need the speed of autofocus I'd frankly consider getting an old manual-focus camera from the 1960s or 70s. All kinds of excellent cameras and lenses were being made back then, and they can be bought today very cheaply.

So unless you're looking for a cool-looking new toy to impress your friends and members of the appropriate sex, it's best to spend the bulk of your money on good quality lenses and not the camera body itself.

Of course this doesn't necessarily hold true if you're looking at digital. In this case, yes - the more expensive a camera the higher quality the output, in most cases.

Simply because more expensive cameras tend to have greater resolution than cheaper ones. But even here it's worth using good glass. No point getting a super hi-rez digital SLR and slapping a cheap lens on it. You could also look into a used top of the line camera, which might be cheaper than a new consumer or midrange camera, but which will still offer excellent image quality.

Should I buy a used camera or lens?

There are a lot of quite reasonable buys to be found in the used market. You can buy, for example, a used older-model midrange camera for the price of a new entry-level model. The older camera may not have all the bells and whistles of the newer model, but midrange models are generally better-constructed and more feature-equipped than consumer models.

There are few things to note, however.

- The most obvious point is that used cameras generally have either short or non-existent warranties. Canon products are well made on the whole, but many people appreciate the peace of mind from decent warranty coverage.
- Small local camera shops tend not to carry much used EOS gear, presumably because it's in high demand. You can sometimes come across a good deal, but most small shops seem to carry mostly old manual-focus equipment that people have traded in.
- You can find a good range of used EOS gear on online auction sites such as eBay, but there are big risks buying expensive items via auction sites. (have a look at my online auction risks article for more information)
- Reputable dealers such as B&H and KEH sell a reasonable selection of used EOS gear and describe the condition of the used equipment fairly honestly and accurately, but also tend to charge higher prices. So the tradeoff with such dealerships is lower risks but higher costs.
- You can often find used gear from private sellers by looking for ads posted at camera shops, attending local camera swap meets or checking out Web sites such as Photo.net, but the selection is obviously very hit and miss. There are also risks associated with buying from individuals - you don't know the if the lens has hidden damage, if it's stolen property, if the seller will actually ship the product to you upon receiving payment, and so on.

I've just bought (such and such camera). What do you think?

Many people claim that there's no such thing as a dumb question. I disagree, as this is one. Why buy something and then ask for advice *afterwards*?

Comparing camera models.

What is meant by a "consumer" camera versus an "advanced amateur" or "professional" camera?

Canon design their cameras very carefully. Each model is aimed at a specific segment of the camera-buying market, and each model's feature list is tailored to fit that market. Naturally, Canon don't put too many advanced features into low-end cameras, because doing so would affect sales of their more profitable and expensive

high-end cameras. The categories break down like this, from inexpensive (big EOS numbers) to expensive (small EOS numbers).

Consumer (low-end) cameras.
These are affordable cameras meant to be sold to novice (snapshot) and casual photographers, usually from shopping mall/high street camera shops, discount warehouses, etc. They are lightweight cameras with a basic feature set that have been designed to be as inexpensive as possible. This doesn't mean they're total junk - Canon design fairly decent products, on the whole - but they aren't meant to be durable enough for anything much more than casual use. To keep things simple they are also highly automated and tend to have very few manual controls, and they're made almost entirely from plastic.

Cameras of the Rebel series (North America), Kiss series (Japan), three-digit series (EOS 300, etc) and four-digit series (EOS 5000, etc) are in this category. The EOS 300D/Digital Rebel/Kiss Digital and EOS 350D/Digital Rebel XT/Kiss N Digital are as well.

Advanced amateur/midrange cameras.
These are cameras sold to experienced amateur photographers who, while not counting on their cameras to earn their living, nonetheless want somewhat more rugged and feature-laden cameras than beginners. These models aren't weatherproofed and aren't as tough as the all-metal pro cameras, but they're still decent performers and offer reasonable manual controls. In the case of film cameras they're built mostly from plastic with some metal for top shells and so on. Some of the more recent digital cameras in this range have metal bodies.

Cameras of the Elan series (North America) and two-digit series (EOS 30, etc) are in this category. All the digital two-digit cameras - the D30, D60, 10D, 20D, 30D - are also in this group.

Professional cameras.
These are the expensive and solid cameras sold to photographers who make their living doing photography and require utterly reliable equipment. They're heavy, have a full complement of both manual and automatic controls, and the 1 series cameras are weatherproofed. Their autofocus systems are extremely rapid and are more accurate than those of lesser cameras. Bodies are built with a fair bit of metal in addition to plastic components.

All EOS cameras in the 1 series (1, 1N, 1V, 1D, 1D mark II, 1Ds, 1Ds mark II) are considered to be professional cameras. Other one digit cameras - the EOS 3 and EOS 5 (A2/A2E in North America) - are usually considered to be semi-professional cameras. In the realm of digital all the 1 series cameras (1D, 1Ds, 1D mark II, 1Ds mark II) are pro cameras, and the EOS 5D is likewise semi-pro.

Now, obviously it's perfectly possible for someone to earn a living using a cheaper camera - you aren't obliged to use one designated "professional." And camera marketers are notorious for applying terms like "professional" to any type of product with wild abandon. But generally these are the categories that people use for classifying Canon's EOS cameras.

What's the difference between a Rebel, Elan or Kiss camera and an EOS number camera?

For marketing reasons, Canon use product names (tough manly words like "Rebel") to identify some of the cameras they sell in North America. Many of their Japanese products also have names unique to that market - cute kawaii words like "Kiss." Elsewhere in the world, Canon use straightforward and sober numbers to identify their EOS cameras - the smaller the number, the more expensive the camera.

A table of some of the more common models looks like this:

International	North America	Japan
EOS 1000	EOS Rebel	EOS 1000
EOS 1000FN	EOS Rebel S II	EOS 1000S QD
EOS 500	EOS Rebel XS	EOS Kiss
EOS 100	EOS Elan	EOS 100
EOS 50/50E	EOS Elan II/IIE	EOS 55
EOS 500N	EOS Rebel G	EOS New Kiss
EOS 300	EOS Rebel 2000	EOS Kiss III
EOS 33/30	EOS Elan 7/7E	EOS 7
EOS 3000N	EOS Rebel XS N	EOS 66
EOS 300V	EOS Rebel Ti	EOS Kiss 5
	EOS Rebel G II	
EOS 300D	EOS Digital Rebel	EOS Digital Kiss
EOS 3000V	EOS Rebel K2	EOS Kiss Lite
EOS 30V	EOS 7N/7EN	EOS 7S
EOS 350D	EOS Digital Rebel XT	EOS Kiss N Digital

In the majority of cases the cameras themselves are identical - only the nameplate on the front is different. But there are a few minor differences here and there - the EOS 100 has an automatic popup flash in icon modes whereas the EOS Elan does not, for example. The EOS 5 has a nice manual metering mode display whereas the EOS A2 has a lousy one. Japanese versions may include fake panorama features (the ability to mask out the top and bottom of the negative), and so on. But, on the whole, most of the consumer-level cameras are the same across marketing regions.

Sometimes you'll see someone advertising an international version of a camera in the USA or vice-versa. You do not have to be concerned about quality differences in this case - an Elan 7 rolled off the same assembly line which made an EOS 33, and so on. This can sometimes be to your advantage. For example, Americans seem to be unfamiliar with the international EOS names, since such cameras when sold used

usually command lower prices on average than their identical but US-named counterparts.

The main issue is warranties. In the case of EOS film cameras Canon appear to honour international warranties - a camera bought in Japan should be serviceable under warranty in Britain, for example. However, in the case of digital EOS cameras Canon disappointingly do *not*. If this is an issue for you be sure to examine the fine print of the warranty before buying - that cheap camera you bought in New York on holiday may suddenly seem like less of a great deal if it fails under warranty when you're home in Paris or Sydney. It could also be a hassle if you're a professional photographer on an extended shoot overseas.

Note that Canon introduced their current numeric system (smaller numbers = more expensive cameras) with the introduction of the EOS 1. EOS cameras sold before then - the 600, 700 and 800 series models - have a fairly random numbering scheme. For example, the EOS 600/630 was an advanced amateur/semipro camera for its time, whereas the 750 and 850 were really low-end consumer cameras. Otherwise Canon have stuck fairly faithfully to this numbering scheme for all international EOS models. North American and Japanese product naming does not, however, follow much of a pattern and generally just goes by whatever sounds good.

Should I buy a consumer camera or an advanced amateur camera?

The answer to this question depends on your priorities. And, yes, it can get a little confusing sometimes. Particularly since a recent-model consumer camera can have a similar feature list to an older-model advanced amateur camera. But the basic differences are as follows, at least in terms of EOS film cameras:

	Consumer models	**Advanced amateur models**
Product series, North America	Rebel	Elan
Product series, Japan	Kiss	Varies - EOS 100, 55 and 7
Product series, international	Three (except EOS 100) and four-digit EOS	Two-digit EOS and the EOS 100
Weight and size	Very light and small	Medium and midsized
Build quality	Lightweight	Sturdier
Rear command dial	No	Yes
Custom functions	No	Yes
Manual controls for metering (evaluative,	No	Yes

partial, etc)		
Manual controls for AF modes (AI Servo, etc)	No	Yes
DEP or A-DEP mode	A-DEP (automatic focus point selection)	DEP (manual focus point selection)
Lens mount material	Plastic (except Rebel Ti/EOS 300v/Kiss 7)	Stainless steel
Maximum shutter speed	1/2000 sec or 1/1000 sec, depending on model	1/4000 sec
Maximum flash sync (X-sync) speed	1/90 sec	1/125 sec
Flash exposure compensation controls on body	No	Yes (only controls internal flash on Elan/100)
Patterned red AF assist light	No	Yes (except Elan 7/7E/30/33/7)
Motor drive speed	1-2.5 frames per second, depending on model	2.5-4 frames per second, depending on model
Eye-control version available	No	Yes (except original Elan/100)
Viewfinder type	Early models use a pentaprism (brighter); later models use a roof mirror (dimmer)	Pentaprism (brighter)

So which camera is better depends, as always, on your needs. The consumer series cameras are inexpensive lightweight cameras and an excellent value for beginners and people on a budget. The advanced amateur series cameras are sturdier, offer more control and are more appropriate for people who want to take their photography beyond casual snapshots.

Therefore you should consider an advanced amateur camera if you want greater control over metering and motor winding modes, if you want the rear control dial (which makes shooting in manual mode and using exposure compensation easier), if you want a higher flash sync speed (1/125 sec rather than 1/90), if you want flash exposure compensation built into the body and if you want the camera body to be slightly tougher.

How do the EOS A2/5, EOS Elan II/50, EOS Elan 7/30 and EOS Elan 7N/30V compare?

This is a popular question right now, since the cameras are available for roughly similar prices these days. However they're very different models with different positions in Canon's marketing lineup. I've written up a separate page listing the differences between these three models.

How do the Rebel 2000/EOS 300/Kiss III and the Rebel Ti/EOS 300V/Kiss 5 compare?

At time of writing the two models are actually fairly closely priced. And if you're definitely interested in buying a new camera, the Rebel Ti/300V looks like an excellent deal. You get quite a lot of features for not much more money over the older Rebel 2000/EOS 300, such as a metal lens mount, dioptric adjustment, optional infrared remote control (date model only) and so on. The main issue with the newer model is personal opinion - not everyone likes the new swoopy look of the Ti/300V. I've written up a separate page listing the differences between the Rebel Ti/300V/Kiss 5 and its two predecessors.

How do the first generation EOS cameras like the 600 series or the 700/750/850 hold up today?

The 600 series (in chronological order, the 650, 620 and 600/630) was the first group of EOS film cameras that Canon built. As the EOS system was still in its infancy back in the late 1980s the product lineup wasn't quite as well-organized into consumer, midrange and pro lines. Canon's autofocus technology was also less refined than it is today.

The 600 series cameras are thus quite interesting. Since they covered a wider range of marketing categories than modern EOS cameras they often contain desirable features available today only on high-end EOS models. For example, the 600 series cameras are very sturdily built - a diecast metal chassis with a plastic shell. Their shutters require no power to keep open, making them perfect for astrophotography and other long-exposure applications, they can be used with all types of high-speed infrared film and they support interchangeable viewfinder screens. The EOS 630 had a very high frame rate at 5fps and the 620 and 600/630 had illuminated top-deck LCDs. The 600 series cameras also support the Technical Back E, a remarkable device that contains all kinds of interesting features like reprogrammable metering program, a keyboard for recording notes and an intervalometer.

On the downside, 600 series cameras have linear autofocus sensors which are rarely as decisive as cross sensors. They also have less developed user interfaces that are particularly inconvenient to use in manual exposure modes. These early cameras also suffer from disintegrating shutter bumpers. And Canon no longer carry parts for these old cameras, so you may need to rely on third party repair shops for repairs.

The 700, 750 and 850, on the other hand, were Canon's early forays into building consumer EOS cameras, much like the Rebels of today. And they're rather clunky slow cameras with incomplete feature sets - no manual exposure modes, for example. They also contained interesting but ultimately unsuccessful user interface experiments like the 700's reversible mode dial. I wouldn't recommend buying one today. You can get better cameras for not much more money.

Note that you can safely use all EOS-compatible lenses with any of these old cameras. Aside from minor issues with IS lenses they all work just fine.

How do the early 90s EOS cameras like the 100/Elan, 10/10s and A2/5 hold up today?

By the early 1990s Canon had essentially standardized the user interface for their midrange and low-end EOS film cameras and had also separated out their product line into the basic categories seen today. Many of the cameras from this era offer an excellent balance of features and functionality and can be bought quite cheaply on the used market. Canon have been steadily increasing the base feature set of their EOS line over the years, so a midrange camera of a decade ago may have a similar feature set to a beginner camera of today, but the older midrange camera will have been built to a higher level of sturdiness and quality since it cost more back then.

I have reviews elsewhere on this site of the 100/Elan and the 10/10s. I don't have a full review of the A2/5, but it is included in a comparison chart.

How do early 90s Rebel/consumer cameras compare today?

Consumer-level EOS film cameras of the early 1990s, such as the original Rebel and the EOS 1000, are basically of the same build quality as that of contemporary consumer-level cameras. The main difference is that Canon has gradually increased the feature set of its introductory cameras over the years. For example, nearly all consumer-level EOS cameras these days have multiple focus points and support for E-TTL flash.

Obviously, such older cameras are now available quite cheaply, so they can be a great way for somebody on extremely tiny budgets to get started in photography. Particularly if they affect the choice between getting a half-decent lens and a really lousy lens. But given the limitations of these older models - particularly their slow

autofocus mechanisms - I'd recommend saving up for something a little more capable. After all, the price difference between a used Rebel/EOS 1000 and a used Rebel 2000/EOS 300 is about the same as buying and processing maybe half a dozen rolls of film.

How do the EOS 1, 1N, 3 and 1V compare?

This isn't really a beginner question, since none of these are beginner cameras and all are quite expensive. All four are tough, versatile and heavy professional cameras but as they were introduced at different times their feature lineup is somewhat different. I've written up a separate page listing the differences between the four models.

General Canon EOS camera questions.

I've heard that Canon bodies are easily broken, since they're made of plastic and not metal.

Nonsense. Canon EOS bodies are indeed mostly made of plastic, except for the largely-metal EOS 1 series of professional cameras and the more recent one and two-digit digital EOS cameras. But EOS cameras have been in production since 1987 and it's pretty clear that the plastics used in other models are quite tough and sturdy. The midrange cameras, for instance, typically use fibreglass-reinforced polycarbonate and ABS plastics for various shell components.

In fact, quality plastic shells are superior to thin metal in some cases - plastic is slightly resilient and can bend slightly to absorb a blow whereas thin metal can dent or deform badly, damaging internal components. (thick metal like the alloys used in high-end cameras are tougher than either, though) Plastic is also much lighter, which makes hiking around with a lot of gear more comfortable, and since it doesn't transmit heat as easily as metal, can be more comfortable to hold in colder weather.

Now, it's true that lightweight plastic cameras do feel less impressive to hold and heft. If that's important to you then, yes, low to midrange EOS cameras are not for you.

Does the lens mount material - plastic or metal - make a difference?

Low-end Canon EOS *film* cameras built since the early 90s have used lens mounts made of polycarbonate plastic. (the EOS Rebel Ti/300V/Kiss 5 being the sole exception) All other EOS cameras, including all affordable EOS digital cameras to date, use lens mounts made of metal.

The main advantages of the plastic mounts are that they're very lightweight and cheap to manufacture. Polycarbonate plastic is pretty tough, and although you could probably break such a lens mount if you really tried, most people don't have a problem. Besides, if your camera took a blow strong enough to crack the lens mount you'd probably have other problems with it too.

The main advantages of metal mounts are that they have superior resistance to abrasion and they look posher. So if you hardly ever change lenses then plastic is

probably just fine. But if you frequently change lenses you'll probably want a metal mount, since it won't wear down as quickly. A heavily worn lens mount could, in theory, fit much more loosely.

Besides, most non-pro EOS cameras contain plastic frames regardless of their lens mounts. A metal lens mount screwed to a plastic frame isn't going to be much tougher than a plastic lens mount screwed to a plastic frame.

How can I tell what market segment a camera is aimed at?

Look at the advertising. If the camera brochure features lots of snapshot photos of happy families on holiday, it's a low-end or consumer camera. If the brochure features lots of photos of attractive young women smiling coyly at the camera, it's a midrange camera. And if the brochure features more glossy fashion photos, landscapes, etc, then it's a professional camera.

I have an EOS film camera. Is there any way to turn it into a digital camera?

No, there isn't. The only way to do so is to sell the film camera and use part of the proceeds to buy a digital camera. The other alternative is to shoot with film as usual and then scan the film into the computer.

This question comes up all the time, but the answer hasn't changed. There are a number of reasons why.

First, most EOS cameras don't have removable backs. A few do - the 600 series, the 3, the 1 series - but most have permanently hinged backs, which limits access to the insides.

Second, even if you were to remove the back there isn't much room inside a film-based 35mm camera. Somehow you'd have a cram an image sensor, batteries, processing chips, storage and so on into a convenient add-on module. Which, given the current state of the art in miniaturization, would be tricky. And then link the thing's operation to the shutter release and film advance mechanisms of the camera body itself. There was a firm named Silicon Film which announced such a product a while ago, but after years of repeated promises nothing emerged for sale and the company quietly disappeared from sight.

Third, it is true that Kodak have made a number of digital cameras built around film bodies. The DCS series of cameras, for example, were built around heavily modified EOS 1N and similar Nikon cameras. But these modifications were done during the design and manufacturing process - they used most, but not all, of the 1N body components as a basis for the DCS products. And not only were the bodies re-engineered (motor drives left out, etc) but the digital components ended up sticking out the bottom in massive cases. The one exception to this was the DCS 200 back for the Nikon 8008s/F-801s camera, which was a replaceable digital back with a huge digital computer on the bottom. That one sort of worked but wasn't exactly a bestseller.

Fourth, it's also true that you can buy add-on digital modules for certain medium format cameras. These exist for all the reasons why a 35mm add-on digital module

are impractical. The MF cameras in question are designed with removable backs and film modules from the start, the cameras are quite big so an add-on digital module (particularly one tethered to a personal computer, as many are) isn't a problem and finally, the modules are aimed at the extremely well-heeled commercial photography and advertising markets which can afford the astoundingly high prices for the devices.

Finally, it's obviously theoretically possible for a digital add-on device for EOS cameras to be built, but the likelihood of someone building one is low, for economic reasons. Canon aren't going to do it because they want you to buy brand new digital EOS cameras. Third parties aren't going to do it because the engineering and development costs would be astronomical, each add-on would have to be tied to specific cameras bodies (thereby limiting the potential market dramatically), the technical difficulties in making such a thing would be significant, and so on.

So. Am I saying we will *never* ever see such a thing? Of course not. Who knows what might happen in the future? However, the likelihood of such a product appearing on the market anytime soon would seem to be pretty much nil.

Is it true that you can't use Canon film cameras with infrared film?

This is not a question with a yes or no answer. The short answer is that it depends on the specific model you use and the specific type of infrared film.

The medium-length answer is that most Canon EOS film cameras use infrared film-positioning LEDs (lights) as part of the motordrive mechanism, and these LEDs can inadvertently fog Kodak HIE and EIR infrared film. Konica 750 and Ilford SFX films are not affected.

The long answer is that this depends on the specific EOS model in question - please consult my separate article on the topic.

Why do none of the low to mid range EOS cameras have a spotmeter?

Pro EOS cameras are the only models to contain spotmeters, and this is for marketing reasons. Canon have apparently decided that spotmetering capability - metering light over a small area of the image, typically 1-3% - is a good tool to use to get people to buy more expensive cameras. So unfortunately only their professional and semi-professional cameras have true spotmeters; the exception being the advanced amateur digital EOS 30D.

The least expensive of these options is the venerable and now-discontinued EOS 5/A2/A2E. The other cameras with spotmetering - the EOS 3, 1, 1N, 1V, 1D, 1Ds, 1D mark II, 1D mark IIN, 1Ds mark II, 5D - are all pretty costly.

If you can't afford any of these cameras or don't like how big and heavy most of them are then you'll have to make do with the partial metering feature - metering over about 6.5% to 10.5% of the image area, depending on the model - carried by almost all EOS cameras. Or you can acquire a separate handheld spotmeter and use that. Note, however, that partial metering is very much like a fat spot meter - you can use it in a similar fashion in many cases. Also, if you have a zoom lens you could

zoom in to your metering point, meter with the partial meter, and then zoom out. The result is that you'll be metering from a small area, just like a real spot meter.

How old is my camera or lens?

Canon EOS products often have date codes stamped onto them. These alphanumeric codes are separate from the numeric serial number and are usually hidden away somewhere - inside the film chamber of most cameras or on the black light baffle on the underside of many lenses. Not all EOS products have this code (for some reason Canon gear built in Taiwan often lacks date coding) and those that do often have the code printed in shiny black ink that's hard to read.

The code looks like UG0205, for example. The first letter represents the name of the factory at which the product was made - often O for Oita (cameras) or U for Utsonomiya (lenses). The second letter is the date code, in which A is the year 1986. The next two digits are the month of manufacture, and the last two digits are apparently internal codes meaningful only to Canon. In the UG0205 example, therefore, my lens was built in Utsonomiya in February 1992.

While this date code is entertaining to look up, note that it doesn't necessarily tell you much about the condition of a given item. An old lens might have sat around on the shelf and be in perfect condition today or a nearly new lens might have been knocked around and abused. The date code won't help you here.

I'm left-handed, but EOS cameras are all designed for right-handers. Do I have any choices?

Sadly, no. You just have to get used to it.

Canon, like virtually all other camera manufacturers, have never made cameras designed for left-handed users. All the major controls on EOS bodies are located on the right-hand side of the camera, and the viewfinder also assumes you're right-eyed unless you enjoy jabbing your eye with your thumb. I guess you could use the camera held upside-down if you find the usual orientation to be hard to use, though operating the shutter release with your thumb is a drag. You can buy a crummy left-handed point and shoot if you don't mind eschewing SLRs. But other than that this problem is unfortunately another example of the tyranny of the majority.

Camera functions and controls.

Is there any reason not to use the basic (picture icon) modes of my camera?

Yes. The icon modes are great for beginners but teach you nothing about how to use your camera. Each mode contains a set of assumptions and computer programs that Canon's engineers think will cover the various types of shooting conditions reasonably well.

But if you want more control over your camera's operation - and thus over how your photos will turn out - you'll need to explore the letter modes of your camera as described in the next section.

What do the various letters (P, Tv, Av, M, C, etc) on the command dial mean?

These letters let you choose specific automatic exposure (AE) methods. They're referred to as "creative zone" modes by Canon, since absolute beginners are expected to use the icon ("image zone") modes instead. The creative zone modes give you greater control over the operation of the camera, however, and are thus more appropriate for more experienced photographers.

Program AE mode (P).

When your camera's command dial is set to to **P** the camera will automatically select both shutter and aperture settings for you according to its built-in basic program. It's similar to the green rectangle mode in this respect.

Unlike the green mode you can often adjust exposure compensation, AF, film winding and metering modes in addition to supporting AE lock, exposure bracketing and multiple exposures, depending on the model.

Shutter priority AE mode (Tv).

In this AE mode you set the shutter speed (time) by rotating the main dial located next to the shutter release button. The camera will then automatically set an appropriate lens aperture for you. **Tv** stands for "Time value."

Use this mode if specifying the shutter speed is important. For example, you may want a fast shutter speed to freeze motion or a slow shutter speed to blur it.

Aperture priority AE mode (Av).

In this AE mode you set the lens aperture by rotating the main dial located next to the shutter release button. The camera will then automatically set an appropriate shutter speed for you. **Av** stands for "Aperture value."

Use this mode if specifying the lens aperture is important. For example, you may want a large aperture for better low-light shooting or narrow depth of field. Or a small aperture for wide depth of field.

Metered Manual mode (M).

In this mode you set both the lens aperture and the shutter speed completely manually. If your camera has a rear (back panel) dial then you set the shutter speed with the main dial and the aperture with the rear dial. (or vice-versa, if your camera lets you reverse the dials) If your camera has only a main dial then you have to press and hold a rear button in conjunction with rotating the main dial.

The camera will assist you by telling you whether it thinks you have the correct metering. Some older EOS cameras display little **+** and - arrows telling you whether your picture is correctly exposed, overexposed or underexposed. Other models display a little animated slider bar with a dot indicating the current exposure setting;

a simulated matchneedle. If the dot is exactly in the middle then you're using the setting that the camera believes to be correct metering.

Depth of field mode (DEP and A-DEP).

These modes allow you to concentrate on the depth of field - the area in the picture in which stuff is in acceptable focus. For more details on these modes see the DEP/A-DEP section below.

Custom mode (C).

The custom mode is to be found on many Canon point and shoots and some newer digital EOS cameras, starting with the EOS 5D. Custom is essentially a dial setting which allows you to roll your own icon mode. You set the characteristics you need for the camera (aperture priority with second curtain sync and spot metering, for example) and store the setting. Then you can switch your camera over instantly to those settings by turning your camera to the C function. This can be very useful for rapid access to normally hidden camera functions, such as mirror lockup.

How can I find out what all the icons and acronyms on my camera mean?

I have an online photographic dictionary which lists the most common camera icons and acronyms if you're interested.

What is the difference between DEP and A-DEP modes?

DEP stands for "depth of field automatic exposure" and A-DEP stands for "automatic depth of field AE". Both modes will choose a shutter speed and aperture combination to let you achieve a certain depth of field effect, but they do so differently. Most EOS cameras have either DEP or A-DEP modes. However one model, the 10/10s, has both and some newer digital bodies, such as the EOS 1D mark II and the 5D, have neither.

DEP.
To use DEP, first autofocus on a foreground item within your desired depth of field by selecting the subject and pressing the shutter halfway. "dEP 1" will appear in the viewfinder. Then recompose the image and autofocus on a background item by selecting the subject and pressing the shutter halfway. "dEP 2" will appear in the viewfinder. Finally, compose the final image in the viewfinder and press the shutter release halfway again.

The camera will then calculate the necessary aperture setting and shutter speed to keep both items, and everything in between, in focus. If this isn't possible then the camera will blink a warning. If your camera has multiple focus points do not change the selected focus mark at any stage during this process. Press the shutter release all the way to take the photo.

A-DEP.
A-DEP requires multiple focus points and so is never available on any EOS camera with only one focus point. In this mode you arrange your image in the viewfinder such that a *foreground* item within your desired depth of field is covered by either

the *left or the right* focus mark, and that a *background* item is covered by *one of the two* remaining focus marks. Press the shutter halfway and hopefully two focus marks will light up in the viewfinder telling you which items were chosen.

The camera tries to set the aperture and shutter speed such that everything between your two selected points is in focus. If it's not possible for that to happen then the camera will blink a warning at you. If it is possible then neither the aperture nor the shutter speed will blink and you can press the shutter all the way to take the photo. A-DEP, as its name implies, is more automated and also affords less control than DEP.

What is bulb (B) mode?

Camera shutter times are normally specified in fractions of a second. Taking pictures on a sunny day, for example, can easily mean extremely brief exposures of 1/60 to 1/1000 of a second. But what if you want to take really long exposure photographs - perhaps several minutes - at night?

Most cameras don't have a way to dial in extremely long (longer than 30 second) exposures. Instead the camera has what is known as "bulb" mode. To enter this mode on most EOS cameras you set the camera to manual metering (M) and then set the shutter speed to "buLb", which is usually the setting past 30 seconds. With some cameras you set the camera to B mode. Either way, in this mode the shutter will remain open for as long as you keep the shutter release button pressed down. You then set a stopwatch or something and time the exposure manually. More conveniently, some recent EOS bodies have a top-deck timer so you just need to turn on the LED backlight and you can watch the seconds tick by.

There are three obvious problems with this way of exposing film. First, if you press and hold the shutter release button on the camera body itself there's a very good chance that you'll inadvertently bump the camera slightly and risk blurring the exposure. Second, it can be really tedious holding down the shutter for a long period of time. And third, metering can be tricky.

The first two problems are easily addressed by using a remote shutter release. Most EOS cameras take optional wired shutter releases which plug into small sockets on the side of the camera. These accessories let you trigger the camera shutter without physically touching the camera. Several EOS cameras also support an optional wireless release which lets you trigger the camera by pointing a small device at it. The shutter release command is sent to the camera via pulses of invisible infrared energy. For more information have a look at the section on remote shutter releases.

Wired remote releases also typically have lock mechanisms, making it much easier to take a long exposure. Wireless remotes on EOS cameras also work well with long exposures, since one press of the remote button opens the shutter and a second press closes it. (this is analogous to the "T" or Time exposure mode used in many older cameras)

The exposure problem is different. Ordinary light meters inside cameras can't really meter for extremely low light levels, so metering for long exposures is essentially a matter of trial and error. It's best to settle on one type of film and a fixed aperture

choice and learn what shutter speeds work well for you. Astrophotography of stars and such can easily involve exposure times in the hours.

Incidentally, bulb mode is so named because in the olden days of purely mechanical cameras remote shutter releases were typically rubber bulbs linked to the camera via hoses. Squeezing the bulb pushed a mechanical lever at the end of the hose, pressing down the shutter release. The use of the term on modern computerized cameras is an anachronism.

What do the various metering modes and icons mean?

Canon cameras support a number of different ways of metering light coming in through the lens. The midrange and professional models let you choose which metering mode you want, and consumer cameras generally default to evaluative in most settings with partial as an override option. Here are the various metering modes.

Evaluative metering.
Evaluative metering is the most automated metering mode. In this mode the image is divided into a number of zones - usually 3, 6, 16, 21 or 35. The camera's computer then looks at the metering zones and applies various algorithms (computer programs, essentially) to guess a likely exposure setting. It then chooses appropriate shutter and/or aperture settings based on these calculations. Unfortunately, Canon have not published details of how these algorithms work. Nikon, incidentally, call this type of metering "matrix metering," and sometimes people use the term "matrix" to refer to all forms of multiple-cell computerized light metering.

Evaluative metering usually works reasonably well, though the meter can often be fooled by extreme metering conditions - such as a person backlit with a bright light. A larger number of metering zones does not, however, necessarily mean improved metering. Some cameras with 6 metering zones can meter just as well or as reliably as another model with 35 - it really depends on the camera model. Evaluative metering is convenient but, since it's so automated, doesn't teach you much about the fundamentals of metering.

Evaluative metering is identified in midrange and pro EOS models by the [(*)] symbol.

Spot metering.
Spot meters examine a very small area (a spot) of the overall image - usually just 1% or 2% or so. They're popular with experienced photographers who select an area that they want to appear as light grey on the final image and use that to meter from. Spot metering is an essential tool for metering in challenging light situations, but is harder to master from the point of view of the novice. Only professional and semi-professional EOS models offer spot metering. Some also offer multi-spot metering, which allows you to select multiple spots and then average out the readings.

Spot metering is identified in midrange and pro EOS models by the [*] symbol.

Centre-weighted averaging metering.
This mode essentially simulates the typical metering mode used in cameras sold in

the 1970s. Such cameras average the total amount of light coming in across the whole image but give a bit more importance (weight) to the centre. Unfortunately Canon do not publish the weighting percentage and weighting diagrams for most of their cameras, so only experience will tell you how this mode works.

Though technically simple, this metering mode works well for images which have relatively little variation in light level across the scene. A classic example might be a landscape on a sunny day. The sky at the top will be fairly bright, but since the metering is centre-weighted the bulk of the scene should be metered correctly.

Centre-weighted averaging metering is identified in midrange and pro EOS models by the [ ] symbol.

Partial metering.
Very similar to spot metering, only a larger area of the image is used - typically 6.5%, 9.5% or 10%, depending on the model. Think of partial metering as a very fat spot. Some cameras with multiple focus points tie the area to be metered to the currently selected focus point.

Partial metering is good for giving you more control over metering results. For example, let's say you're trying to take a photo of something which is surrounded by darkness. Evaluative metering might be a problem as it might be thrown off by all the dark areas. With partial you can select a section of your image that you want to be medium grey and then you don't have to worry about the meter being fooled by the stuff around it.

Partial metering is identified in midrange and pro EOS models by the [( )] symbol.

Does the number of metering zones matter?

There's quite a variation in evaluative metering zones across the Canon EOS lineup. Some cameras meter from three zones, some from six, some 16, some 21 and some 35. And Canon have generally been increasing this number over the years.

The immediate assumption one can make is that the more zones the better. But that's not necessarily the case. Many other factors come into play - the speed of the camera's internal computer, the sophistication of its algorithms (computer programs) and so on. Given the choice between a low-end camera with a ton of metering zones and a midrange or pro camera with a handful of metering zones I'd go for the latter any day.

In short, while metering zones are important I personally wouldn't make a purchasing decision based on the number of evaluative metering zones a given camera has.

What does Single versus Continuous wind mean?

EOS film cameras all contain motorized film-winding mechanisms. How the camera winds film depends on the mode you're in. Note that not all EOS cameras have a specific control for choosing wind modes, but most do. If your camera lacks the ability to choose winding modes remember that each icon mode is associated with

one or other of the winding modes. So if you need a specific winding mode you might look up which mode uses which mode.

Single frame.
In single-frame wind mode the camera will shoot one picture each time you press the shutter release button. Nothing happens when you continue to hold down the button. Single-frame mode is usually identified by a rectangle icon. Use this mode for shooting something static, such as a landscape. For this reason the landscape icon mode uses single frame winding.

Continuous.
In continuous wind mode the camera will shoot as many frames as it can for as long as you hold down the shutter release button. Until you run out of film or storage space, of course. The shooting rate depends on both the motor-drive speed of the camera (anywhere from 1 to 10 frames per second, depending on the model) and which autofocus mode the camera is in. Continuous wind mode is usually identified by an overlapping rectangle icon.

This mode is useful for shooting rapid-fire pictures of something. For example, an exciting moment in a sports tournament or a speech by a famous politician might both be moments when you want to shoot a lot of frames in the hope that one will turn out well. For these reasons the sports and portrait icon modes use continuous frame winding.

What are the One-Shot and AI Servo autofocus modes?

Most EOS cameras support three autofocus modes - One-Shot, AI Servo and AI Focus. Midrange and professional EOS cameras let you choose which mode the camera is in, often via controls marked in yellow.

However, low-end EOS cameras do not let you choose these modes directly. Instead, each of the basic modes is preprogrammed to use one of the three autofocus modes. So you can sort of choose your autofocus mode indirectly by choosing a basic mode that happens to have the autofocus mode you want to use.

One-shot AF (autofocus).
In this mode the camera locks in on your subject and doesn't refocus once you've achieved focus. It won't take a picture unless you're in focus or unless the lens is in manual focus mode. It's good for shooting static subjects.

AI ("artificial intelligence") servo mode.
In this mode the camera tries to keep refocusing the lens as you track your subject. The exposure is determined when the shutter release button is fully depressed in both single and continuous winding modes. AI Servo is supposed to be able to track subjects moving to or from the camera - a feature called predictive focus.

Since it requires a lot of computer power to do this all accurately, generally speaking newer models do a better job of this focus tracking than older models. It's a useful feature for shooting moving objects, but again more with faster cameras than slower older ones.

AI Focus mode.
In this mode the camera starts in One-Shot mode but switches automatically to the AI Servo mode if it detects subject motion.

What camera setting should I use for a wedding? Landscape? Birthday party? (etc)

Unfortunately it doesn't work like that. There are no magic settings and formulae for choosing camera settings. You have to learn what the various settings do - and the right time to use them - through experience.

For this reason I don't recommend the basic (icon) modes if you're interested in learning photographic technique. In the icon modes the camera makes all the decisions for you and you have no idea what internal settings it actually used. I'd recommend sticking to the four creative zone modes (P, Tv, Av and M) and reading up on photographic technique. Many libraries and bookshops have some excellent books that can help you with this. Many of them date back to the 70s and 80s, during the heyday of amateur photography, but the techniques they describe are still fundamentally applicable today.

What is exposure compensation?

The camera isn't always right when determining the proper exposure for a photograph. Sometimes for technical reasons - the camera's internal light meter might be fooled by a bright light, for example. And sometimes for artistic reasons - the camera is only a machine and doesn't know what areas of a picture you consider particularly important.

So for that reason most EOS cameras have a way of overriding the exposure setting determined by the camera. This is quite often implemented via a rear command wheel which you can rotate to select the number of stops of light to be added or taken away from the camera's default measurement. EOS cameras which lack a rear command wheel, such as low-end EOS models, usually allow you to apply exposure compensation by pressing a back-panel button and rotating the main command dial.

For example, since camera light meters assume you want everything to be a medium-light shade of grey it can be a real problem taking a photograph under bright conditions. The classic example is the photo of the white dog standing in white snow. A photographer might apply a stop or two of positive exposure compensation. This additional exposure time means that the dog and snow should appear white in the final photo, not grey.

Note that in addition to regular exposure compensation, which involves compensating for the metering of ambient light, most midrange and better EOS cameras also feature flash exposure compensation (FEC). FEC allows you to adjust the light output from a flash unit, and does so independently of the ambient light metering.

What is a custom function?

Canon's midrange and pro cameras - as well as their best flash units - have custom functions, which are user-controlled settings that let you customize the camera somewhat and access special features. For example, some people like using first-curtain sync flash and some people prefer second-curtain sync flash. Many EOS cameras have a custom setting which lets you choose the option you prefer. None of Canon's consumer cameras have custom functions.

Unfortunately all EOS film cameras just number their custom functions, so there's no way of knowing what the various custom functions do without consulting the manual. Alternatively, Photozone.de maintains a list of all the custom functions for EOS cameras which have them.

I set a custom function but it has no effect. What's wrong?

Custom function settings are ignored if the camera is in a basic (icon) mode. You have to turn the camera's mode dial to one of the advanced or "creative" zone letter modes, such as P, Tv, Av or M. So if the camera exhibits its default behaviour (eg: using first curtain sync rather than the second curtain sync that you've set using a custom function) be sure to check which camera mode you're in.

What is leader out?

Normally film is spooled all the way back into the canister when a motordrive-equipped camera like an EOS film camera rewinds film. This is usually a good thing, as it's then easy to identify the canister as being used.

However there are times when you might want to leave a tongue of film protruding from the canister when you rewind it. For example, perhaps you want to change rolls of film in the middle - maybe going from colour to black and white - and then you want to reload the partially used film later. If the film leader is out then this is pretty easy to do.

Most midrange and high-end EOS cameras have leader-out as a user-configurable option, set using a custom function. And, as custom functions are ignored in icon modes, this functionality only works in the creative (letter) modes.

How can you change films in the middle of a roll?

Nearly all EOS film cameras have a pushbutton or setting which causes the camera to rewind the film back into its canister immediately, even if the roll is not fully exposed. If there's a button it's usually recessed to avoid accidental pressing and is marked with a film canister with two arrows pointing into it. A few older EOS cameras require bizarre antics to rewind midroll, such as removing the lens, setting the camera to ISO and pressing the two back buttons.

However, unlike APS, 35mm film has no way to record the total number of shots used on a roll. There is no automatic way to switch films midroll and have the shot count recorded if you're using a 35mm film camera. So if you decide to rewind a roll of film midway through for later use then you will have to write down the framecount so you don't double-expose the film. Black fine-tipped indelible markers are good for this - you can write this number directly onto the canister itself.

To reload the film to the correct position use the following procedure.

- Load the previously partially-shot film.
- Cover the lens with a lens cap (or a body cap if you have no lens installed).
- Set the lens to manual focus, if it's an autofocus lens, so that the camera doesn't try to focus.
- Set the shutter speed to the fastest setting possible (eg: 1/2000 sec, 1/4000 sec) and aperture to the smallest (largest *f*-stop digit) setting possible (eg: *f*/22).
- Press the camera's shutter release repeatedly and wind through frame by frame until the camera's frame counter indicates the frame you noted down earlier.

Most modern EOS cameras use infrared diode positioning systems and are extremely accurate in aligning the film when you load it. So you shouldn't need to shoot one additional blank frame to make sure there's no overlap between the last frame shot the first time through and the first frame shot the second time through. However, if you have an older EOS camera with an electromechanical frame counter then you may need to add a blank frame for safety purposes. Check my article on infrared photography to see which type of film positioning system your camera uses.

Camera features and accessories.

What is mirror lockup?

Nearly all SLRs use a flip-up mirror mechanism. When you take a photo the mirror flips up out of the way to expose the film or digital image sensor. Unfortunately this mirror motion induces slight vibrations in the camera, which can result in slight blurring appearing in the photo, particularly with extremely long telephoto lenses. Cameras contain foam bumpers to reduce this mirror slap, but some vibration is inevitable in a moving reflex mirror camera.

The simple solution to avoid blur caused by mirror slap is to flip up the mirror, wait at least a second or two to let the vibrations die down and then take the photo. There are two basic ways that cameras can do this.

Some cameras offer true mirror lockup. Such cameras let you flip up the mirror whenever you like. They may be purely mechanical mirror lock mechanisms or they may be electro-mechanical. Most of Canon's high-end cameras offer true mirror lockup.

Other cameras offer what's often known as mirror pre-fire. These cameras flip up the mirror a couple of seconds before taking the picture when the camera is in self-timer mode but don't let you lock up the mirror at will. Most of Canon's midrange cameras offer mirror prefire in conjunction with the self-timer or an infrared remote control.

Obviously there's a significant drawback to mirror lockup - you can't look through the viewfinder when the mirror is locked up. For that reason mirror lockup is really only used in slow-paced picture-taking conditions, such as landscape photography when using a tripod, and so on. Canon are also notorious for hiding mirror lockup or prefire access in the camera custom function area, which makes it inconvenient and slow to

access. (unless your camera has a C mode on the command dial) However, don't worry unduly if your camera lacks the feature. For most applications it doesn't make a massive difference in camera blurring, and Canon cameras have fairly well-damped mirrors.

What is a pellicle mirror?

As noted above, most SLRs contain moving reflex mirrors which flip up to let light from the lens expose the surface of the film or the digital image sensor. However some SLRs use fixed mirrors instead. Canon have made a number of such cameras over the years - the EOS RT and EOS 1N RS being the most recent models.

These cameras have "pellicle" mirrors which are essentially fixed half-silvered mirrors which send some light up to the viewfinder while passing the rest through to the shutter. The result is a camera which can shoot instantly with no mirror blackout time - perfect for sports and action photography - and no need for mirror lockup. The drawbacks are less light reaching the film, a dimmer viewfinder and the need to keep the mirror scrupulously clean at all times. Such cameras are fairly specialized pieces of equipment and not used by most photographers.

What is meant by a bright or dim viewfinder?

Very simply this refers to the amount of light reaching your eye when you look through the camera's viewfinder. High-end Canon cameras tend to have very bright and clear viewfinders. Cheaper Canon cameras tend to have dimmer viewfinders, almost as if a brightness knob has been turned down.

Obviously bright viewfinders are better than dim ones, as they make it easier to see your scene for focussing and composing. Unfortunately, bright viewfinders also require large glass pentaprisms (see below). Canon's cheaper cameras have either smaller prisms or roof mirror systems.

What is a pentaprism? A roof mirror?

The key feature of the SLR camera is the ability for the photographer to look through the viewfinder and see directly out of the taking lens, and a clever optical trick is required to make this possible. The traditional approach is to use a large solid glass prism to reflect incoming light from the lens and project it up into the viewfinder. This prism is known as a pentaprism because it has five sides through which light passes or is reflected. The pentaprism is also the reason why SLR cameras have large angular humps on the top.

While it may seem obvious today, the pentaprism was quite a breakthrough when it was introduced with the 1949 Contax S camera. Before the advent of the pentaprism, camera viewfinders usually displayed laterally reversed and/or upside-down images.

While pentaprisms work quite well there is one drawback associated with them - they're solid blocks of heavy and expensive optical glass. For that reason Canon, starting with the Rebel X/EOS 500 series of cameras, began putting hollow mirror systems into their consumer EOS cameras rather than pentaprisms. This has the

advantage of making the camera considerably lighter in weight and lower in profile, but also has the drawback of creating a dimmer viewfinder, since mirrors are less efficient at reflecting light than prisms.

What is a viewfinder shutter or cover for?

High-end Canon SLRs have a flip-down lever by the viewfinder that lets a mechanical shutter swing down and physically cover off the back of the viewfinder so you can't look through it anymore. Canon SLRs which lack this feature usually ship with a detachable plastic or rubber cover either attached or built into the camera strap.

What's this for? Well, the light metering sensors in an SLR are located inside the top hump of the camera as part of the viewfinder assembly. They record light levels inside the viewfinder. And when you're peering through the viewfinder then most of the light entering the camera is coming in through the lens. However, when you're not looking through the viewfinder (thereby physically blocking it) then light can enter the camera from the viewfinder itself, throwing off the light meter. This is particularly a problem if you're using the camera on a tripod in self-timer mode.

Viewfinder shutters, therefore, reduce the risk of metering error from stray light entering the viewfinder. So they're only useful in automated exposure modes. If you're shooting in manual metering mode then the shutter isn't needed since it's you, not the camera, who's setting both shutter speed and aperture. Note that there's no risk of this stray light affecting the film or image sensor at all - it can't make its way past the flipped-up mirror. It only affects metering.

Of course you can use anything on hand to block this stray light if you lose the viewfinder cover. You could put a hat over the back of the camera, say. Kodak's black 35mm film canister lids fit neatly over a lot of EOS camera viewfinders as well, though Fuji's don't (partly because they're translucent white and partly because they don't fit).

What is dioptric correction?

Many people who wear glasses don't like wearing them when they look through the viewfinder. The glass bumps up against the eyecup, so you can't get your eyes close to the viewfinder. This makes it hard to see the entire image, particularly with EOS cameras which are notorious for not having the greatest viewfinders in this regard.

But obviously if your eyes require corrective lenses then you won't be able to look through the viewfinder if you take your glasses off. At least not if you couldn't adjust the focus of the viewfinder itself. This is what dioptric correction does - it lets you adjust the viewfinder so that spectacles-wearing photographers can see through it *sans* glasses. Cameras with built-in dioptric correction have tiny dials or sliders located next to the viewfinder. Moving these controls adjust the viewfinder focus point.

Note that you aren't out of luck if your camera lacks such correction facilities and you want it. Canon sell small add-on lenses which clip directly onto the viewfinder of most EOS models. These dioptres are available in a variety of strengths to suit different eye prescriptions.

Personally, as a glasses-wearing person, I don't find dioptric adjustment very useful. I'd be much happier if Canon cameras would simply accommodate eyeglasses wearers better by altering the exit pupil of the viewfinder such that you don't have to jam your face right up against the viewfinder to see everything. Dioptric correction means that you have to take your glasses off to look in the camera, put them back on to see the world, take them off again, etc. Still, many people do find dioptric adjustment very useful. You're probably best off trying the camera in a shop to see what works best for you.

What is depth of field preview?

When you look through the viewfinder of a Canon EOS camera - or just about any modern SLR - you're looking through the lens when the aperture is set to its widest setting. This means as much light as possible is coming through, which makes it easier to see the scene and focus and so on.

However, depth of field is at its shallowest when the lens is wide open. So if you want to get a sense of the depth of field that will result from some other aperture setting you need to close the lens down physically to that setting. The depth of field preview button available on most Canon EOS cameras does just this.

Unfortunately the differences in depth of field between various settings can be hard to make out in the viewfinder itself. So all the DOF preview button usually does is to make things look darker. And if you're shooting in low light conditions, making the viewfinder darker may mean you can hardly see anything at all. So DOF preview buttons, while they have their uses, are of somewhat limited value.

What is eye-control focus (ECF)?

Eye-control focus is a technology unique to Canon that lets the camera track what you're looking at in the viewfinder so it can select the nearest focus point automatically.

ECF works as follows. A series of tiny infrared LEDs (light emitting diodes) shine harmless infrared energy onto your eyeball as you peer through the viewfinder. Light sensors record the infrared reflecting off your eye and calculate the focus point. A computer in the camera then examines this data and decides which of the focus points is closest to that point and selects it. If the camera is in AI Servo mode then it will also adjust focus automatically based on that selected point.

ECF is thus a very complex technology which involves a lot of different factors. And, needless to say, it works well for some people and not well at all for others. Each ECF-capable camera must be calibrated for each user, but even thorough calibration (you need to run through calibration at least a half dozen times or more before things will be set up properly) is no guarantee that ECF will necessarily work for a given person. Reliability of ECF depends also on the speed of the eye scanner. The EOS A2E/5, the first cameras to use ECF, were fairly slow at selecting the correct focus point. The EOS 3 and the Elan 7E/EOS 30/7, by contrast, have faster computers and so respond more quickly. Interestingly, the 1V (Canon's top of the line film camera) does not support ECF. Canon have stated that this is because they wanted the 1V to work 100% of the time, and that ECF does not attain that level of reliability.

Some people use ECF a lot and consider it a very useful feature; almost magic. (look at something and it goes in focus!) Others find it a pointless gimmick that doesn't work reliably. At time of writing Canon have not released any digital cameras with the feature, so it's unclear what its future is.

What is a cross sensor?

There are two basic configurations of autofocus sensors used in SLR cameras. Linear sensors detect lines in one direction only - usually just vertical lines, though some camera sensors, such as the EOS 10/10s outer sensors, can detect only horizontal lines. Others, known as cross or cross-shaped sensors, can detect both vertical and horizontal lines. With their higher sensitivity, cross sensors are considerably more accurate than linear sensors, particularly in lower-light conditions. Some cross sensors are also high-precision sensors (see below).

Most EOS cameras with multiple focus points have a cross sensor as the central point and vertical-line sensors as the other points. So in challenging focus situations it's usually best to switch manually to the centre sensor so you get the full benefits of the cross. Note that the first generation of EOS cameras (600 series) and most early Rebel/three or four digit film cameras do not have cross sensors.

Autofocus doesn't work very well when it's dark. What can I do?

Low-light autofocus is quite a challenge for any camera that uses a passive autofocus system, like all EOS cameras. Passive autofocus means that the camera simply looks through the lens and reads whatever's there - it doesn't send out infrared or sound or light or radar beams or whatever to determine the correct focus distance. (the AF assist systems used by most Canon cameras and flash units don't change this, since the lights are *optional* assist systems and are not required by the autofocus system)

Generally speaking the more expensive the camera the better the autofocus. There are exceptions to this, but it's a reasonably accurate predictor of how good AF is going to be when light levels are lower. So a top of the line EOS 1V is going to have wildly better low-light autofocus than an old EOS 1000 consumer camera, for example. This doesn't quite apply with digital cameras, though - the D30 and D60 are both more expensive than roughly comparable film cameras, but have very poor low-light autofocus.

One way to get a sense of the camera's low-light AF performance is to look at its specifications. Light levels for AF systems are measured in exposure values (EV), and autofocus systems have their light sensitivity levels expressed as a range of EV. A good camera can autofocus from 0-20 EV. A consumer camera can usually only manage 2-20EV, which means that it needs more light at the dimmer end of the scale to work properly.

Unfortunately low-light AF performance is one area where Nikon products are generally better than Canon products. Many Nikon products autofocus down to -1 EV, for example. Nonetheless there are several things you can do to help your camera with its low-light AF performance.

- The majority of EOS cameras with multiple focus sensors have a cross-type sensor as the central sensor. As noted above, cross-type sensors are more accurate than linear sensors because they can detect both horizontal and vertical lines rather than just lines in one direction. So always switch manually to your camera's centre focus point for improved accuracy.
  There is one significant drawback to this approach which you should keep in mind, however. Canon E-TTL flash biases flash exposure to the selected autofocus point. So if you focus on something with the central focus point, recompose the image by moving the camera and then take a photo there's a good chance that the flash metering will be out. In this case you should lock flash by using FEL prior to recomposing.
- Passive autofocus systems try to detect changes in contrast, so help your camera out by giving it a sharp line to focus on. Look for a wall or the edge of something where one side is brighter than the other and the two areas are sharply delineated. This, more than anything else, will make a tremendous difference. Don't try to focus on a blank wall - AF systems have difficulty with featureless surfaces in bright light, let alone when it's dark.
- Use an AF assist system. Many EOS cameras contain some sort of light-producing lamp which helps the autofocus system in low light conditions. The best kind of AF assist light is a bright red LED which projects a series of patterned lines. It's relatively unobtrusive as AF assist goes, and the striped lines help the AF system lock focus. A number of cameras - notably the 10/10s, Elan/100, Elan II/50, 5/A2/A2E, Rebel S II/EOS 1000FN and others - have such red lights. Other cameras have white incandescent flashlight-type AF assist lights which work, though not as well. Others, such as the Rebel 2000/EOS 300, Elan 7/EOS 30/33/7, have no dedicated lights and simply emit stuttering pulses of light from the popup flash, which is extremely annoying. Whichever system your camera uses, however, see if it helps with autofocus. Note that some large lenses or lens hoods can block the light from body-integral AF assist lamps.
- Attach an external Speedlite flash unit. All Canon Speedlite flash units contain red AF assist lamps which can help autofocus considerably, especially if your camera hasn't got one. There are a couple of limitations to keep in mind, however. First, two cameras - the 5/A2/A2E and the 10/10s - will not activate external Speedlite AF assist lights. Second, many flash units are not capable of a wide enough spread of their AF assist light beams and so cannot illuminate the outer autofocus points of multiple focus point cameras. Even those with the ability to cover all the focus points of your camera generally illuminate the centre point with lots of light and the outer points with less light. So again it's best to stick with the centre AF point.
- Use a faster lens (ie: a lens with a smaller maximum aperture value). A lens with a maximum aperture of f/1.8 is going to autofocus in low light much more reliably than one with a maximum aperture of f/4.5, for the simple reason that the faster lens will let in many times more light.
- Try to focus manually. This is difficult if your camera has a simple matte focus screen. But if you're lucky enough to have a focus screen with a split circle focus assist aid (see below) then it's probably most reliable to focus manually.

Which EOS cameras can use split circle viewfinder screens?

Back in the 1960s and 70s microprism viewfinders were common in SLRs. These were special viewfinder screens containing tiny prisms on the surface. These prisms would break up the surface of out of focus areas, making it easier to focus. A later

innovation was the split circle (split prism) viewfinder. Such viewfinder screens featured a circle, bisected by a usually horizontal line, in the centre of the screen. To focus the camera you would find a high-contrast vertical line (eg: edge of a wall, a tree trunk) and look at it through the viewfinder. You would then adjust the focus until the line appeared unbroken in the split circle. Split circles worked quite well, but had two notable drawbacks. First, you needed to find a straight line to focus on and second, the image in the circle tended to black out when used with very slow lenses. There were also combination viewfinders with split circles in the centre and a ring (collar) of microprisms.

Sadly, most camera makers ditched these convenient manual focus aids with the advent of autofocus in the late 1980s, apparently on the assumption that autofocus is so fabulous that you'll never need to focus manually again. And worse yet, most EOS cameras do not have interchangeable focus screens. There are, therefore, only a handful of EOS camera models to which split circle viewfinder screens can be added. These cameras are listed below. All other EOS cameras cannot use a split-circle viewfinder.

The following cameras had or have interchangeable viewfinder screens, and Canon make or made a variety of optional screens for these cameras, including split circle screens. Some also have third party screens available from American makers; Reflexite Beattie Intenscreen being one and Brightscreen being another - though note that these makers do not necessarily support all of the cameras listed below.

EOS 600 series (650, 620, 600/630, RT), EOS 1 series (1, 1N, 1N RS, 1V, 1D, 1Ds, 1D mark II, 1Ds mark II, 1D mark IIN), EOS 3.

The following EOS cameras have interchangeable focus screens, but Canon never made a split circle screen for them. Not sure why - presumably because Canon never designed their metering systems to accommodate a split prism, which is a shame. The Beattie Intenscreens for Canon EOS cameras are Canon screens with Beattie's custom coatings, so you can't buy a split circle from them either. There are third party screens for the EOS 5D, however.

EOS 5/A2/A2E, EOS 5D

The following camera was not sold as an EOS camera, but was a stripped-down Rebel/1000 without the ability to autofocus. Since it was a manual focus camera it shipped with a split circle viewfinder:

EF-M

The following cameras do not have officially interchangeable viewfinder screens, but by happy coincidence have viewfinder screens of precisely the same size and dimensions as the long-discontinued EF-M (ie: they were all built around the same basic mirror box chassis design). As a result it's fairly easy to remove the stock laser matte screen and replace it with an EF-M screen. For information on making this change have a look at my split circle screen page.

EOS Rebel/1000 series (EOS 1000, EOS 1000F, EOS 1000F QD, EOS Rebel, EOS Rebel S, EOS Rebel S Quartz Date, EOS 1000 QD, EOS 1000N, EOS 1000FN, EOS

1000FN QD, EOS Rebel II, EOS Rebel S II, EOS 1000S QD and EOS 1000S QDP), EOS 100/Elan. (possibly others)

The following digital cameras do not officially have interchangeable viewfinder screens according to Canon, but have third party focus screens available from two separate American entrepreneurs - Katz-Eye and Haoda Fu. These add-on screens give you a split-circle manual focus assist with, on some versions, a microprism collar. I have not tried the Katz-Eye products, but I have a review of a Fu viewfinder on this site.

EOS 10D, 20D, 300D/Digital Rebel/Kiss Digital, 350D/Digital Rebel XT/Kiss Digital N

How good are EOS cameras and lenses for manual focus work?

Frankly, not great. EOS cameras and lenses are both completely optimized for autofocus operation. You can go into manual-focus mode at any time (only a couple of really old cheap EF lenses lack manual focus rings) on any EOS camera, but it's not always an easy thing.

First of all, EF lenses generally have very short throws, which makes precise focussing by hand fiddly. (this was done deliberately, since lenses with short throws can autofocus more quickly than those with long throws) Second, most EOS cameras do not have interchangeable finder screens and the screens that the cameras ship with lack any form of focussing aid, as mentioned in the previous section.

So if your priority is manual focus then the EOS system may not be the system for you. You should consider either an EOS camera with a split-circle focus aid (see above) or a different camera system.

What does it mean that Canon professional cameras are high-precision and optimized for fast lenses?

Canon's high-end EOS cameras (1, 1N, 3, 1V, 1D, 1Ds, 1D mark II, 1Ds mark II, 5D) contain high-precision cross sensors. These are autofocus sensors which focus three times more accurately than the standard sensors found in other camera models. The drawback is that they require very fast lenses to work. If you put a slower lens onto one of these cameras then the cross sensors revert to linear sensors which detect lines in one direction only. The upshot is that putting a slow lens on one of these cameras is a bad idea as you're not taking full advantage of its capabilities.

Is this a big deal? Should you be worried that your non-high-end EOS camera has only standard precision autofocus sensors? Well, if you're shooting under conditions of very narrow depth of field all the time - extreme macro photography or really long telephoto lenses - then using a pro camera can help you autofocus more accurately. But if you're doing normal photography then you probably won't notice a difference.

What is the advantage of a rear control dial (QCD)? Why doesn't mine work?

Most EOS midrange and pro cameras (from the EOS 100/Elan on and the EOS 1 on, respectively) have thumb-operated rotating dials on the back panel. These command dials are a very popular feature as they let you adjust both aperture and shutter

speed with one hand when in manual mode and let you adjust exposure compensation in P, Tv and Av modes, again with one hand. This dial is also known as a QCD, or Quick Control Dial.

Cameras which lack this rear dial have a back-panel shift button. You have to press this button while rotating the main index-finger-operated dial to adjust the second function, which is considerably less convenient.

The 580EX flash unit also has such a rear control dial, which makes it easier and quicker to adjust flash exposure compensation and other functions.

If your camera has a rear control dial and it doesn't seem to work it's likely that it isn't turned on. Most EOS cameras with rear dials have small on/off switches next to the dials which allow you to disable the dial so it doesn't get nudged accidentally. Some EOS cameras have a three position power switch - off, on with the rear dial off, and on with the rear dial on.

What are add-on handgrips for?

Many EOS cameras can have optional handgrips added to their bases, and a few (notably 1-series digital cameras) have large handgrips permanently attached. These handgrips serve a number of different functions.

- Many add-on handgrips, such as the BG-E3 for the EOS 350D/Digital Rebel XT or the BG-E4 for the EOS 5D, can contain additional batteries for extended shoots. The most common battery grips can contain either two regular camera batteries (frequently disposable 2CR5 or rechargeable BP-51x, depending on whether they're film or digital) or else a number of AA cells. The advantage of AA support is that AA cells are pretty well ubiquitous. If you find yourself in the middle of nowhere and run out of regular battery power there's a good chance there'll be a tourist giftshop or a grocery store nearby with AAs.
- Many handgrips, particularly those for midranged to advanced models, contain additional controls. The most common additional control is a second shutter release button to make shooting in portrait (vertical) configuration more comfortable and convenient. Studio photographers frequently use handgrips for this reason. Some grips also contain second control dials and other features. For example, the VG-10 Vertical Grip for the EOS 5/A2/A2E film cameras sports a shutter release button, a main dial, an AE lock button and an AF focusing point selection button, but oddly lacks additional batteries.
- Handgrips make the camera easier to grab and move for people with larger meatier hands, particularly when the camera is in portrait orientation.
- Some handgrips have attachment points making it easy to attach handstraps, for people who like carrying their cameras around in one hand rather than over one shoulder.
- Handgrips make the cameras big and impressive looking, which may appeal to some people. Conversely, of course, they can make the camera rather bulky and noticeable, which isn't always a good thing.
- A handful of camera grips, such as the GR-60 for the EOS 10/10s or the GR-70 for the EOS 1000/Rebel, contain no additional features and are simply lumps of rubber. And one or two others contain unusual features, such the

fold-out mini tripod in the GR-80TP grip for the EOS 500N/Rebel G. It all depends on the camera model.

What is the advantage of a removable camera back?

Certain EOS film cameras, mainly the high-end pro models, have interchangeable backs. This feature lets you remove the camera back which shipped with the camera and install a different back instead.

For example, you could swap your regular camera back out for one with more sophisticated timer functions, such as the Command Back E1 for EOS 1 and 1N cameras. Or you could add a Quartz Date Back E to an EOS 630 to get date printing. Professional photographers sometimes install Polaroid film backs so that they can get instant previews of complex lighting situations.

None of Canon's current low or mid-range film cameras support interchangeable camera backs. None of the digital cameras have interchangeable backs for obvious reasons and neither are their electronics upgradeable.

Should I pay extra for a date back film camera?

Personally I don't think that film date backs are a useful feature, because all Canon EOS 35mm cameras with date printing will print this information on the *visible* portion of the negative - in the lower right-hand corner of the final print or slide. This is great for identifying what day you took a snapshot or keeping track of research photos on an expedition, say, but it's also really ugly-looking, as the print will obscure part of the image. And, just like VCRs with their flashing time displays, people always seem to forget how to change the clock and end with piles of photos with the wrong date or time on them.

Sadly no Canon EOS cameras have the ability to print the date between frames on the negative. Models with date capabilities are typically identified as "QD" (for Quartz Date) or "DATE" in the product name. EOS consumer cameras marketed in Japan, however, nearly all ship with date-printing as standard feature, as it's apparently considered a desirable function there. You can, of course, turn date-printing off if you don't want to use it.

The exceptions to this problem of printing dates on the image are Canon's APS cameras and the digital cameras. APS cameras record date information to a magnetic strip on the film, so you can request the date be printed on the back side of the photograph when you have it developed. Digital cameras record the date and other shooting data along with each picture, but the data is stored separately (as EXIF data) and so does not appear on the actual image.

The only camera for which I recommend the date version is the Rebel Ti/EOS 300V/Kiss 5. For some reason the date version of this camera supports the optional wireless remote control, whereas the non-date version does not. So if you're looking to get this camera I recommend the date version for that reason alone - wireless remotes are great.

Of course, if you think there might be a chance you'd want date printing then you should make sure your camera has the feature when you buy it. Aside from a handful of exceptions listed above, most EOS cameras do not have interchangeable backs, which means you can't add date printing capabilities later on.

What types of remote controls are there?

Remote shutter releases are an essential part of every photographer's toolkit. They let you take photos without touching the camera, which can be important if you're using a tripod and want to avoid camera blur, particularly in bulb mode. And they let you trigger the camera at some distance from it.

All EOS cameras use either wired electric shutter releases (wires with simple pushbutton switches on the end) or wireless infrared shutter releases or both. The old style mechanical shutter releases (sort of like bicycle cables with plungers) are not supported, though if you really miss them you can buy the Canon Cable Release Adapter T3 (see below).

Canon have included three basic types of wired connectors with their EOS cameras over the years. This isn't really a beginner question per se, but here for completeness:

T3 connectors.

The first EOS cameras, the 600 series, did not ship with shutter release sockets but had optional handgrips (GR-20 handgrips) which had plugs for shutter releases of the T3 variety. Several other EOS models of the late 80s and early 90s - notably the 1, 1N and 5/A2/A2E - shipped with T3 connectors built in. A few - notably the Elan/100, the 10/10s and the Rebel/1000 line - lacked support for any kind of wired shutter release at all.

T3 connectors are a proprietary electrical connector and are not supported by anyone but Canon. And sadly they're fiddly and annoying to deal with, especially if you're trying to fit a shutter release to your camera in the dark, as they're tricky to thread on.

Cameras which have T3 connectors:

T90, EOS 650, 620, 630/600, (all EOS 600 series cameras require the GR-20 grip) 750, 850, 1, RT, 5/A2/A2E, 1N, 1NRS.

T3 accessories:

Remote Switch 60-T3 (or RS-60T3). A simple wired remote with a 60 cm cord.

Extension Cord ET-1000T3. A 10 metre (33 foot) extension cord for T3 releases.

Cable Release Adapter T3. A device with a switch on the end of a short length of cable which adapts old-style mechanical shutter releases to all EOS cameras with T3 wired connectors.

Remote Switch Adapter T3. An adapter cable for adapting old-style Canon TM-1 shutter releases (the kind used on really old manual-focus FD mount cameras) to T3-equipped cameras.

Wireless Controller Set LC-3. A staggeringly expensive wireless infrared shutter release system for T3-equipped cameras, consisting of a separate transmitter and receiver. 100 metre range.

2.5 mm miniplugs.

Most midrange EOS cameras since the mid 90s and consumer EOS cameras since the late 90s come with standard 2.5mm (3/32" in the USA) audio three-connector sockets for remote shutter releases. These connectors, named "E3" by Canon, are handy since they're commonly available and thus homemade shutter releases (see below) can easily be made. You can also make an extension cord for this type of connector as well - just get a headset extension cord for a cellular phone which uses 2.5mm stereo plugs. The downside is that the tiny plugs are a little fragile and do not lock, which means they can come unplugged easily by mistake.

Cameras which use 2.5mm miniplugs:

EOS 50/50E/55/Elan II/IIE, EOS 30/33/7/Elan 7/Elan 7E, EOS 30V/33V/7S/Elan 7N/Elan 7EN, EOS 500/Rebel X/XS/Kiss, EOS 500N/Rebel G/New Kiss, EOS 5000/888, EOS 3000N, 66, Rebel XS N, EOS 300/Rebel 2000/Kiss III, Kiss IIIL, EOS 300V/Rebel Ti/Kiss 5, IX, IX 7, IX Lite, EOS 300D/Digital Rebel/Kiss Digital, EOS 350D/Digital Rebel XT/Kiss N Digital.

2.5mm miniplug accessories:

Remote Switch RS60-E3. A simple wired remote with a 60 cm cord. Two position button with optional lock feature for long exposure (bulb) photos. Note that there is a minor naming inconsistency between the RS60-E3 and its sibling, the RS-80N3.

N3 connectors.

High end EOS cameras now ship with N3 connectors in lieu of T3 connectors. Like their predecessors they're proprietary Canon-only connectors, but they're less of a pain to use and are lockable. They're not as fun as 2.5mm plugs since you can't just go down to your local Radio Shack and buy a connector for purposes of playing around, but they are sturdier connectors in general and can't get pulled out by mistake.

Cameras which use N3 connectors:

EOS 3, 1V, 1D, 1Ds, D30, D60, 10D, 1D mark II, 1Ds mark II, 20D, 20Da, 5D.

N3 accessories:

Canon Remote Switch RS-80N3. A simple wired remote with an 80 cm cord. Two position button with optional lock feature for long exposure (bulb) photos. Note that

there is a minor naming inconsistency between the RS-80N3 and its sibling, the RS60-E3.

Extension Cord ET-1000N3. An incredibly expensive 10 metre (33 foot) extension cord for N3 releases.

Remote Switch Adapter RA-N3. A cable adapter which converts old T3 accessories for use with N3 camera bodies.

Timer Remote Controller TC-80N3. A handheld wired remote with a computerized timer and a backlit LCD screen. This feature-packed remote gives you all kinds of self-timer options including normal timers from 1 second to nearly 100 hours, an interval timer and so on.

Wireless Controller Set LC-4 and LC-5. These are both staggeringly expensive wireless infrared shutter release system for N3-equipped cameras, consisting of a separate transmitter and receiver. 100 metre range. The LC-4 is basically the LC-3 with an N3 connector attached instead of a T3 one.

The LC-5, introduced in 2005 in conjunction with the EF-S 60mm macro lens, is a minor upgrade to the LC-4. It adds what Canon call a one-shot release mode (1SR) which triggers the camera when a subject walks into range of a prefocussed camera. It can also wake a camera which has gone into low-power sleep mode. It's odd that Canon chose to release the LC-5 in conjunction with the EF-S macro lens, since only one camera body at the time - the 20D - could use both products. The LC-5 also isn't something that confers huge advantages to macro photography - a wired remote is usually just as good for this.

Third party shutter releases:

For years Canon were the only maker of EOS-compatible shutter releases. But in 2003 or so a Chinese firm based in Hong Kong, Adidt Tenologies (sic), produced a line of EOS-compatible products. Their M1 series is basically an RS-80N3 clone and consists of a simple handheld switch remote sold as three different products - with 2.5mm (M1-C1), T3 (M1-C2) or N3 (M1-C3) plugs. As one might expect, these products are a matter of getting what you pay for. They're much cheaper than the equivalent Canon products but they're also not as sturdily made. I have a more detailed review of these remotes. Note that more recently Adidt have produced a more interesting and innovative product, the R3 series of wireless remotes. These remotes use radio frequency (RF) signals rather than infrared, meaning you get much better range (up to 100 metres with one version) and you don't need line of sight. They also have keychain pocket transmitters.

Oddly enough, it seems other companies have decided that there's a huge market for Canon-compatible remotes, as since Adidt's entry into the marketplace, two other firms have released remote products. One, Nova Photography, is another Chinese firm selling cloned switches that closely resemble the Canon RS-80N3 product. The other, Seculine, is a Korean firm selling a video viewfinder for SLR cameras. They sell an advanced version, the ZigView R, which has a number of interesting features, such as intervalometer timing, motion sensor shutter release (an animal moves into the field of view, for example), bulb release and so on.

Homemade fun:

It's also a fun, albeit nerdy, hobby project to build your own remote transmitter. Since the Canon remote release circuit is extremely simple - two momentary normally-open single-pole switches - it's simple to construct a homemade release that does the same thing.

I've built one myself using a radio-frequency remote kit. This consisted of a largeish box with relays which hooked up to the camera and a small pocket digital remote. I put a 2.5mm plug on it and then built a tiny 2.5mm socket into a Canon RS-80N3 remote. This way I can plug my radio remote receiver into any Canon camera that uses a 2.5mm socket or an N3 socket. You can also hook up cameras to infrared or laser tripwires to take wildlife photography (the animal effectively takes its own photo when it crosses the invisible beam of light!) and so on.

Should I get a wired or wireless shutter release?

Wired shutter releases use simple electrical wires with switches soldered to the end. Wireless shutter releases, on the other hand, work on the same principle as handheld remote controls for TV sets and other entertainment devices. They're essentially small boxes which send pulses of digitally-encoded infrared energy, invisible to the human eye, through the air to the camera.

Most of Canon's midrange cameras support both wired electric shutter releases and wireless infrared shutter releases. The wireless system is particularly convenient since the wireless receivers are built into the camera bodies and require no external receiver devices - you just need a tiny handheld transmitter to trigger the camera remotely.

Naturally there are pros and cons with buying the wired or wireless shutter releases for your camera, assuming your camera supports both. Which kind you need really depends on what you want to do, though since they're fairly cheap as camera accessories go you might want to consider just buying one of each.

Wireless shutter releases:

Canon's wireless shutter releases for midrange EOS cameras, the RC-1 and RC-5, are both miniature handheld devices powered by long-life lithium cells. They're easily clipped to your camera's neckstrap for portability and work only with certain EOS bodies designed to receive their signals, as listed below. (for more information on the two-piece LC-3, LC-4 and LC-5 wireless releases see the previous section)

Wireless releases are great for group photos when you need to be in the photo. You can set the camera to IR-receive mode, walk casually over to the rest of the group, press the wireless shutter remote in two-second timer mode, lower your hand and smile for the camera. No need to dash frantically over to the camera before its self-timer runs out or run long cables along the ground.

They're also great for taking long time period exposures at night. When the camera is in bulb mode one press of the button opens the shutter and another press closes

it. You can thus easily take bulb mode pictures without bumping the camera and blurring the picture.

The main drawbacks of the wireless system are as follows. First, the camera's wireless receiver is built into the front of the body. This means that the wireless transmitters don't work very well if you're standing behind the camera. You can tape a piece of paper to the camera to reflect the infrared signal downwards, which sometimes helps, but it's obviously not a great solution. Second, the IR receiver on earlier EOS cameras is mounted near the lens mount and is thus easily blocked by large lenses or lens hoods. Later cameras - the Kiss IIIL, the 30/33/7/Elan II/IIE and 300V/Kiss 5/Rebel Ti - have receivers mounted on the handgrips which makes them slightly less susceptible to this problem. Third, the cameras have time-out values linked to their IR receive modes. If you don't take a photo within 5 minutes or so of setting the timer then the camera turns off its IR-ready mode, which limits its utility for certain applications. Fourth, Canon warn that the IR receivers are susceptible to interference from fluorescent lamps and may trigger inadvertently if brought too close to one, though I've never noticed this happening before. Finally, the transmitters are small and easily lost or broken, and have a range of just a few metres.

Despite these drawbacks, however, they're really handy little devices and highly recommended for all EOS owners with cameras which can use them.

The main two Canon wireless transmitters compatible with midrange EOS cameras are the RC-1 and RC-5. The RC-1 is a small device about as big as a pack of chewing gum. It has a three position switch - off (lock), two-second delay and immediate release. You then press the release pushbutton to take a picture in either two-second delay mode (which can invoke mirror prefire on certain cameras) or immediately. The RC-5 is flatter and wider and, while intended for Canon's point and shoot cameras, also works with infrared-compatible EOS cameras. It only has a two-second trigger mode, however, and cannot be set to fire immediately.

Note that there's apparently also the RC-4, which seems to be a bit bigger than the RC-1 but with the limited feature set of the RC-5. I've never seen one and they appear to be available only in certain markets. So I don't know for certain if it uses the same IR signals as the RC-1 and RC-5, as I've seen suggested.

One fun thing to experiment with is that some learning remotes for TVs and VCRs happen to support the same infrared control pulses as Canon's camera remotes. It's probably not immensely useful, as home entertainment remotes are fairly large, but it may turn out that you already have a camera remote sitting in your living room.

Wired shutter releases:

The RS-60E3 remote switch for low and midrange EOS cameras is more useful for taking photos when you're behind the camera and don't want or need to be in the picture. The cable is pretty short at 60cm, but can easily be extended with a cellular phone headset extension cable that has 2.5mm stereo plugs.

Unlike the wireless releases the wired releases have two-position pushbuttons, so you can meter and focus by pressing halfway and then shoot by pressing the switch all the way.

Note that there are significant differences between the way cameras work when triggered by wired versus wireless shutter releases. EOSdoc have a convenient (if daunting) table listing how the EOS 30/33/7/Elan 7/7E works with these two remotes.

Cameras with support for wireless shutter releases:

EOS cameras with built-in wireless infrared receivers only and no wired shutter release sockets:
EOS 100/Elan, 10/10s.

EOS cameras with both built-in wireless infrared receivers and 2.5mm wired shutter releases:
EOS 50/50E/55/Elan II/IIE, IX, EOS 30/33/7/Elan 7/7E, Kiss 3L (Japan only) EOS 300V/Rebel Ti/Kiss 5, EOS 300D/Digital Rebel/Kiss Digital, EOS 350D/Digital Rebel XT/Kiss N Digital, EOS 30V/33V/7S/Elan 7N/7EN.

Unfortunately, Canon's semi-pro and pro cameras do not support wireless remotes directly. You can buy LC-3 and LC-4 receiver/transmitters for them, which give you ten times the range of the tiny remotes built into the midrange cameras, but those devices are extremely expensive and quite bulky.

What is an intervalometer?

A fancy name for an interval timer or time lapse timer. A normal self-timer will take a single photograph after a set period of time - usually 2 or 10 seconds. But what if you want to take a photo once every 5 minutes or once every hour? This is where interval timers come in handy. They are useful for taking photos of things which change over time, such as flowers opening up or the sun setting in the sky. On some cameras you can also combine the intervalometer with multiple exposures so you can take a single-frame photo showing the moon rising in the sky or the progress of a solar eclipse.

Only one EOS film camera shipped with a built-in intervalometer - the EOS 10/10s. However, you could add a Technical Back E to an EOS 600 series camera or the the Command Back E1 to an EOS 1, 1N or 1NRS. You can also buy an external intervalometer, the rather expensive Canon TC-80N3 (see above). This handheld device is compatible with all EOS cameras which use the N3 connector for remote shutter release.

There are add-on devices for hobbyists, scientists and other experimenters, such as the Digisnap line of products. Korean maker Seculine sell a video viewfinder for SLR cameras, the ZigView R, which has a number of interesting features including intervalometer timing. Additionally, most digital EOS cameras can be controlled remotely by personal computers and can easily be set up in this fashion, though of course must remain tethered to the Mac or PC using a USB cable the whole time. In fact, digital cameras are perfect for intervalometer work since you don't have the limitation of the length of a roll of film - you can keep filling up your computer hard drive with nearly endless photographs.

Camera problems.

I took a photo and stuff appears around the very edge of the photo that I didn't see in the viewfinder. Why?

Only top of the line EOS cameras (all 1 series cameras and the EOS 3) have 100% viewfinder coverage. All other EOS cameras have lesser amounts of coverage - typically 92% or 90%. So it's possible that things at the very periphery of the picture may not be visible in your camera's viewfinder.

Canon do this because 100% viewfinders require larger, heavier and costlier pentaprisms or mirrors. Normally it's not a big problem, though. Photo labs tend to crop images slightly when printing and slide mounts tend to cover the edges of slide film.

My camera says it can go from *f*/1 to *f*/91. Why won't it?

The aperture range of any camera/lens combination is determined entirely by the optical properties of the *lens* and not the camera.

The aperture range of a camera is very wide so that the camera can be used with a wide range of lenses. But if you've got a lens that has a maximum aperture of *f*/3.5 then that's the maximum aperture you're going to get. Trying to set the camera to *f*/1.8 will do no good at all.

The same goes for the minimum aperture setting. Most EF-compatible lenses have a minimum aperture setting of *f*/22 or *f*/32 (though this value is not printed on the outside of the lens) and can't go to *f*/64 or anything like that.

There are black specks in my viewfinder! I got fingerprints on the mirror! What can I do?

First of all, remember that dust in the viewfinder and fingerprints on the mirror do not affect picture quality in any way. When any SLR takes a photograph the mirror is flipped up out of the way and light passes through the lens and strikes the film directly. Viewfinder dust is merely an irritant when you use your camera. In theory heavy marks on the mirror could affect accurate metering and autofocussing, but it probably won't make a difference unless the contamination is really severe.

Second, all the internal components of the camera are extremely fragile. Mirror coatings and viewfinder screens in particular are extremely delicate and very easily scratched. If you're a beginner you're probably best off taking your camera to a repair shop and having a professional clean it - it probably won't cost much at all, if anything. Don't use solvents, since the finder screens are made of etched plastic. Viewfinder specks are frequently caused by dust particles on the top side (ie: inside surface) of the viewfinder screen. Since most EOS cameras have viewfinder screens that aren't meant to be user-removable you have to be extremely careful when messing around with them.

In short, don't worry about it unless it really bothers you. Being overly fastidious about camera condition is a great way to waste a lot of time, but doesn't help actual photography at all. Keep your lens glass clean, though!

My camera's back flexes slightly when I squeeze it. Is this a problem?

Nope. Many low to midrange EOS film cameras have a bit of creaking flex to their backs. It doesn't feel particularly reassuring but isn't a sign of pending failure or low quality or anything else really. Nothing to worry about.

My lens is slightly wobbly when attached to the camera. Is this normal?

A very slight amount of play between the lens and the camera body is normal, yes. When the lens is locked into position you often will be able to rotate it in either direction by a tiny amount, particularly on less expensive EOS cameras. You should not, however, be able to rock it back and forth - the lens barrel mount and the camera body mount should remain precisely parallel. But a minute amount of rotational lens play is really not important.

The camera is turned off and yet the screen on the top is still on. Why?

This is normal with EOS film cameras. If you've got film loaded into the camera then the top-deck LCD panel will display the current frame count even when the camera is off so you don't have to turn the camera on just to see how much film is left. This is why Canon called the "off" position on the command dial "L" for "lock" for many years - the camera is still technically powered on, just in a low-power mode.

This does of course consume battery power. But don't worry about it unless you're planning on leaving your camera in storage for some prolonged period of time - months or years. Consider digital wristwatches - they display stuff on their screens on an even tinier battery for very long periods of time too.

Why does my camera click faintly when I tilt it?

A few EOS cameras, notably the EOS A2E/5 and the 10D, contain a position sensor that detects whether the camera is being held normally (landscape orientation) or vertically (portrait). This sensor is used by different things depending on the camera - the ECF system (the A2E/5 has ECF which works only in landscape mode), the evaluative metering system (to determine whether there's bright sky at the top of the frame) and capture orientation (for digital cameras). The position sensor can make a faint clicking sound when you tilt the camera.

Why does my camera wind for so long when I first load a roll of film?

Your camera is probably a consumer-level (or Rebel series) film camera which uses a "safety prewind" system for loading film. This type of camera unspools the entire film from the canister when you first put it into the camera. As you shoot photos the film is then spooled back *into* the canister. When you reach the end of the roll the short length of film remaining is wound back into the canister, and you're done.

This is advantageous since if you open the camera back inadvertently you will be exposing (and ruining) all the unused film. You might lose a frame or two, but the bulk of your photos will have been spooled back into the canister and are safely out of harm's way. Not only that, but the camera's LCD will always display the exact number of frames remaining on the roll - you don't have to think and remember if

you have a 24 exposure or 36 exposure roll in the camera and calculate the remaining shots from there.

All other EOS film cameras wind the traditional way - they spool the film out, shot by shot, and then rewind the film back into the canister when you're done. This difference in film-spooling methods can be a problem if you want to exchange a partially shot roll of film between a consumer EOS camera and any other model.

My camera won't load a roll of film. What can I do?

There are a few things you can consider.

- Is the cartridge correctly seated in the camera? If you're using 35mm film, did you pull the tongue of film out so that the tip lines up with the film-load mark (usually bright orange) on the inside of the camera body? If you fail to do this then the camera's motor will probably wind for a few seconds and then the film canister icon on the camera's top deck LCD will start blinking.
- Is the battery good? If the battery is low then the camera will not load correctly. The usual symptom of this problem is a blinking battery symbol on the camera's top deck LCD.
- Is the camera locked up in some way? For example, if you keep the popup flash on a camera (if it has one) from opening - by pressing it down when it tries to open - then the battery symbol may flash on the camera. The camera may then not respond to any controls until you turn it off and then back on.
- Is the interior of the camera clean and free of dirt? Most EOS cameras use infrared diodes to determine film position. If the small clear plastic window to the upper right corner of the shutter is covered up then the film won't load.
- Is the camera loading the film and then immediately rewinding it all the way back into the camera, wasting the roll? If so, you probably have a consumer series (1000/Rebel) camera from which the film was extracted before being properly rewound. To correct this problem close the camera up empty (ie: make sure there is no roll of film inside) and then fire the shutter. When you open up the camera and reload a fresh roll of film it should work fine.
- Do you have a digital EOS camera which does not take film?

Which EOS models are vulnerable to the problem of blank photos caused by a sticky (oily) shutter?

EOS film cameras made from the late 1980s to early 1990s are vulnerable - the 600 series, EOS 10/10s, 100/Elan, 1000/early Rebels, etc. All of these cameras have an internal foam rubber shutter bumper which deteriorates with time, turning into a black shiny glue-like oil which gums up the shutter blades. A stuck shutter will often result in blank or wildly underexposed photos being taken. In my experience the problem is exacerbated by high temperatures.

Unfortunately most of these oily shutters show up long after the warranty period has expired, so Canon will not replace the shutter for free. You have to clean the shutter yourself (see my brief article on the topic) or have it replaced at your expense.

Which EOS models are vulnerable to broken command or mode dials?

The EOS A2/A2E/5 are the models best known for this problem. The Elan/100 is also susceptible.

These film cameras have a design flaw in the main (top deck left) mode dial. The dial has a small central lock button which you must press down before turning the dial. Unfortunately the dial's detent mechanism is held in place with two tiny plastic pins which are easily broken. If they break then the top dial simply freewheels and can't be used for adjusting anything. Quite often the dial becomes stiffer to turn with age, increasing the pressure on the small pins.

Some people claim that this breakage problem is user error and that people must always remember to press the lock button down before turning the dial. While pressing the lock button before turning is important it also seems not to be the entire issue, as many users who claim to press the lock button religiously before turning the dial also experience breakage problems.

If your camera dial broke under warranty Canon will have replaced the entire top deck assembly which includes a new dial with allegedly slightly thicker pins. Many users report that the new dials break too, unfortunately. You can fix the problem yourself by replacing the pins with tiny screws if you're extremely mechanically adept or you can pay Horizon Electronics, a popular repair shop, to do it for you. See also Jim Strutz's EOSDoc article on the subject.

The built-in flash on my EOS 5/A2/A2E won't pop up. What's wrong?

This is a fairly common problem. The camera's hotshoe has two small microswitches which detect the presence of a flash unit - or anything else - in the shoe. If either of these switches are depressed then the internal flash unit will not pop up. Unfortunately these switches can easily get stuck.

For more information on fixing this problem, which usually involves a couple minutes of work with a small Philips-head screwdriver, have a look at this Photo.net post by Todd Fredrick.

What's this about the EOS 3 having exposure problems?

Some early models of the EOS 3 had a firmware (internal computer program) bug which lead to the camera underexposing images by about 2/3 of a stop. Later models have revised firmware which fixes the problem. If you suspect your camera might be misbehaving in this fashion you can simply take your camera to Canon who can reprogram the camera without opening it up.

While this problem was real it should be noted that most EOS 3s don't suffer from this problem. So by all means have your camera checked out if you notice real exposure problems on narrow-latitude films such as slide or infrared film, but don't worry about it unduly otherwise.

Why does my camera lock up when I push the shutter release button?

If your camera locks up (ie: does not respond to any controls) after you press the shutter button then have a look at the following:

- Is the battery OK? Try using a different battery that's known to be good.
- Is the battery slightly the wrong size? All camera batteries should be precisely the same length, but sometimes there are tiny discrepancies between one make and another, particularly when it comes to 2CR5 batteries. Try a different brand of battery.
- On some cameras, notably the EOS Elan II/IIE/EOS 50/55, the battery compartment is slightly too long to accommodate typical 2CR5 batteries, which results in poor electrical contact. Try folding a piece of thin cardboard in half and jamming it underneath the battery door cover and see if the camera works again.
- Try cleaning the contacts on both the camera and battery. Use the tip of a clean pencil eraser and rub the metal contacts very lightly, being careful not to get crumbs of eraser into the works.
- Try cleaning the connections on the camera's lens mount and the contacts on the camera lens itself. Again, be really careful - the contacts are quite delicate.
- Are you using a third party lens? Many older Sigma lenses will lock up newer cameras, particularly those introduced post the Elan 7/EOS 30/33/7. Try a different lens, particularly a Canon-built EF lens, and see what happens. If it turns out it's your Sigma lens you should contact Sigma and ask them if it's possible to reprogram or rechip the lens for compatibility. Some lenses can be modified to work with new cameras and some cannot.
- Has the film jammed if you're using a film camera? Try pressing the midroll rewind button. If you need to extract film, do so in total darkness if you want to recover any images which may already be on it.
- Does the shutter have oily patches on it? Earlier EOS cameras - the 600 series and the 10/10s and 100/Elan - have a known problem of a tar-like material forming on the shutter blades. This stuff gums up the shutter, causing the camera to lock up when you try to take a photo.

  Failing all that you may need to take your camera to a repair shop.

My camera displays "bC" or "Err 99" when I try to take a picture. What does this mean?

BC is an error condition in EOS film cameras, and means one of two things. It either means "battery check," so try putting in a fresh battery, or it's a general error condition of some type. If the battery is fine, have a look at the previous section for things to check, especially dirty lens contacts or lens compatibility problems with Sigma lenses. Error 99 is essentially the same error condition as BC, only on EOS digital cameras. The EOS D30 also had error codes 09 and 10, which are similar.

My camera displays "00" as the aperture setting. What does this mean?

A 00 aperture reading means that the camera can't communicate with the lens electronics and so is operating in stop-down metering mode. There are a number of common reasons why this might appear.

- There is no lens installed on the camera.
- There's a lens on the camera but it isn't mounted properly.

- The lens on the camera has no internal electronics, such as the case of an old manual-focus lens which has been adapted to an EOS camera by means of an adapter ring.
- The contacts on either the lens or camera or both are dirty or defective. Try cleaning the lens and camera contacts gently and carefully.
- The lens electronics are shot.
- The lens is an older third party lens (eg: an older Sigma) which is not compatible with your camera. Try an EF lens made by Canon and see if the problem persists.
- The camera's electronics are shot.

Why does my camera's date printing feature not work?

Is date printing turned off? If the date back LCD display shows "----" then no date information will be printed. Try pushing the MODE button on the camera back, if it has one, until it displays the date.

If the date back doesn't respond at all then you may need to replace the battery. Most EOS film cameras with date capabilities use a tiny lithium CR2025 button cell to power the date back - they usually don't use the camera's main 2CR5 battery. (the 10QD being one exception)

Or you could do without - surely your photos look nicer without the date stamped all over the corner?

Choosing a lens and basic lens categories.

Why doesn't my camera just come with a lens? Isn't that kind of cheap?

No. It's actually a good thing. First of all, the whole point of a camera with interchangeable lenses is you can attach whatever lens you need. Unlike a simple point and shoot with its non-removable lens you aren't limited to whatever the manufacturer builds into the camera. Second, everyone has different needs and budgets. So it's usually desirable not to include a lens so you can choose the lens or lenses which are right for you, not some generic lens. Third, what if you were to buy another camera? Then you would have two of the same lenses.

Having said that, Canon do sell many EOS cameras bundled with included lenses. Such lenses are called kit lenses, but frankly not all kit lenses are of a particularly high quality. You're often best off buying the camera body which suits your needs and finding a good lens to match it.

What are wide-angle, normal and telephoto lenses?

We've all had the experience before. You're trying to take a photograph of some friends, but you just can't fit everybody into the picture. You step backwards further, but there's a wall or cliff or something, and it just isn't going to work, so you tell your friends to squeeze in closer. Or you see a bird flying by in the distance, you

grab your camera, and you end up with a big photograph of sky with a disappointingly tiny little dot in the middle of the frame.

In each case the field of view provided by the lens isn't appropriate for your subject matter. In the first instance your lens is not "wide" enough to take in the whole scene, and in the second your lens isn't "long" enough. There are three rough categories of lenses when it comes to how much of a scene they can take in, and the field of view of each type is defined by an optical property known as the focal length of the lens (a property explained later in this document).

- A so-called **normal lens** roughly approximates the perspective, though not the area of, a scene seen by one human eye. By convention a normal lens on a 35mm film camera (and thus a full-frame EOS digital SLR) has a focal length of 50mm or so. Think of normal lenses as being good for taking pictures in close, but not intimate, proximity to a subject, like a waist-up picture of a person in an ordinary room.
- A **wide-angle lens** can take in a large area of a scene. This has two common applications - first, it means you can take in sweeping panoramic landscape scenes, and second, you can take in large areas of an ordinary room. If you want to take a photo of a group of friends at a dinner party you'll need a wide angle lens unless you can back up far enough to get everyone in. On a 35mm film camera a wide angle lens would have a focal length of, say, 35mm or less.
- Looking through a **telephoto lens** is like using a telescope - it narrows down what can be seen in a scene or makes the subject seem much closer than it really is. A telephoto lens might have a focal length of 70mm or more on a 35mm camera.

Note one area of potential confusion - there are different measurements expressed here in millimetres, but which refer to two different physical properties. In the case of 35mm film cameras, we're talking about the width of the film material. But in the case of, say, an 80mm lens, we're talking about its focal length. You can thus put a 28mm lens on a 35mm camera - the measurements are about different things.

These are just broad categories, of course, and there are big variations in each one. You can get an inexpensive 28mm lens, for example, which is only modestly wide. Or you can get a crazy expensive 14mm lens which can take in a huge area of a scene - perfect for shots of ultra-dramatic skies. Similarly you could put an 85mm lens on your camera for portrait photography, or you could sell your car and buy a huge 600mm lens that requires a large suitcase for transportation but which lets you take a closeup of a bird's face from a huge distance away.

What's the difference between a zoom lens and a fixed focal length (prime) lens?

A prime lens is a lens in which the field of view (focal length) cannot be adjusted. The only way to take in more or less of the scene is to walk closer to or further from the subject. (sometimes called "zoom with your feet," though this is technically inaccurate since changing camera position is not the same thing as adjusting the focal length) Or you have to carry a selection of lenses of different focal lengths with you and swap them out as required.

A zoom lens is a lens in which the field of view can be adjusted. If you can't fit in all your friends in the picture, for example, you could just rotate the zoom ring on the lens until they're all in there. Or if that bird is too far away you could rotate it the other way to zoom in closer.

Up until the late 1980s prime lenses were the most common lens sold, because from an optical design standpoint it's much easier to design a high quality prime lens that can take nice sharp photographs than a decent quality zoom lens. But a prime is also obviously a lot less convenient, since you have to move around more to fit stuff in. So by the late 80s zoom lenses became more and more popular. Today hardly any low-cost lenses are prime lenses, because everybody wants zooms.

So why buy a prime lens at all? Well, for the same reason as ever - prime lenses are easier to build and offer fewer compromises in design. If you want a really sharp crisp lens, then a good prime will offer sharper pictures than most zooms. Or if you want a lens that can let in lots of light and thus can be used for low-light photography then you'll probably want a prime, since it's much harder to build a "fast" (lets in lots of light) zoom lens. And some crusty old photographers also argue that using prime lenses is very important for novice photographers since it forces them to learn about the importance of focal lengths and perspective.

Lens construction is thus always about tradeoffs. You may want a lens that's small, lightweight, has zoom capabilities, lets in lots of light, is really sharp, has high contrast, doesn't distort the image and is cheap. But in real life you can only get some of those properties - it's impossible to get all of them, sadly.

Most amateurs on a budget choose the flexibility of low-cost zoom lenses over picture quality as their compromise. Many advanced amateurs choose the higher picture quality of affordable primes and deal with the inconvenience as theirs. And many professionals buy high quality zooms that weigh a ton and cost piles of money as theirs.

Note one common misconception - a lot of people think zoom lenses are used for taking photos of things far away. That's actually a better description of a telephoto lens, as described above.

Which lens should I buy for my camera?

As with buying a camera there are a lot of things to consider, so this question really can't be asked without asking many more questions first. Here are some of them:

What exactly are you going to be photographing?
Your photographic goals and objectives essentially inform all of the other decisions. Will you being shooting landscapes? Portraits? Your kids or pets? Flowers? Wild birds? Sports? Architecture? Will you be doing travel photography? Will you be hiking with your gear? These sorts of questions are critical to ask yourself first.

How much money do you want to spend?
You can spend huge amounts of money on lenses, so determining your budget, as with cameras, is pretty important.

Do you want to buy a used or a new lens?
The same questions apply as when purchasing a new or used camera.

Do you want a prime (fixed focal length) or a zoom (variable focal length) lens?
Prime lenses generally afford higher optical quality than zooms, except in the case of really expensive pro zoom lenses. However prime lenses mean you have to walk around more - you can't simply adjust the zoom setting to get the framing you need.

What focal length or focal length range do you want to cover?
I'd sit down with your photos and think about what focal lengths you tend to use most and where there are gaps. Maybe you want an extreme wide angle, for example. If so there's no point getting another telephoto.

Do you need a fast lens?
Do you want to do low-light photography without a tripod or flash? Do you want to do portrait photos while blurring the background? These applications call for a faster lens which can let in more light.

Do you want to buy Canon-built or third party lenses?
Third party makers build many great lenses, but many are also really poor - you have to do some research. And others have compatibility problems with existing cameras or may have future compatibility problems. Are the price savings worth it for the specific lens you're interested in?

Do you care about the user interface and build quality?
A lens may be slow to focus or inconvenient to use but offers higher optical quality than another lens with a faster motor and a better designed UI. Ring USM motors are fast, silent and offer full-time manual override, but lenses containing such motors tend to cost more than slower, noisier non-FTM arc-form (AFD) motors.

What aspect of optical quality is important to you?
Obviously sharpness and contrast are pretty important to most people, but what about distortion? Many consumer zooms have a lot of distortion, making them unsuitable for architectural photography. They also tend to be more vulnerable to flare (lowering contrast or resulting in bright spots on the picture if a bright light like the sun is in or near the frame) and tend to have very slow maximum apertures.

Which lens should I buy for my EOS digital camera?

There are two things that are important to keep in mind when shopping for lenses for an EOS digital camera, such as the EOS 10D, rather than an EOS film camera.

First, EOS digitals are still not as cheap as film cameras, so don't just try to find the cheapest lens you can. And if you're going to be shelling out this much money for the camera body, buying the cheapest lens you can find is not merely false economy, it's downright foolish, if you ask me.

It's like spending massive amounts of money on a high-end CD player and amplifier and then plugging them into a pair of toy loudspeakers. Just as the final sound of your music will be hobbled by the toy loudspeakers the final quality of your pictures

will be hobbled by a cheap lens. So avoid lenses in the "cheapie" category (see below).

Second, with the exception of the cropping factor the selection criteria for buying a lens for a digital camera really don't differ much from the criteria for buying a lens for a film camera. What type of photography do you want to do? Do you need a wide angle for landscapes? A fast-focussing telephoto for sports? A sharp and short telephoto for portraits? How much weight do you want to carry around? These questions are the same regardless of whether you want to shoot film or digital - check the list above.

But as noted, there is one major difference to keep in mind with most digital EOS cameras - the cropping factor, also known as the focal length multiplier. With the exception of the EOS 1Ds, 1Ds mark II and 5D, which have full-size image sensors equivalent in size to a 35mm EOS film camera, most current EOS digital cameras use image sensors smaller than a 35mm film frame. If your camera has a cropping factor of 1.6x it means that, say, a lens with a 50mm focal length will suddenly behave rather like a lens with an 80mm focal length. The focal length of the lens does not change, but its apparent effect does. (since the image sensor is smaller, think of it as simply snipping off all four sides with a pair of scissors, resulting in a smaller picture, and then enlarging the picture on a photocopier)

This issue has two nice advantages. First, you can buy a cheap 50mm lens and use it as a very nice portrait lens. Second, you can attach a telephoto to your camera and it'll behave like a much longer telephoto - you'll have much more reach. The drawback, of course, is that wide angle pictures are harder to achieve as you need much wider lenses for such photos. This can be a significant problem for many people.

So with such digital cameras you will probably want to get a lens that's a bit wider than you would if you were buying for a 35mm film camera. If you use a 28-105mm lens on your 35mm camera, for example, you might get a 24-85mm lens instead.

The one question related to this is whether the EF-S 18-55 lens (see next section) included with the EOS 300D/Digital Rebel/Kiss Digital kit is worth it. The consensus is that it's definitely worth the small increase in price over the body only. The EF-S 18-55 is no L series lens by a long shot, but it offers surprisingly decent optical quality for the incredibly low price, and it's the only affordable way to get down to moderately wide angles (roughly the same as a 29mm lens on a 35mm film camera) on the 300D.

One final issue with digital is that some newer lenses have coatings which work a bit better with digital image sensors than those used on older lenses. Generally speaking this is a fairly subtle issue, advertising notwithstanding.

What is an EF-S lens?

From essentially the introduction of the EOS camera system in 1987 through to 2003 Canon standardized on a single lens mount system for all of their SLR cameras - the EF (electrofocus) lens mount. So throughout this time there was no possible source of confusion, since all EF lenses made by Canon and other lensmakers will physically fit all Canon EOS cameras.

However, in 2003 Canon introduced a new digital camera, the consumer-oriented EOS 300D/Digital Rebel/Kiss Digital camera, which sported a new lens mount design dubbed EF-S. All consumer to midrange digital EOS cameras released since have been both EF and EF-S compatible. For reasons explained in a moment, no film camera has ever been EF-S compatible.

So it's important to remember that digital camera bodies with EF-S lens mounts are totally compatible with all regular EF lenses. However an EF-S lens can fit only EF-S compatible cameras and no others. (unless the lens is altered - see the section on hacking below).

EF-S bodies have small mirror boxes - roughly 2/3 the size of a regular EOS camera (also known as a 1.6x cropping factor) - because they use image sensors which are smaller in area than 35mm film. They, and APS cameras which similarly used small imaging areas, are thus often called subframe cameras. Cameras which use 35mm film or which use large sensors that are the same size as a frame of 35mm film are commonly called full frame cameras these days.

EF-S cameras thus support lenses with a shorter back focus distance than EF lenses, because the mirror swings further back. This is where the "S" comes from - EF-S lenses have *shorter* back focus distances. (ie: the back part of the lens can get physically closer to the image sensor since the mirror is smaller) Having a shorter back focus distance allows Canon to produce cheaper wide-angle lenses that work with the smaller image format of a subframe digital SLR, since it's optically very challenging to create a wide angle lens with a long back focus distance.

Canon have a small but growing series of EF-S lenses available, ranging from inexpensive kit lenses to very good high-quality lenses with image stabilization. There's even a very interesting 60mm macro lens with an EF-S mount. The super wide angle EF-S 10-22mm 3.5-4.5 USM (roughly 16-35mm coverage if it were full frame) is particularly well regarded, as is the EF-S 17-55 2.8 IS USM, which is an L lens in all but build quality and name.

The main issue to be concerned about with EF-S is the future value of the lenses. Right now full-frame image sensors are extremely expensive to make, which is why nearly all digital SLRs out there have image sensors smaller than that of a frame of 35mm film. But in the future it's likely that prices on such sensors will drop, at which time full-frame digital SLRs will become more affordable and thus EF-S lenses will no longer be of use except on pre-existing cameras. The two questions are - how long will this take and will you be able to get good use of your investment in EF-S lenses before this occurs? The first nobody knows the answer to, and the second can only be answered by you. For the time being it seems likely that it'll be some years before affordable full-frame sensors are ubiquitous, so EF-S lenses aren't necessarily a bad idea, assuming you aren't planning on upgrading to full-frame as soon as you can.

Can my camera take EF-S lenses?

Any Canon EOS camera with a red dot on the lens mount can take EF lenses. Any Canon EOS camera with both a red dot and a white square on the lens mount can take both EF lenses and EF-S lenses.

What you see is what you get

This whole discussion about focal lengths and EF versus EF-S can be very confusing if you're a beginner. The key thing to remember if you're just starting out is *what you see is what you get.* When you look through the viewfinder you're going to see pretty well exactly what will be in the photograph - minus a tiny little strip along each edge on consumer cameras. So there's no need to worry about mathematical calculations and whatnot to figure out what will be in your picture and what won't.

The only time the whole cropping factor is really an issue is when you're comparing how much of a scene (coverage angle) is taken in by an EF lens on a full-frame camera, compared to an EF lens on a cropped body, or compared to an EF-S lens on an EF-S compatible camera. For guidance on this, take a look at my Complete EOS Lookup Page. It allows you to compare multiple lenses to see how much of a scene each lens can take in when used on cropped or full frame bodies.

Distinguishing EF from EF-S

Regular EF bodies and lenses use raised red dots for aligning lens and body. EF-S bodies have a white square as well, which must be lined up to the white square on EF-S lenses. Interestingly enough, EF-S lenses also have rubber rings around the end which press up against the interior of the camera body. This is not as sophisticated as the weather seals used in L series lenses, but presumably helps reduce dust levels inside the camera slightly. Also, according to Canon, this ring minimises damage if you were to try and mount an EF-S lens on a EF-only camera.

Full frame equivalent

You'll sometimes see phrases such as "full frame equivalent" or "35mm equivalent" in conjunction with lenses designed for subframe sensors, such as EF-S lenses. Properly speaking these are not *equivalent* values for a variety of technical reasons, but they are nonetheless useful points of reference. For instance, a 60mm EF-S lens has the same field of view as a 96mm lens on a 35mm film camera. So sometimes 60mm EF-S lenses are said to have a full-frame equivalent field of view of 96mm.

EF-S lenses and film cameras

No EOS 35mm film camera has or is ever going to use an imaging area smaller than 36x24mm, so no EOS 35mm film camera will ever be able to support EF-S lenses. Even if you were to attach one somehow the mirror would collide with the back of the lens when it flipped up, and the lens would vignette severely because EF-S lenses can't image an image circle as large as 35mm film. In theory Canon might be able to build an APS camera with support for EF-S lenses, since APS film uses a surface area smaller than that of 35mm film, but since APS is a commercially moribund format that isn't ever going to happen. So the only cameras you'll ever see with EF-S lens mounts are going to be digital.

Hacking EF-S lenses

While EF-S lenses are not designed to fit EF-only cameras, it *is* possible to saw off or, in some cases, unscrew the back of an EF-S lens and attach the lens to any EOS camera. The problem is that if you put a modified EF-S lens on an EOS camera with a standard sized mirror box then the mirror will flip up and smash into the lens when

you try to take a photo. So modified EF-S lenses will only work with older EOS digital cameras with cropping factors of 1.6x that predate the EF-S system: namely the EOS D30, D60 and 10D. Even then there are risks. For example, at its widest position the EF-S 10-22mm lens collides with the mirror in non-EF-S compatible cameras, even those with small mirror boxes. (for this reason it's unwise to use a modified EF-S lens on a 1.3x digital camera such as the 1D) Messing around in this fashion is fun - I've done it myself and it works well - but obviously invalidates your Canon warranty and runs the risk of breaking something.

What are all these numbers printed on my lens?

Lenses have bits of text printed on the barrel or around the front element which convey a lot of important information about their properties. Be really careful when shopping for lenses. Two lenses may have very similar-looking names, but may actually be completely different one from the other.

Here are two examples. Note that all the technical terms used here are described later on in this FAQ.

CANON LENS EF 28-80mm 1:3.5-5.6. Ø58mm.

EF means that the lens is of the Canon EF type. EF lenses fit Canon EOS cameras and virtually no others.

28-80mm refers to the focal length of the lens. In this case there are two values since the lens is a zoom lens which can go from 28mm at its widest to 80mm at its longest. These numeric values in millimetres essentially indicate the coverage area of the lens.

1:3.5-5.6 refers to the widest aperture of which the lens is capable. The 1: is there since f/stops are, technically speaking, ratios. Since the lens is a zoom there are two aperture values - f/3.5 and f/5.6. This particular lens is an inexpensive amateur lens which can be opened up to f/3.5 at the widest end (28mm) but only f/5.6 at the longest end (80mm). This means it's a fairly slow lens - it can't let in much light, even when its aperture diaphragm is fully open.

Note that the autofocus motor type is not indicated, which means that the lens uses either an AFD (arc-form drive) or micromotor drive. Both types are slow and noisy compared to ultrasonic (USM) motors.

Ø58mm refers to the filter ring diameter. In other words, screw-on filters 58mm in diameter will fit this lens.

CANON LENS EF 200mm 1:2.8L II USM. Ø72mm.

EF means that the lens is a Canon EF lens for EOS cameras.

200mm refers to the focal length. Since only one value is indicated, this lens is a prime lens (ie: a lens with a fixed focal length).

1:2.8 refers to the widest aperture of which the lens is capable. f/2.8 is reasonably wide, especially for a 200mm telephoto lens, and so this is considered a fast lens.

L indicates that the lens is an L or "luxury" series Canon lens. Such lenses are generally the best that Canon manufacture. They are marked with a characteristic red stripe around the end of the lens barrel.

II indicates that this is the second version of this lens with these particular numerical specifications that Canon have made.

USM refers to the autofocus motor type used by the lens. In this case it uses an ultrasonic motor - see below. Non-L USM lenses are marked with a characteristic gold stripe around the end of the lens barrel. L lenses usually have USM motors, but have a red stripe instead (ie: the red stripe takes priority and you don't see lenses with two stripes).

Ø72mm refers to the filter ring diameter. In other words, screw-on filters 72mm in diameter will fit this lens, making it a fairly large lens.

What is a Canon L-series lens and why is it a big deal?

Canon sell a number of lenses in a special series they refer to as L for "luxury." These are their most expensive and highest-quality lenses, and are readily identifiable by the red stripe painted around the end of the barrel.

L series lenses offer higher optical quality than their non-L equivalents, and have an important technical aspect in common. At least one element in every L lens is either made of fluorite crystal rather than glass, is a ground aspheric lens element (not a moulded/replicated aspheric lens as used in less expensive lenses) or is made from ultra-low dispersion glass. Most L series lenses are also sturdily built - many are encased in metal barrels and are weatherproofed - and most are very fast lenses for their focal lengths. Nearly all telephoto L series lenses are also off-white rather than black.

These lenses are, therefore, marketed as professional camera lenses and are usually priced out of the range of most consumers. They can be used to take great photographs, but the cost, weight and size of these lenses are the tradeoffs.

Of course, a lens doesn't have to be an L series lens to take good pictures. Many EOS lenses offer excellent optical quality - they just don't need and thus don't have exotic fluorite lens elements and so on. Many of Canon's prime lenses in the 35mm to 135mm range fit in this category - see below. And some recent EF-S lenses offer near-L image quality but lack the red ring and the tough build quality of contemporary L series lenses.

Note also that the presence of a red ring around the end of a lens barrel only indicates an L series lens if it's actually made by Canon. Some other makers happily paint red stripes around the end of their lenses too, but this in no way guarantees that the lens meets the quality standard of a Canon L lens.

What other general categories of Canon EOS-compatible lenses are there?

In addition to the aforementioned L series lenses most other Canon EF lenses fall into a number of broad categories. Note, however, that these are not official Canon-named categories. As far as Canon is concerned, EF lenses come in two categories - L and all the rest. Nonetheless these informal categories are useful to keep in mind when lens shopping.

Category 1 - consumer lenses.

At the bottom of the consumer line are the cheapies - ultra-low cost, low-quality, slow lenses with plastic mounts and no distance scales. Most of the kit lenses - 28-80 and 28-90 lenses with typical aperture ranges of 4.0 to 5.6 - fit into this category. These lenses are built to be sold as inexpensively as possible and don't have very good optical quality. The only exception to this basic rule is the 50mm 1.8 II - plastic lens mount - which has excellent optical quality despite its cheap build quality, because it isn't a zoom lens like all the others. The cheapies are easily recognizable by their all-plastic construction and straight, parallel-sided lens barrels. Most of the late-model cheapies are identified by the silver (chrome) ring around the end.

Am I being a huge snob by calling them "cheapies"? Maybe, but the point is that Canon optimize these lenses for cheapness. They want products to sell in massive numbers in shopping mall/high street camera shops and department stores. This market does not, it seems, place a great deal of value on image quality - cheap prices for impulse buys are everything. That's great for Canon's balance sheet, but frankly, if I'm going to be dealing with the hassle of carrying around an SLR camera I want at least half-decent optical quality for the attached lens. Otherwise I think it's a lot easier just to carry around a cheap lightweight point and shoot camera.

Category 2 - midrange zooms.

In the midrange are better lenses with improved optics, sturdier build quality, metal mounts and distance scales. These often have ring USM motors. The 24-85 3.5-4.5 USM, 28-105 3.5-4.5 USM and 100-300 4.5-5.6 USM are typical examples. They're decent consumer lenses but don't have the optical clarity of the pro lenses, especially when shooting wide open. However, they generally cost a fraction of the price of the top of the line stuff. These lenses are generally fairly elegantly designed, with slightly rounded and tapered lens barrels, and usually have easy to grip ribbed rubber zoom rings rather than bare plastic.

There are also older low-end zooms with decent optical quality, such as the 28-70 3.5-4.5 II, which don't use modern USM drives but which nonetheless offer good value for money on the used market.

Category 3 - inexpensive primes.

Canon also sell and have sold a number of prime (ie: non zoom) lenses with acceptable optics and average build quality (usually with noisy motor drives, metal mounts and distance scales), such as the 28mm 2.8 and 50mm 1.8 (metal lens mount). Despite their low cost and pretty unremarkable construction they can provide quite good photographic results.

All lenses in this category are mostly normal or near normal lenses - no super wide angles and no long telephotos. The designs generally date back to the early days of the EOS lineup, so they tend to look a bit old-fashioned, style-wise. Canon just haven't seen the need to update any of them.

Category 4 - good primes.

This is a group of prime lenses which offer excellent optics and decent build quality, but which don't really need and thus don't use ultra low-dispersion glass or calcium fluorite crystals or other hallmarks of L-class lenses. Remarkably good lenses like the 85mm 1.8 and the 100mm 2.8 macro fit into this category. Most have ring ultrasonic motors. They generally resemble the category 2 lenses - slightly rounded and tapered lens barrels. Optically they are professional lenses in all but the name, though they're usually not quite as heavy-duty as the fancier L lenses.

Category 5 - specialized lenses.

Canon also make a handful of expensive specialized lenses for unusual applications which I'll just lump into this category for lack of anywhere else to put them. These include their tilt-shift TS-E lenses, the MP-E 65mm super-macro lens and the DO (diffractive optics) lenses.

Which lens falls in which category?

Here's a list of most Canon EOS-compatible lenses - both current and discontinued - sorted according to the categories above. Lenses are EF lenses (all EOS cameras) except those marked EF-S, which fit only EF-S-compatible digital EOS cameras.

The numeric value marked with the Ø symbol is the filter mount diameter. In other words, round screwmount filters of the size indicated can be attached to this lens. A few lenses - the extreme wide-angle lenses and the really long telephotos - use drop-in or gelatine filters inserted into the lens barrel.

Many lenses have the word "Macro" marked on them but only those identified here as macro are true macro lenses. True macro lenses are defined as those lenses capable of 1:1 focussing or better. The only Canon macro lens which doesn't quite fit this definition is the 50mm 2.5 Compact Macro, which requires the add-on Life-Size adapter to reach 1:1.

Check out Canon's Camera Museum site for technical details on all the EF lenses that Canon has ever produced.

Category 1 - cheapies.

These inexpensive lenses feature all-plastic barrel construction with plastic lens mounts (the 75-300 series and the 28-200 lenses being exceptions - they have metal mounts) and no distance scales. Those lenses in this category which have ultrasonic motors (USM) use cheaper micromotor USM, not ring USM. USM lenses are marked with a striped gold line around the end. Some of these lenses also have silver (chrome) rings around the end for good looks. Most lenses in this category

support optional manual focussing, but their manual focus rings are usually awkward and cumbersome to use.

EF-S 18-55 3.5-5.6, Ø58
Inexpensive EF-S kit lens; reasonable optical quality

EF-S 18-55 3.5-5.6 USM, Ø58
Apparently only sold in Japan

EF-S 18-55 3.5-5.6 II, Ø58
Cosmetic update to the above

22-55mm 4.0-5.6 USM, Ø58

28-105mm 4.0-5.6, Ø58

28-105mm 4.0-5.6 USM, Ø58

28-80mm 3.5-5.6, Ø58

28-200mm 3.5-5.6, Ø72

28-200mm 3.5-5.6 USM, Ø72

28-80mm 3.5-5.6, Ø58

28-80mm 3.5-5.6 II, Ø58

28-80mm 3.5-5.6 II USM, Ø58

28-80mm 3.5-5.6 III, Ø58

28-80mm 3.5-5.6 III USM, Ø58

28-80mm 3.5-5.6 IV USM, Ø58

28-80mm 3.5-5.6 V USM, Ø58

28-90mm 4-5.6, Ø58

28-90mm 4-5.6 USM, Ø58

28-90mm 4-5.6 II, Ø58

28-90mm 4-5.6 USM II, Ø58
Silver-coloured

35-70mm 3.5-4.5 A, Ø52
Autofocus only - no manual focus ring

35-80mm 4-5.6, Ø52

35-80mm 4-5.6 PZ, Ø52
Powered (motorized) zoom

35-80mm 4-5.6 II, Ø52

35-80mm 4-5.6 III, Ø52

35-80mm 4-5.6 USM, Ø52

35-105mm 4.5-5.6 USM, Ø58

38-76mm 4.5-5.6, Ø52

55-200mm 4.5-5.6 USM, Ø52

55-200mm 4.5-5.6 II USM, Ø52

75-300mm 4-5.6, Ø58

75-300mm 4-5.6, Ø58

75-300mm 4-5.6 II, Ø58

75-300mm 4-5.6 II USM, Ø58

75-300mm 4-5.6 III, Ø58

75-300mm 4-5.6 III USM, Ø58

75-300mm 4-5.6 USM, Ø58

80-200mm 4.5-5.6, Ø52

80-200mm 4.5-5.6 II, Ø52

80-200mm 4.5-5.6 USM, Ø52

90-300mm 4.5-5.6, Ø58

90-300mm 4.5-5.6 USM, Ø58

100-200mm 4.5 A, Ø58
Autofocus only - no manual focus ring

Category 2 - midrange zooms.

All lenses in this category have metal lens mounts, and come in two basic flavours - old-style lens barrel and new style. The old style feature hard textured plastic barrels with narrow focus rings and their AF/MF switches are low and sometimes difficult to adjust. The new style feature slightly more resilient shiny plastic with wider focus and zoom rings, often with lots of easy-grip ribbed rubber. The new style lenses also boast ring USM focus drives and easier to operate AF/MF switches.

EF-S 10-22mm 3.5-4.5 USM, Ø77
Unusually for a lens not marketed as L series, this lens contains a Super UD element and has very good image quality.

EF-S 17-85mm 4-5.6 IS USM, Ø67

EF-S 17-55 2.8 IS USM, Ø77
This is an interesting lens since it actually has L-series image quality thanks in part to the use of UD glass. However, build quality is on par with better consumer lenses and not L series lenses.

20-35mm 3.5-4.5 USM, Ø77

24-85mm 3.5-4.5 USM, Ø67
Available in silver or black

28-70mm 3.5-4.5, Ø52

28-70mm 3.5-4.5 II, Ø52

28-80mm 3.5-5.6 USM, Ø58
(unlike later all-plastic II and higher models, these lenses have a metal mount)

28-105mm 3.5-4.5 “Macro” USM, Ø58

28-105mm 3.5-4.5 II “Macro” USM, Ø58

28-135mm 3.5-5.6 IS “Macro” USM, Ø72

35-70mm 3.5-4.5, Ø52
Old-style barrel

35-105mm 3.5-4.5 “Macro”, Ø58
Old-style barrel, push-pull zoom

35-135mm 4-5.6 USM, Ø58

50-200mm 3.5-4.5, Ø58
Old-style barrel

70-210mm 3.5-4.5 USM, Ø58

70-210mm 4 “Macro”, Ø58
Old-style barrel, push-pull zoom

70-300mm 4-5.6 IS USM, Ø58
The replacement to the 75-300 4-5.6 IS USM

75-300mm 4-5.6 IS USM, Ø58
Optically a cheapie, but image stabilization moves it up a category

100-300mm 4.5-5.6 USM, Ø58

100-300mm 5.6 “Macro”, Ø58
Old-style barrel, push-pull zoom

Category 3 - inexpensive primes.

With the exception of the all-plastic (including plastic lens mount) 50mm 1.8 mark II, the inexpensive primes all have old-style lens barrels - hard textured plastic, a narrow focussing ring and distance scale.

28mm 2.8, Ø52

35mm 2, Ø52

50mm 1.8, Ø52

50mm 1.8 II, Ø52
Plastic lens mount, no distance scale but same good optics as the 50mm 1.8

Category 4 - good primes.

As with the midrange zoom lenses, the good primes are available in either old-style lens barrel designs or new-style.

15mm 2.8 fisheye
Old-style barrel

20mm 2.8 USM, Ø72
New-style barrel

24mm 2.8, Ø58
Old-style barrel

28mm 1.8 USM, Ø58
New-style barrel

50mm 1.4 USM, Ø58
New-style barrel

50mm 2.5 Compact macro, Ø52
True (1:2; 1:1 with adapter) macro, old-style barrel

EF-S 60mm 2.8 USM macro, Ø52
EF-S only true 1:1 macro lens

85mm 1.8 USM, Ø58
New-style barrel

100mm 2 USM, Ø58
New-style barrel - do not confuse with the 100mm 2.8, which is a macro lens

100mm 2.8 Macro, Ø52
True 1:1 macro, old-style barrel

100mm 2.8 Macro USM, Ø58
True 1:1 macro, new-style barrel

135mm 2.8 SF, Ø52
Old-style barrel, adjustable soft focus control

Category 5 - specialized lenses.

Unusual, expensive and specialized lenses.

MP-E 65mm 2.8 1-5x Macro
Powerful macro lens, for closeups only

TS-E 24mm 3.5 L, Ø72
Tilt-shift, manual focus only

TS-E 45mm 2.8, Ø72
Tilt-shift, manual focus only

TS-E 90mm 2.8, 58
Tilt-shift, manual focus only

EF 70-300 4.5-5.6 DO IS USM
Diffractive optics. Marked with a green ring

EF 400mm 4 DO IS USM
Diffractive optics. Marked with a green ring

L series lenses

All L series lenses are easily identifiable by the red ring around the end of the barrel and the letter L at the end of their technical designations.

Most L series lenses are heavy shiny black plastic or white-painted metal. Most newer lenses (since 1999 or so) are weather-sealed though some (the earliest L

series) are textured black plastic. The handful of early L series lenses with old-style barrels are not built to the same tough build quality of modern L lenses, though optically they're fine.

Most L series lenses are large and fast lenses and thus quite expensive. However in the past few years Canon have also released a few more affordable L series zooms. These lenses are optically slower *f*/4 lenses which are smaller, lighter and cheaper than their *f*/2.8 counterparts. No L series lens has ever been made with an EF-S lens mount: they are always EF lens mounts only.

14mm 2.8 L USM

24mm 1.4L USM

16-35mm 2.8 L USM, Ø77

16-35mm 2.8 L II USM, Ø82

17-35mm 2.8 L USM, Ø77

17-40mm 4 L USM, Ø77

20-35mm 2.8 L, Ø72

24-70mm 2.8 L USM, Ø77

24-105mm 4 L IS USM, Ø77

28-70mm 2.8 L USM "Macro", Ø77

28-80mm 2.8-4 L USM, Ø72

28-300mm 3.5-5.6L IS USM, Ø77

35mm 1.4 L USM, Ø72

35-350mm 3.5-5.6 L USM, Ø72

50mm 1 L USM, Ø72

50mm 1.2 L USM, Ø72

50-200mm 3.5-4.5 L, Ø58
Old-style barrel, push-pull zoom

70-200mm 2.8 L USM, Ø77

70-200mm 2.8 L IS USM, Ø77

70-200mm 4 L USM, Ø67

70-200mm 4 L IS USM, Ø67

80-200mm 2.8L
Old-style barrel; not compatible with teleconverters

85mm 1.2 L USM, Ø72

85mm 1.2 L USM II, Ø72

100-300mm 5.6 L, Ø58
Old-style barrel, push-pull zoom

100-400mm 4.5-5.6 L IS USM, Ø77
Push-pull zoom

135mm 2 L USM, Ø72

180mm 3.5 Macro L USM, Ø72
True 1:1 macro

200mm 1.8 L USM

200mm 2.8 L USM, Ø72

200mm 2.8 L II USM, Ø72

300mm 2.8 L USM

300mm 2.8 L IS USM

300mm 4 L USM, Ø77

300mm 4 L IS USM, Ø77

400mm 2.8 L USM

400mm 2.8 L II USM

400mm 2.8L L IS USM

400mm 5.6L USM

500mm 4 L IS USM

500mm 4.5 L USM

600mm 4 L USM

600mm 4 L USM II

1200mm 5.6L USM

What's wrong with the "kit" lens included with my camera? Why do you call it a cheapie?

Don't take it personally. Canon sell most of their inexpensive consumer cameras either as camera bodies alone with no lenses or as complete kits with a cheap lens, camera strap and perhaps other accessories included. Such kits are usually aggressively priced, and most consumers go for them since they're convenient and the supplied lenses are so cheap. The included lenses are usually referred to as "kit lenses," though they can also be purchased separately if you like.

Unfortunately, kit lenses for low-end cameras are optimized for cheapness, as noted above. They aren't engineered to offer the best optical quality you can find. This means they're usually not terribly sharp and they also tend to produce somewhat low-contrast photos. Kit lenses are also considerably less rugged than more expensive lenses. Finally they're always very slow lenses and so are not much good in low-light situations. These drawbacks are also the case, to varying degrees, for kit lenses made by every manufacturer, incidentally, not just Canon.

Of course, a cheap kit lens will take better photos than a lens you can't afford and thus don't have. Particularly if you avoid shooting wide open and use an aperture setting like *f*/8 to maximize sharpness. Nonetheless, you don't have to settle for poor quality if you check out the used market or if you're willing to pay a little extra - see the section after next for details.

Why are quality lenses so expensive?

Lenses are very complex and costly products to design and manufacture. Each component has to be built to incredibly tight tolerances and carefully assembled. The extremely pure optical-grade glass used in making lenses is very expensive to produce. Expensive lenses don't have the volume sales of cheap lenses, making them more expensive still to produce profitably. So, unfortunately, when it comes to lenses you generally get what you pay for.

Lenses going for 200-300 US$ or € may seem very expensive to a novice, but they are in fact considered dirt cheap lenses by professionals. This isn't snobby elitism necessarily - it's just how it is. Lenses with high optical quality usually cost a lot of money. Photography is, unfortunately, a fairly expensive endeavour.

What's a good beginner lens?

This really depends on your photographic goals. Here are some possibilities to consider.

But before you rush out and buy a lens based on these suggestions I strongly recommend trying out the lenses you're interested in before you buy. Most decent stores won't mind if you go in with your camera and roll of film or an empty memory card and take a few shots of the shop using a couple of lenses. (be sure to use a tripod or rest the camera on a sturdy surface and use identical settings for each lens) They might grumble a bit, but how else can you decide whether a given lens is good

for you? Certainly you don't want to be trusting the advice of random people on the Internet!

Cheap prime lens.
If your primary objective is to learn more about basic photography skills and take photos of reasonable quality then your first lens should probably be a Canon 50mm 1.8 lens. This is a very fast fixed focal length lens. But since it's technically easy to build a 50mm lens, it's also astoundingly cheap. New Canon 50mm 1.8 mark II lenses can be bought for as little as $75 US.

Such a lens, while cheap, takes sharp clear photos and can be used in extremely dim environments without the harsh light of a flash because it's so fast. So the photos you take with it will look better than those from a typical point and shoot both because they're sharp and because you're not bathing your photos in ugly glaring light from a camera's built-in flash. Natural light photographs almost always look better than on-camera flash.

Of course, since it's a prime lens you will have to walk around more to get a lot of shots framed right. And some wide-angle or telephoto-type shots you won't be able to get at all, so those are the obvious disadvantages.

Note that Canon have made two versions of the 50mm 1.8 lens. The older lens has no Roman numeral designation and has a metal mount, a distance scale and an optional clip-on hood. The mark II version has a plastic mount, no distance scale and a clumsy screw-on optional hood. If you can find an original lens it's probably worth going for - it costs as much used as the mark II does new, but is of slightly tougher build quality. Optically the two lenses are basically identical. Canon also sell the 50mm 1.4 USM, which is optically a bit faster and uses a USM drive with FTM, but it costs considerably more than the 50mm 1.8.

However, if you use a digital camera with a cropped sensor (basically any EOS digital camera except for a few top models) then the 50mm might be a less useful choice, since it essentially behaves like a longer telephoto on such models, and won't let you get in much of a scene. In such cases a 28mm 2.8 might be a better option.

Cheap zoom lens.
If you value convenience and image quality is not a priority then an inexpensive zoom lens, such as the kit lenses sold with consumer-level cameras, is fine. However I don't recommend most of these lenses (the "cheapies" in category 1 above) to anyone who's at all interested in photographic image quality. The one exception is probably the EF-S 18-55 kit lens included with the EOS 300/350/400 and Digital Rebel series cameras. This lens, while incredibly cheap, is actually not too bad if you factor in the low cost. Especially if you stop down to f/8 or so when using it.

So what if you're on a budget but really want the convenience of a zoom? Well, you could pick up a used zoom lens of an older generation, many of which have quite decent optics for the price. For example, you could buy a used metal lens mount 28-70 3.5-4.5 II for nearly the same price as a new 28-80 all-plastic cheapie. If you want a lens with silent-focussing USM you could consider the metal lens mount 28-80 3.5-5.6 USM (*not* one of the later plastic lens mount models with Roman numerals), which has similar build quality to the 28-105 3.5-4.5 USM. Two other reasonable but discontinued lenses available inexpensively on the used market

include the 35-135 4.0-5.6 USM and the older 35-105 3.5-4.5. The main drawback is that these lenses aren't really wide enough to be useful on cropped digital SLRs.

In short, you don't have to put up with shopping mall quality just because you're on a tight budget so long as you're willing to consider used lenses.

Mid-priced zoom lens.
If you have a slightly larger budget, a mid-priced zoom (category 2) is worth considering. For example, two popular Canon zoom lenses are the 28-105 3.5-4.5 USM and the 24-85 3.5-4.5 USM. Both are reasonably sturdy lenses with decent though not outstanding optical quality. They feature fast and silent ring USM autofocus motors. They're more expensive and heavier than cheap zooms, but most people find the tradeoff worth it.

Of the two lenses the former has a bit more reach and so is good for isolating objects or for doing simple portrait work. The latter has less reach but is considerably wider (there's a surprisingly big difference in coverage area between a 24mm lens and a 28mm lens) and so is popular for travel photos. The 24-85 is also a good match for those digital cameras with less than full frame image sensors, such as the 300D/Digital Rebel/Kiss Digital or 10D.

If you're interested in the 28-105 3.5-4.5 USM see the important note below about its similarly-named low-cost cousin.

What are some popular Canon EF and EF-S lenses?

Here are a number of popular Canon EF and EF-S lenses you might come across.

EF 16-35 2.8L USM and **EF 17-35 2.8L USM.**
Professional-quality new and old fast wide-angle zoom lenses, used by many photojournalists. Expensive.

EF 17-40 4L USM.
Affordable and optically slower version of the above, popular with advanced amateurs.

EF-S 18-55 3.5-5.6.
Pretty well every 300D/Digital Rebel, 350D/Rebel XT and 400D/Rebel XTi owner out there has one of these, since they're bundled with most consumer Canon digital SLRs sold. Image quality is OK considering the rock-bottom price.

EF-S 17-85mm 4-5.6 IS USM.
Very popular with users of Canon's subframe D-SLRs, this lens combines decent image quality with a useful focal length range and has image stabilizing to boot.

EF 28mm 2.8.
Inexpensive lightweight wide-angle lens, suitable for landscapes and so on.

EF 50mm 1.8 and **EF 50mm 1.8 II.**
Super-cheap lightweight fast lenses, ideal for beginners and advanced amateurs. Take surprisingly sharp pictures for the price.

EF 50mm 1.4 USM.
Versatile standard lenses, useful in low light. These lenses contain micromotor USM mechanisms that unusually support full-time manual focussing.

EF 24-70 2.8L USM and **EF 28-70 2.8L USM.**
Large, heavy black L series lenses, noted for their high quality. Expensive and popular with wedding photographers.

EF 24-105 4L IS USM.
Very popular and quite expensive L-series image-stabilized walkaround lens.

EF 28-70 3.5-4.5 II.
Cheap older lenses with a reputation for decent optical quality despite the really low price. Rotating recessed end makes filter use awkward, however.

EF 28-80 3.5-5.6 II-V, 28-90 4-5.6.
Extremely cheap Canon lenses, supplied with many low-end camera bodies as kit lenses. Lousy optics.

EF 24-85 3.5-4.5 USM, 28-105 3.5-4.5 USM and **EF 28-105 3.5-4.5 USM II.**
Medium-sized, medium-priced and medium-speed lenses popular with many amateur photographers. The 24-85 is particularly popular with APS and subframe digital EOS users owing to its wider short end. Do not confuse the 28-105 3.5-4.5 lenses with their cheaper and slower 4-5.6 cousins.

EF 28-135 3.5-5.6 IS USM.
Popular and versatile midrange lenses equipped with image stabilization for low-light shooting.

EF 85mm 1.8 USM.
Sharp and relatively inexpensive prime lenses, ideally suited for portraiture.

EF 100mm 2.8 Macro and **EF 100mm 2.8 Macro USM.**
True macro lenses capable of 1:1 closeup photography, yet equally useful as portrait lenses.

EF 70-200 2.8L USM and **EF 70-200 2.8L IS USM.**
Heavy white L series lenses, favoured by a lot of photojournalists. Expensive.

EF 70-200 4L USM.
Optically slower and less heavy siblings to the 2.8L. Considered a bargain for the price by many photographers, and popular with advanced amateurs.

EF 70-200 4L IS USM.
The image stabilized version of the 4L. Much more expensive, however.

EF 70-300mm 4-5.6 IS USM.
A popular lens for its compromise between size, convenience and image quality. Much sharper than its 75-300 predecessors, and image stabilization is a big plus. Not to be confused with the DO (diffractive optics) lens, which is extremely expensive.

EF 75-300 4-5.6.
Commonly available cheapie-series telephoto lenses (see below). Ubiquitous owing to the low price, but optically poor.

EF 1200mm 5.6L USM.
Okay, so these gigantic and insanely expensive telephoto lenses aren't popular as such, but always feature prominently in Canon's lens advertising. Canon will gladly custom-build one for you, given a prepaid order. I think they run for roughly the cost of a luxury automobile.
Frankly if you need this sort of focal length you're better off with the 600mm 4L IS USM and a 2x teleconverter, though admittedly you'll need an EOS 1V, 1D, 1Ds or 3 to autofocus with it.

Should I buy a non-Canon (third party) lens?

Despite Canon's vigorous advertising campaign against third-party lenses a lot of people happily use lenses made by Tamron, Tokina and Sigma (and lenses with other brandnames but probably built by one of those three). And there's one really good reason for this - the third party lenses are almost always much much cheaper than equivalent offerings from Canon.

So. Should you buy a third party lens? It's not a simple yes/no issue, so here are some points to consider.

- Price savings of third party products can be considerable, particularly if you're looking to get a faster, higher-quality zoom lens.
- Remember that the cheapest lenses are optimized for price, not for optical quality. And the profit margins for cheap products tend to be very thin. The price differential between Canon and third party isn't huge when it comes to super-cheap lenses, so I don't know if third party lenses are such a great idea in this case.
- Third party makers produce lenses in a variety of market categories. Conventional wisdom is that if you're considering third party at all you should consider the higher end of their product line, not the lower end for the reason above.
- On the whole, Canon lenses seem to hold up their used value more than third party. If you intend to resell the lens anytime soon this can be a consideration.
- Camera salespeople seem very eager to push third party lenses, so it's likely that they receive bigger kickbacks from the manufacturers in return. Don't let yourself be swayed by an eager salesperson - he or she probably isn't trying to convince you to buy something for your benefit.
- Buying Canon is pretty well a guarantee that your lens will work with any Canon EOS camera. However Tamron also have an excellent compatibility record with EOS cameras. Always test with your camera first, but be aware that the lens may not necessarily work with future EOS cameras.
- Some older Sigma lenses do not work correctly with the latest EOS cameras. They fit the camera but don't have compatible electronics, so the camera tends to lock up when you try to shoot. If you have such a lens you'll need to contact the manufacturer to see if they can provide a free repair to the problem. The lenses don't damage the camera - they just cause a temporary

lockup that's quickly cured by turning off the camera and turning it back on again.
- Build quality of older Sigma products is notoriously inconsistent. A quick search of the Web reveals countless complaints from unhappy Sigma lens owners. Newer Sigma lenses seem to be a bit sturdier, judging by anecdotal evidence.
- Many of Tokina's lenses have heavy metal lens barrels, which take a lot of abuse but are a drag when hiking.
- Canon offer many lenses with USM and full-time manual. Most third party lenses don't have these features.
- There are some operational differences. For instance, some third party lenses have focus or zoom rings which rotate in the opposite direction from the usual Canon direction.
- It's difficult finding useful comparative data. You can look up the MTF scores on sites such as Photodo, which is a useful guideline, but the only way to compare lenses properly is to test them yourself to see if they meet your needs. Asking, "Is the Tokina XYZ 2.8 lens better than the Canon XYZ 2.8 lens?" rarely yields helpful answers, because most people don't buy both lenses and try them out.
- Some specific third party lenses are better known than others. For example, Tamron's 90mm macro lens has a reputation for excellent image quality at a price considerably less than Canon's 100mm macro. Sigma sell an 8mm fisheye which Canon do not make.
- But the biggest deciding factor is, as always, money. Only you can decide what's your priority - low initial purchase price, mechanical reliability, compatibility, user interface or optical quality.

Types of lenses.

Why doesn't my camera have a motorized zoom lens with wide/tele buttons?

Because it's not a point and shoot. Such motorized lenses are fine for simple tiny consumer-oriented cameras, but SLRs with interchangeable lenses are meant for a different market.

All Canon EF zoom lenses but one are manual zooms. That is to say you adjust the focal length either by turning a ring (two touch) or sliding the lens in and out (push-pull). And most people find that adjusting the zoom setting on such lenses is much faster and more precise than a slow and cumbersome motorized point and shoot zoom lens.

Note that Canon did briefly sell a motorized zoom lens for EOS cameras a while back, presumably as a sort of experiment. That lens, the Canon EF 35-80 4-5.6 PZ (Power Zoom), was an all-plastic cheapie with fairly low optical quality. The lens barrel had two pushbuttons that let you adjust the zoom position.

What's the difference between all the Canon 28-105mm lenses?

Canon sell and have sold a number of different lenses which use the 28-105mm focal range.

28-105mm 3.5-4.5 USM, flower icon.
This is the first version of this popular lens, released in the early 1990s. It's a midrange consumer zoom with decent optics and a fast and silent ring USM motor with FTM. The mark I version with a flower icon on its lens barrel apparently had a 5-blade aperture diaphragm. Marked with a striped gold line since it's a USM lens, and has a metal lens mount. Discontinued.

28-105mm 3.5-4.5 USM, "MACRO" icon.
This is the second version of the lens, though it was never officially identified as such - it's still considered to be a mark I. It's identical to the first version but it has the word MACRO printed on the lens barrel in lieu of the flower (closeup) icon. Internally, however, it has a 7-blade aperture diaphragm, which in theory offers slightly better bokeh, or out-of-focus blurring. Marked with a striped gold line since it's a USM lens, and has a metal lens mount. Discontinued.

28-105mm 3.5-4.5 USM II.
This is the official second version of the lens, as indicated by the II symbol. According to Canon the original 28-105 and the mark II versions have identical optics, but the mark II version has slightly different external styling, including an allegedly slightly tougher design. According to Canon Malaysia an internal component used in the zoom mechanism has been updated to metal from plastic. Marked with a striped gold line since it's a USM lens, and has a metal lens mount. Discontinued.

28-105mm 4-5.6 USM.
This lens is a cheapie lens, released in 2002. It is a completely different and very much inferior lens from all the ones listed above. It's almost entirely made of plastic (including the lens mount) and has vastly worse optics than the faster lenses. It can easily be identified by the silver (chrome) ring around the end of the barrel. Interestingly, while it uses a micromotor USM autofocus system it nonetheless supports full-time manual, according to Canon's literature. It's a lens intended for consumers and does not fit the same position in the lineup as the 28-105 3.5-4.5 USM II.

In short, be *very* careful when shopping for a 28-105 lens. You don't want to buy a lens thinking it's the popular midrange lens only to end up with the bottom of the line cheapie instead. Always double-check the listed aperture range before buying.

Should I buy the Canon 28-200 or the Tamron 28-200 or the Sigma 28-300 (or some other lens with a big focal range)?

A popular question back in the late 90s, when such lenses were heavily marketed as the ultimate in consumer convenience since they cover such a huge focal length range. Sadly, the lenses tend to be fairly big and heavy, as consumer lenses go. And most importantly, the optical quality of these lenses leaves a lot to be desired. It's very difficult to build optically sharp zoom lenses, particularly those with a really wide zoom range like these ones. The lenses are pretty slow, with small maximum apertures. They also tend to have a lot of distortion, which makes squares and rectangles in photos appear like they're bulging in or out slightly - bad for photos of buildings.

If you only take 4"x6" snapshots then these drawbacks are probably fine, but if you ever want to make enlargements beyond that you may find that your photos look

disappointingly soft - not very sharply focussed. Since they're optically so slow you'll probably also find that any telephoto photos you take will be badly blurred unless you use a tripod or flash. Finally, using long telephoto lenses requires a certain degree of technique and experience since the focal lengths are so long. You can't easily handhold a slow 300mm lens, for example. Doing so, particularly without high-powered flash, is a surefire recipe for disappointingly blurry photos. And Sigma has regrettably a long history of older lenses turning out to be incompatible with later EOS cameras.

As a beginner you're probably best off getting one or two lenses of a more modest focal length range, no matter what nonsense the salesperson in your camera shop may say about you never needing to buy another lens again. In short, consumer-level 28-200 or 28-300 lenses always suffer from tremendous optical compromises; compromises which render them of limited value, especially at the long (200-300mm) end.

There are really only two lenses with a huge focal length range that are generally accepted as possessing decent optical quality - Canon's 35-350 3.5-5.6L and Canon's 28-300 3.5-5.6L IS. However both are gigantic and expensive lenses not intended for beginners.

What affordable Canon long telephotos are there?

Canon make telephoto zooms which fall mostly into two basic categories - very cheap slow lenses with mediocre optical quality and very expensive fast lenses with fabulous optical quality. There are few intermediate choices, though the 70-300 4.5-5.6 IS USM is one to consider. Canon have also never built any affordable long EF telephoto prime lenses - all EF telephoto primes longer than 135mm are L series lenses.

There are a number of Canon zoom lenses in the 75mm to 300mm range, however. Here's a bit of basic information about some of them.

75-300 4-5.6
75-300 4-5.6 USM
75-300 4-5.6 II
75-300 4-5.6 II USM
75-300 4-5.6 III
75-300 4-5.6 III USM
Canon sell and have sold quite a few different lenses with focal lengths from 75mm to 300mm. All apparently use the same optics - they just have different cosmetic styling of the lens barrel (the mark III version, for example, has a silver ring on the end to impress novice camera buyers) and different autofocus motors. They're very inexpensive lenses as telephoto zooms go, but offer fairly mediocre optical quality. At the short (75mm) end they're not too bad but at 200-300mm they tend to get very soft (slightly blurry). You really need to stop them down to f/8 or f/11 or so for okay optical quality, which of course requires longer shutter speeds.
The 75-300 USM models all have micromotor USM autofocus mechanism which do not support full-time manual (FTM). All other versions of this lens use slow and noisy micromotor or DC motor drives. These lenses, while in the "cheapie" category of Canon lenses, have metal lens mounts. They do not, however, have distance scales.

All versions of this lens have rotating ends when focussing, which makes using a polarizing filter rather inconvenient.

75-300 4-5.6 IS USM
One notable lens in the 75-300 series is the IS model, which offers image stabilization for improved shooting at lower shutter speeds. It was the first IS lens offered by Canon, but the lens sadly has the same unremarkable optics as the other 75-300 lenses.

70-300 4.5-5.6 IS USM
Do not confuse this lens with the cheaper 75-300 crowd or the more expensive DO lens with almost the same name. This lens combines decent optics with image stabilizing and is an excellent compromise for the advanced amateur. It's not quite as sharp as the 100-300 5.6L, but IS makes it a lot more convenient since you end up with a much higher percentage of keepers when used off-tripod.

70-300 4.5-5.6 DO IS USM
This lens is particularly unusual in that it's the first zoom lens to use diffractive (DO) lens elements. This Canon technology allows for smaller and lighter lenses. The 70-300 DO is considerably shorter than its 75-300 siblings, and has image stabilization (IS) technology to boot. It isn't cheap, however. Do not confuse it with its non-DO sibling.

90-300 4-5.6 USM
I really don't see the point of this lens. It appears to be pretty well the same as all the cheap 75-300 lenses, only its short end starts at 90mm. It's USM but only micromotor USM and thus has no FTM.

100-300 4.5-5.6 USM
This lens is, in terms of build quality and physical appearance, the telephoto zoom counterpart of the 28-105 3.5-4.5 USM and the 24-85 3.5-4.5 USM. It has reasonably solid construction, a fast and silent ring USM autofocus drive which supports full-time manual (FTM), does not having a rotating end and has a distance scale. Optically the 100-300 USM I had was very slightly sharper than the 75-300 at the long end, but many people report that there's really no difference between their samples of the lenses. Essentially the 100-300 USM gives you improved focussing speed and a more convenient user interface compared to the 75-300s, but not improved optics. You also lose 25mm and half a stop off the short end, for what it's worth.

70-210/3.5-4.5 USM
The predecessor to the 100-300 4.5-5.6 USM. Very similar in size and construction, only with a focal range that's shorter at each end. Offers similar optical quality.

100-300 5.6L
An older and now discontinued lens, the 100-300 5.6L is an interesting lens in that, while it's technically an L series lens with fluorite and UD lens elements, it doesn't have the tough build quality of a typical L series lens sold today. It uses a slow and noisy AFD autofocus motor and has an awkward (low-profile) and fiddly (hard to slide) MF/AF switch. The manual focus ring is also rather gritty to turn. However, it does offer considerably improved optical quality over the 75-300 series and the 100-300 USM. It's also sharper than the 70-300 IS USM. So if you can deal with the slow

optical speed (maximum aperture of only 5.6) and the horribly sluggish autofocus motor it's well worth looking into if you're on a tight budget.

50-200/3.5-4.5 L
Similar to the 100-300 5.6L, in that it's a first generation EF-mount L series lens. It has the optics of a modern L series lens - but not the build quality - and has a push-pull zoom design. The 50-200 isn't a bad lens, but for some reason holds its used market value rather well. Personally I think the 70-200 4L USM is a better deal. It's typically not much more money but gives you better build quality and silent focussing USM.

70-200 4L USM
This lens, the smaller and cheaper sibling of the impressive 70-200 2.8L USM professional lens, is considered a bargain by many EOS users. It costs three times as much as the cheapie lenses but it's sturdy, focusses quickly with a ring USM system with FTM and, most importantly, it has great optical quality. It's bigger and heavier than the consumer lenses, but if you want something good but can't afford the 2.8L, consider this lens. It doesn't use a huge 77mm filter like the 2.8L - it uses a 67mm filter like the 24-85 3.5-4.5 USM. This is a little unfortunate, has hardly any other Canon lenses have 67mm filters.

70-200 4L IS USM
The image stabilized sibling to the 4L. Visually almost identical, down to the 67mm filter, but much much more expensive than its non-L counterpart. According to some reviewers, one of the sharpest Canon lenses in its whole zoom lens range.

80-200 4.5-5.6
80-200 4.5-5.6 USM
80-200 4.5-5.6 II
Plastic cheapies, basically analogous to the 28-80 plastic cheapies. They are very lightweight and portable, though. If you want something really inexpensive and never enlarge your photos past postcard size then they're fine.

100-300 5.6
With pretty well identical build quality to the 100-300 5.6L, this older lens has all the disadvantages of the 5.6L without the sharp optical quality of the L lens.

I want to take photos of wild birds. What lens do I need?

You probably won't want to hear this answer, but nature photography of small and fast-moving wild animals is a difficult field and basically requires really expensive lenses. 500mm and 600mm lenses are commonly used by bird photographers - your typical 100-300mm zoom lens is just not long enough for great photos. And lenses longer than 300mm are both incredibly expensive and really heavy.

So the harsh reality is while you may be able to get nice snapshots of fairly tame birds with a 100-300mm lens you won't be able to get those amazing wildlife book or calendar shots - small birds filling the entire frame - with one. You can always use your lens at 300mm and then crop off the edges of the picture, but then picture quality will suffer.

If you really want to do this type of photography on a tight budget you might want to consider buying used manual focus gear. You can find really quite decent used high-end manual focus telephotos quite inexpensively compared to their autofocus counterparts.

I want to do sports photography. What lens do I need?

Unfortunately, this answer is going to be somewhat like the previous one. The challenges of sports and other action photography are twofold. First, by its very nature, sports photography tends to involve rapid motion - fast-moving players or cars or whatever. Second, usually there's some distance between the action and the camera.

Solving the first problem requires lenses which can let in plenty of light, the use of flash or faster film or high ISO settings on a digital camera. Each of these solutions has drawbacks, however. Fast lenses are large, heavy and expensive. Fast film or high ISO settings result in higher grain or noise and thus lower picture quality. And flash may be inadequate to illuminate the subject effectively, particularly if the subject is some distance away.

Solving the second problem basically requires the use of long telephoto lenses. However, most affordable autofocus telephoto lenses are very slow - they don't let in much light. So this amplifies the first problem.

Now obviously there are some cases where these two issues aren't a massive problem. For example, perhaps you're shooting a basketball game and you're in the front row. Basketball courts are of a modest size and so you could probably do okay with flash (assuming you're allowed to use flash - some places won't let you as it can temporarily blind or distract the players) and you won't need an incredibly long lens accordingly. Such a situation is a little less challenging than shooting hockey on a big, poorly lit, rink.

Nonetheless, pro photographers rely on fast lenses, and this is the primary stumbling block for amateur photographers on a budget. Fast telephoto lenses, especially fast telephoto zooms, are really expensive. And there's not much you can do to work around that fact without a lot of compromises. To cover these points further:

Fast lens. Get the fastest (largest aperture) lens you can afford. A 70-200 2.8 lens is great for basketball, for example. A 75-300 4-5.6 is probably not, since even shooting wide open means you'll have slow shutter speeds, which will result in unwanted motion blur.

Telephoto lens. You'll need a long telephoto zoom unless you're planning on shooting very close to your subjects. For example, you won't need a long lens to shoot skateboarders in an urban setting, but you will if you're covering a football game.

Cropping. You can always make up for a long lens to a certain extent by cropping the picture - trimming off the edges. The problem with this is that enlarging the picture also enlarges the grain in the case of film and lowers the apparent resolution in the case of digital.

Image stabilization. Useful for reducing blurring caused by camera motion, but of no value whatsoever in freezing subject motion.

Flash. Useful both for illuminating the subject and freezing subject motion. Not every venue permits flash usage, however.

Film/ISO speed. Fast film or high ISO settings are needed to keep shutter speeds to a minimum. Once again this involves tradeoffs with picture quality.

Camera with fast focus. A fast pro camera (such as the EOS 1 series) can lock focus surely and accurately and has minimum lag time when the shutter release is pressed. A consumer camera is not going to be as surefooted and decisive, and will make it harder to nail the perfect shot.

Fast lens motor. A Canon ring USM lens can autofocus rapidly, whereas a Canon AFD (arc form drive) lens cannot. A lens with a rapid motor frequently makes the difference between achieving a shot and getting nothing.

To summarize - if you plan on putting a 75-300 4-5.6 consumer lens onto your camera, don't expect photos like those which grace sports magazines. This isn't to say that you can't get satisfactory photographs with such equipment, just that it's challenging to do so. It takes a lot of skill, experience and luck to come up with consistently good results. And you should be operating on the expectation that you will face problems with blurring of the subject and general low sharpness and low contrast if you use an affordable consumer telephoto zoom lens.

What about mirror lenses? I can get a really cheap telephoto that way!

Some third-party lens makers sell mirror or, as they're more accurately known, catadioptric lenses. Such lenses use a pair of mirrors to fold the light path in half, in addition to containing regular glass elements. The advantages are that mirror lenses can be made fairly cheaply and will also be shorter and lighter than all-glass (refracting) lenses of the same focal length. And mirror lenses with focal lengths of 500mm to 1000mm are not uncommon. Russian makers produce a lot of these lenses.

Unfortunately mirror lenses have a number of drawbacks. First of all, they're manual-focus only. Second, they are optically really slow lenses - usually around f/8 or so. Third, they don't have aperture diaphragms, so the only way to adjust the exposure is to adjust the shutter speed, the film speed/digital ISO or to put a neutral density (darkening) filter on the lens. Fourth, the smaller of the two internal mirrors blocks the light path somewhat, resulting in rings or doughnuts appearing around bright highlights in out of focus areas. This effect, a form of bokeh, can be visually very distracting. And fifth, they tend optically not to be of the highest quality - you're not going to get National Geographic-quality bird photos using them.

So, while such lenses are attractive if you're on a budget, they do have many limitations associated with them. You're probably better off buying a used manual-focus refracting (non-mirror) lens and adapting it to your camera, or buying a manual-focus body. As noted above, photography can be a really expensive endeavour.

What is a macro lens? My lens has MACRO written on it.

Macro photography is the somewhat confusing name for closeup photography. Just as the human eye can only focus up to a certain distance (a distance which moves alarmingly further away with age), not all lenses can focus as closely as others. Most lenses are designed to focus up to a metre or two with long telephoto lenses having much longer minimum focussing distances than that.

Now this obviously isn't going to help you if you want to take a super closeup of a small flower - you need a much shorter minimum focussing distance. Basically you want to be able to fill the frame with your small subject. And another concept comes in - the magnification factor. Traditionally, true macro photography refers to 1:1 photography and smaller. In other words, a lens with 1:1 magnification is able to image an area as small as the exact size of the image format in question. In the case of 35mm film this means an area of 24x36mm in size. Sometimes magnification is written as a decimal factor, such as 0.25x or 1.0x.

Unfortunately, lens manufacturers tend to throw around the word "macro" with cheerful abandon as a marketing gimmick. The fact a lens has MACRO printed on it basically means nothing, and you have to look closely at the lens specs. If a lens can do 1:1 or 1:2 photography then it's a real macro lens, optimized for closeup photography. It may also be designed with a flat field so it can be used to take photographs of flat objects like stamps without focus problems. Lenses that can only reach 1:4 or whatever can't take really close-up pictures.

True macro lenses are generally of much higher optical quality than ordinary lenses and usually cost more. They are also usually optimized to take photographs of small flat objects with even focus across the surface - flat field. They're still a good buy if you don't do a lot of macro photography, however. You can always use them for regular photography as well - they just have the bonus that they can focus much closer than ordinary lenses can.

What is a portrait lens?

Obviously any lens can be used to take a portrait of someone. However, the results can be very different depending on its focal length.

The distance required between you and your subject, when you take a head and shoulders portrait, depends on the focal length of the lens. If you have a wide angle lens then you need to stand very close to them in order to have their head and shoulders fill the frame. But if you have a telephoto lens then you need to stand a fair distance away from them for the same effect.

This distance results in a change in perspective. Try this experiment with someone in real life without using a camera. If you stand really close to the person and look at their face you'll notice that this position tends to emphasize their nose and make their forehead look like it's sort of sloping away. But if you're further away from them then their face tends to look flatter. And generally speaking people find that a slightly flatter perspective on a face is usually a bit more flattering in general. Portraits taken with wide-angle lenses can, in fact, have a rather comical or grotesque effect.

So generally photographers like to use lenses of about 85mm to 135mm in length when taking head and shoulders portraits, depending on the look they're trying to achieve. Some fashion photographers even use 200mm and 300mm telephotos for a particularly flat effect. You *can* take photos of people with 50mm and shorter lenses, but these lenses tend to distort the face somewhat. Such shorter focal lengths are, however, perfectly fine for waist-up or full body shots.

Canon make a number of of popular lenses used for portrait photography. Two of the more affordable ones include the compact and sharp 85mm 1.8 and the 135mm 2.8 SF which has a "soft focus" feature which allows you to introduce image-softening at will.

Finally, note that the lens focal lengths I list here are for 35mm film or full-frame EOS SLR. If you're using a camera with a smaller image area - digital or APS - then the ideal focal lengths for portraits are going to be shorter. For example, a 50mm lens is generally considered a bit short for most portraiture with 35mm film, but when mounted on an EOS 10D digital camera it takes photos much like those taken with an 80mm lens on a 35mm film camera.

What is a fisheye lens?

Most lenses are "rectilinear," which means they're designed to project an image onto a flat surface (the film or the image sensor) and render straight parallel lines as straight parallel lines. This is actually a complicated optical trick, since a simple lens really wants to project an image onto a spherical surface (such as the interior of the human eyeball). It also becomes increasingly complicated to do as the field of view of the lens becomes larger, as with wide-angle lenses - one reason why really wide angle lenses are so expensive.

This type of projection onto a flat field is something that different lenses do to varying degrees of success. High quality lenses, particularly those intended for use for macro or architectural photography, do a pretty good job. But cheaper lenses will compromise on this slightly and will either barrel or pincushion somewhat. That is to say, a photograph of a square object may appear to be either bulging outwards or squashed inwards, because parallel lines are being portrayed as curved. In fact, nearly all cheap lenses tend to have barrel distortion - it's just that people usually don't realize it because they rarely take photos of square or rectangular objects.

A fisheye lens is a wide angle lens where no effort has been taken to render parallel lines as parallel. Instead, only lines which pass through the centre of the frame are straight. All other lines appear as curves, becoming increasingly curved as you near the edge of the frame. This line curvature has the effect of making near objects seem closer and more distant objects seem further off, as they fall away. If you've ever looked through the glass peephole viewers in a door then you know the effect.

Sometimes people call rectilinear lenses "corrected" and fisheye lenses "distorting," but I don't think that's very useful or accurate. Rectilinear lenses aren't necessarily correct - a wide-angle lens has extreme distortion and stretching towards the edges to make the lines straight. That being said, the fisheye effect is very pronounced and extreme, and does render scenes in a characteristic fashion. Portrait photographs of people taken with fisheyes, for example, have cartoon-like bulging noses and so on.

Fisheye lenses are useful for three basic things. First, it's a lot easier to make a super wide angle fisheye than it is a super wide angle rectilinear lens, so a fisheye lens is going to be cheaper than its rectilinear equivalent. Second, and this is how fisheyes came about, it's possible to build a fisheye lens which covers a full 180° field of view, which is very handy for scientific photography, particularly of the sky. And third, bulgy wide angle effects are fun for taking crazy trippy photographs.

There are two basic types of fisheye lenses. Circular or 180° fisheyes cover a full (or nearly full in most cases) 180 degree field of view across the narrower side of the image rectangle. These lenses make photos that look like bulging circular balls on a black background. The other type are sometimes called full frame or semi fisheyes and basically offer a cropped field of vision so you don't get the black areas at the corner of the picture. As a result they only cover 180 degrees of view on the diagonal.

On 35mm cameras, full frame fisheyes usually have a focal length of 8mm, and semi-fisheyes have a focal length of 15mm or 16mm. In near-circular lenses, Japanese maker Sigma sell an 8mm autofocus fisheye for use with EOS cameras, and Belarus maker Peleng sell an 8mm manual-focus fisheye that can be adapted to EOS cameras. In full frame fisheyes, Canon sell a 15mm autofocus fisheye for EOS, and Russian maker Zenitar sell a 16mm manual-focus fisheye lens which can be adapted. There are also popular screw-on adapters that convert ordinary lenses into fake fisheye lenses. Such adapters are virtually all of extremely low quality, but are definitely fun to play with.

A lot of photographers turn up their noses and dismiss fisheyes altogether as gimmicky remnants of the 1970s. Personally I think fisheye distortion can yield interesting effects if used occasionally, but it's obviously not something you're likely to use every day. In nature or underwater photography, where there are few straight lines, fisheyes can be a useful tool as well.

Lens features.

What is the difference between two-touch zoom and push-pull zoom?

There are two basic ways to adjust the focal length of a zoom lens. Some zoom lenses have a zoom ring as well as a focus ring and so are called two-touch. Rotating the zoom ring adjusts the focal length. Other lenses slide in and out like a trombone or telescope; the so-called push-pull design.

The push-pull design is more vulnerable to zoom creep than two-touch. This is the problem of the zoom accidentally adjusting focal length (sliding) when tilted up or down because the friction of the push-pull system isn't enough to counteract the weight of the lens. Push-pulls also tend to suck in a lot of air and therefore dust into the lens when adjusted. However, push-pull lenses can be operated more rapidly, if usually a bit less accurately, than two-touch zooms.

Why are some Canon lenses painted white or silver?

Nearly all large telephoto L series lenses have barrels constructed from solid metal and painted off-white, rather than black plastic or black-painted metal. Canon say

they do this since white surfaces absorb less heat than black when used out in the sun, and fluorite crystal lens elements are sensitive to heat - they can expand and contract, altering their optical properties. Of course, the fact that a white-painted Canon lens stands out in the crowd is probably part of the reason as well. Look at any major sports event and you'll see rows of hefty white lenses. Though to confuse matters Nikon have also begun to sell some lenses in optional white paint.

A few lenses intended to be sold as kit lenses with silver-painted camera bodies have also been available with silver-painted plastic barrels. These include the 35-135 4-5.6 USM (to match the silver-painted commemorative edition of the EOS 10/10s which was released to mark the sale of 60 million Canon cameras), the 24-85 3.5-4.5 USM (to match the APS IX camera) and the 28-90 4-5.6 USM II (to match the Rebel Ti/EOS 300V/Kiss 5). The silver paint on these midrange and low end lenses is purely for cosmetic reasons.

What is a tripod mount on a lens for?

Normally you put a camera onto a tripod by attaching the camera body right to the tripod head itself. But if you have a really heavy lens this is a bad idea. Large lenses can often weigh far more than the heaviest SLR cameras. So the right way to do it is to attach the lens to the tripod head via a tripod mount. The camera then sort of hangs off the back of the lens unsupported, but this isn't a problem - lens mounts are designed to handle that kind of weight easily.

Lens tripod mounts or collars are mounting rings with built-in clamps. These rings make it easy to rotate the camera from portrait (vertical) to landscape (horizontal) position. If the maker of your lens sell a tripod mount for the lens then it's probably wise to get one.

What is a distance or depth of field scale?

Most Canon EF midrange and better lenses have distance scales - clear rectangular plastic windows set into the lens barrel. A series of numbers can be seen through this window indicating the distance, in both metres and feet, from the lens to the point in focus. Inexpensive consumer lenses generally do not have distance scales.

Canon EF prime lenses also have simple depth of field scales marked on the barrel below the window. These marks indicate the acceptable depth of field distances from the current focus distance, usually for a small number of apertures - *f*/11 and *f*/22, say, or *f*/5.6, *f*/11 and *f*/16. Canon EF zoom lenses, however, do not have any depth of field scales because of the complexity of indicating depth of field over varying focal lengths.

You'll notice that there is usually a red dot on the distance scale window as well. This is used for determining the focus distance when using infrared film with an infrared filter. Since infrared energy focusses at a different point from visible light this dot is a useful aid. However, if you're using infrared film with an ordinary red filter or no filter at all then you may not need to adjust focus using this dot, since much of your image is going to be visible light anyway. For more information please consult my Infrared Myths document.

What is the issue with a rotating end of a lens?

Some lenses have an outer end which rotates when you adjust either the focus or the zoom setting or both. Others do not.

This matters a lot if you're using a polarizing filter or a graduated neutral density (ND) filter, since the properties of the polarizer vary depending on its angle of rotation and the graduation line runs across the filter in a straight line. It can be very annoying to set a filter to achieve the effect you want, touch up the focus, and find that the polarizing or graduated ND effect has changed because the end of the lens has rotated.

Why does it matter how many blades the aperture diaphragm has?

The adjustable aperture diaphragm in most camera lenses consists of a number of flat wedge-shaped metal blades. As you adjust the lens aperture settings these blades rotate in or out, and the aperture opening changes size in an iris-like fashion.

The shape of the hole made by this adjustable diaphragm depends on the number of blades and the shape of the blades. For example, if you have a 5 blade aperture diaphragm then the aperture will be a pentagon in shape. An 8 blade aperture diaphragm will of course yield an octagon.

There are two areas in which this aperture shape affects the final image. First, the shape of lens flare on a photograph is typically governed by the shape of the aperture. You may have seen photographs with pentagonal or hexagonal lens flare, for example, or star-shaped highlight areas in a photograph taken with a small aperture setting. Second, it's generally held that the closer the aperture is to a circle the smoother out of focus areas (bokeh) tends to be, though it isn't the only factor contributing to bokeh. Many lenses have at least 6 or 8 aperture blades, frequently with curved edges, to approximate a circular aperture opening for this reason. Canon have in fact started billing some of their recent lenses as having "circular" apertures, indicating near-circular openings.

Which lenses are weather-resistant?

Most of Canon's new professional (L series) lenses introduced since mid 1999 are equipped with gaskets and rings to keep out dust and moisture. They're not waterproof, by any means, so don't go diving with them. But they're much more resistant to inclement weather than Canon's other products.

Of course, a weather-sealed lens isn't much good unless you have a weather-sealed camera to match it. And at present only the top of the line EOS 1V, 1D, 1Ds 1D mark II, 1Ds mark II and 1D mark IIN cameras (but not the 1, 1N or 3, which have lesser sealing systems) have the same level of weather sealing - gaskets and rings around every opening, button and switch, in fact. You can use the sealed lenses with non-sealed cameras, of course, but the gasket around the lens mount will still let in water unless mated to the gasket around a sealed camera. (this rubber ring around the lens mount is, incidentally, an easy way to tell if a lens is weather sealed or not)

At time of writing the weather-resistant Canon lenses are:

16-35mm 2.8L USM
16-35mm 2.8L II USM
17-40mm 4L USM
24-70mm 2.8L USM
24-105mm 4L IS USM
70-200mm 2.8L IS USM
70-200mm 4L IS USM
28-300mm 3.5-5.6L IS USM
50mm 1.2L USM
85mm 1.2L II USM
300mm 2.8L IS USM
400mm 2.8L IS USM
400mm 4 DO IS USM
500mm 4L IS USM
600mm 4L IS USM

The mark II versions of Canon's teleconverters, the Extender EF 1.4x II and Extender EF 2x II, also have weatherproofing. None of Canon's more affordable lenses or cameras have weather sealing. Note also that weather-resistant zoom lenses do not have sealed glass ends - you need to put a filter on these lenses to seal out the far (non camera) end.

What is the close or minimum focus distance?

Just like a human eye, camera lenses have a near point at which they cannot focus anymore. This focus distance depends on the lens construction, but typically wide angle lenses have nearer close focus distances than telephotos. Many macro lenses, of course, are optimized for near close focus distances.

If you're a human you can adjust this close focus distance by moving the object you're trying to focus on further away. Similarly you can add extension tubes to your lens to move the lens further from the camera and thus bring the close focus distance closer. You will lose the ability to focus on infinity with such a tube, though.

Hey! I can turn the focus ring of my lens *past* the infinity mark! Why?

Your lens can go to infinity - and beyond! Yes, many lenses can be adjusted past the infinity marking on the lens barrel.

It's not a problem. Such lenses are intentionally designed this way to allow the lens to compensate for the changes in optical characteristics that occur when the lens is subjected to ambient temperature changes. (the focus of lenses can be affected by thermal expansion)

What does a lens hood do?

Aside from making the lens look longer and bigger and thus more impressive to non-photographers, lens hoods (sometimes called shades) serve two basic functions. First, they help reduce the amount of stray light hitting the surface of the lens. This is a good thing, since non-image-forming light coming into the lens at an angle results in lens flare. Lens flare can result in lower-contrast images or, in extreme

cases like light from the sun, can result in big glowing blobs in the final photo. Second, lens hoods serve as physical protection for the lens - the plastic or metal tube can absorb blows that might otherwise hit the glass itself.

Lens hoods come in a number of basic forms. The two types sold by Canon today are tube-shaped hoods and petal-shaped (notched) hoods, made of hard black plastic. The petal-shaped type are sometimes called "perfect" lens hoods and shield the lens more effectively than simple tubes of the same weight. This is because the notches are cut out to match the rectangular shape of the imaging area (think about it).

Some hoods clip onto the lens, some twist on bayonet-style and some screw onto the end. Some are lined with black light-absorbing flocking and some are not. You can also buy flexible adjustable rubber hoods from third party makers, but Canon do not sell any such hoods themselves.

Unfortunately, lens hoods are hugely overpriced. Camera makers somehow feel justified in charging massive sums for simple moulded plastic tubes. Ah well.

How are lens hoods named?

Canon lens hoods are identified by a confusing and cryptical alphanumeric code. There is a system to the hood naming, though it's only somewhat informative. Still, if you understand how the hood naming works you can usually figure out which hoods can be interchanged with other lenses.

- The first letter in a hood name is E, indicating that the hood fits a Canon EF mount lens.
- The second letter is either W, S or T. W stands for Wide, S for Standard (probably) and T for Telephoto.
  The letter refers to the type of lens to which the hood fits. W is for any lens wider than 50mm, S is for a 50mm lens (with a couple of odd exceptions) and T is for any lens longer than 50mm.
- The two letters are then followed by a number which indicates the size of the hood mounting ring in millimetres. Some hoods fasten to the very end of the lens barrel by means of a bayonet (rotating and locking) mount and others clip further down the barrel to a small ring by means of small spring-loaded plastic clips in the hood. Generally newer lenses use the former style and older lenses the latter.
- The hood size is sometimes followed by a letter from A through D. This letter indicates the hood style, and unfortunately there's no real way of knowing what style fits what lens without looking it up, because the hood style appears to be chronological depending on when the lens was released and whether there happened to be any lens hoods already in the lineup with otherwise identical specifications but with a different shape. There is no way to tell if the hood is a standard tube or a petal shape ("perfect") lens hood just by looking at this letter.
  For example, the original EW-78 fits the 35-350 3.5-5.6L USM, the EW-78B fits the EF 28-135 3.5-5.6 IS USM, the EW-78C fits the EF 35 1.4L USM and the EW-78D fits the EF 28-200 3.5-5.6.
- Finally, the hood name sometimes ends in a Roman numeral - typically either II or III. This indicates the hood version.
  Generally speaking, mark II and III hoods are flocked on the interior with

black anti-reflective material, like velvet. Hoods with no Roman numeral designation are typically painted flat black, but since this depends in part on when the hood was released this is not a guarantee. Some mark II hoods also have slightly more clearance around the end of the lens so that polarizing filters fit better if their predecessors didn't.

Some hood naming examples:

ET-65 III

E indicates that the hood fits an EF mount lens.
T indicates that the hood fits a telephoto lens.
65 indicates that the hood mount is 65mm in diameter.
III indicates this is the third hood of the ET-65 series, and means in this case that the hood is flocked to reduce reflections.

This particular lens hood fits a number of Canon EF telephoto lenses - the 85 1.8 USM, the 100 2.0 USM, the 135 2.8 SF, the 70-210/3.5-4.5, the 75-300 4-5.6 and the 100-300 4.5-5.6 USM.

EW-78B

E indicates that the hood fits an EF mount lens.
W indicates that the hood is for a wide angle lens.
78 indicates that the hood mount is 78mm in diameter.
B indicates that it's a hood of type B.

This particular hood fits the 28-135 3.5-5.6 IS USM.

ET-160

E indicates that the hood fits an EF mount lens.
T indicates that the hood fits a telephoto lens.
160 indicates that the hood mount is 160mm in diameter.

This gigantic hood fits the 600mm 4L USM IS.

Knowing this system you can figure a few things out. For example, the EW-65, ES-65 and ET-65 can all clip onto the same lenses - the only difference is the length. The EW-65 is the shallowest lens and the ET-65 the deepest, so putting an ET-65 onto a 28mm 2.8 lens is a bad idea as you'll get vignetting unless you have a cropped image sensor on a digital camera. But you can put an EW-65 onto a 100-300 4.5-5.6 USM if you like. It won't shield your lens as effectively as the longer hood, but it's better than nothing. Or if you can't find the discontinued ES-65 you can always use the EW-65 instead.

General lens questions.

Is it okay to change lenses when there's film in the camera?

Yes. A key advantage of a camera with interchangeable lenses is the ability for you to change lenses whenever you want. The camera body contains a shutter which prevents light from hitting the surface of the film regardless of whether or not the lens is attached.

Of course, you should try not to change lenses when you're outside in the pouring rain or in the middle of a sandstorm or whatever. And don't poke your fingers into the shutter itself as you'll damage it.

Are there compatibility problems with any EF lenses made by Canon?

Basically, no. Any Canon EF-mount lens will work with any Canon EOS camera.

Now, there are minor compatibility issues with IS lenses on certain old EOS cameras - the lenses work, but IS control is a bit weird or the image may shake in the viewfinder. Luckily this latter does not affect image quality of the photos at all. And autofocus-only EF lenses (a handful were made) are not much use on the oddball EF-M camera, which was an EOS camera which lacked autofocus circuitry and which can only be used with manual-focus-capable lenses. But these are minor issues on the whole.

Note that this compatibility issue is only slightly complicated by the introduction of EF-S lenses, in that an EF-S lens is not an EF lens. EF-S lenses, marked with small white squares rather than raised red dots, can only fit EF-S bodies.

Are there compatibility problems with any EF lenses made by third party manufacturers?

Sometimes. Unfortunately certain third-party lenses not built by Canon, notably many older Sigma lenses, will not work correctly on some newer EOS camera bodies like the Elan 7/EOS 30/33 and the digital EOS 10D. The most common symptom is the mirror flipping up and then the camera freezing when you try to take a photo. You then have to switch the camera off to unlock it. The only solution to this problem is to see if Sigma will upgrade the lens for you. If they still have inventory of the control chip they apparently will happily do so for free.

The only third-party maker of EF-compatible lenses with no major compatibility problems so far is Tamron. Some people have suggested that this is because Tamron have licensed official lens protocol data from Canon, but Canon USA's Chuck Westfall has stated repeatedly in public fora that Canon have never licensed their lens mount protocol to any other manufacturer. So Tamron have either been very lucky or very clever in their reverse-engineering of the Canon lens system. They seem to be a reasonably safe bet right now for compatibility, given their track record, but it's impossible to predict future developments in this regard.

The following Sigma lenses require upgrading for compatibility with newer EOS cameras, according to Sigma:

24-70mm 3.5-5.6 aspherical UC
28-80mm 3.5-5.6 mini zoom macro aspherical
28-80mm 3.5-5.6 mini zoom macro aspherical HF

28-80mm 3.5-5.6 mini zoom macro II aspherical
28-105mm 2.8-4 aspherical
28-105mm 3.8-5.6 UC-III aspherical IF
28-135mm 3.8-5.6 aspherical IF macro
28-200mm 3.5-5.6 DL aspherical IF hyperzoom macro
28-300mm 3.5-6.3 DL aspherical IF hyperzoom
70-210mm 4-5.6 UC-II
70-300mm 4-5.6 APO macro super
70-300mm 4-5.6 DL macro super
100-300mm 4.5-6.7 DL
135-400mm 4.5-5.6 APO aspherical RF
170-500mm 5-6.3 APO aspherical RF
8mm 4 EX circular fisheye
15mm 2.8 EX diagonal fisheye
24mm 2.8
28mm 1.8 II aspherical
50mm 2.8 EX macro
105mm 2.8 EX macro
300mm 4 APO tele macro
400mm 5.6 APO tele macro
500mm 4.5 APO
500mm 7.2 APO
800mm 5.6 APO
28-70mm 2.8-4 UC
28-105mm 4-5.6 UC
28-105mm 4-5.6 UC-II
70-210mm 3.5-4.5 APO macro
28-200mm 3.8-5.6 aspherical UC

Can you use old Canon manual-focus lenses with EOS cameras?

Not really. In the years before introducing EOS autofocus cameras, Canon sold many manual-focus lenses for their SLR cameras. The majority of these lenses are of the FD type. Sadly, FD lenses cannot be used with EOS cameras. The lens mounts are of incompatible sizes and types. This is in contrast to Nikon - most Nikon manual-focus F-series lenses can be used with most Nikon autofocus cameras.

Now it is possible to use adapter rings to attach FD lenses to EOS cameras. Unfortunately it's usually not worth the nuisance, in my opinion. There are just too many drawbacks. I have a separate article on using manual-focus lenses with Canon EOS cameras, if you'd like to learn more.

Can you use non-Canon lenses with EOS cameras?

That depends. Many third party lensmakers - Tamron, Sigma and Tokina being the big three - manufacture lenses specifically designed to fit Canon EOS cameras. These lenses will, of course, work fine with EOS cameras. The main caveat is the compatibility with the electronics detailed above.

However, if you have a third-party lens which does not physically fit onto your EOS camera then you can obviously assume that the lens will not work with EOS cameras. Sometimes third party lenses can be adapted to fit EOS cameras by way of

metal adapter rings, but it's often not worth the bother. Autofocus will not work, and apertures will have to be set manually on the lens. So adapting lenses this way is only worth it if you have a particularly unusual lens or are operating on a particularly tight budget. For more information have a look at my using manual-focus lenses with Canon EOS cameras article.

I have a consumer Canon camera. Can I put a professional L-series lens on it?

Of course. As noted above, any Canon EOS camera works with any Canon EF (or compatible) lens.

The major issue you really have to be concerned about is weight, since a really heavy lens can strain the lens mount. The answer is to support the heavy lens by the *lens* itself - just let the camera hang off the back of the lens. The weight of the camera is not going to strain the lens mount. This applies to all low to midrange EOS cameras, since even those cameras with metal lens mounts have steel mounts attached to plastic body frames. All larger lenses either come with or have optional tripod mounting brackets (see below), so you can attach the lens to a tripod rather than the camera body.

Now of course an inexpensive low-end camera won't have the manual exposure control, focussing speed (AF speed is determined by both the lens motor and the speed of the camera's computer and AF sensors) and film-winding motordrive speed to make full use of a top of the line lens the way a professional would like it. And a small camera will feel unbalanced and cumbersome on a large lens. But it's better to have a great lens on a so-so body than the other way around. Renting professional lenses is a great way to learn and practice when you're on a budget.

This brings up the other issue which might arise - snide looks from camera ignoramuses who think that your little Rebel Ti camera isn't fancy enough for the 70-200 2.8L you've got fastened to it. Ignore them. They're probably the sort of wealthy dummy who rushes out and buys an EOS 1V and then sticks a cheap consumer lens on the end.

What's the big deal about *f*/8?

Most lenses provide sharpest results when used in the middle part of their aperture range. Lenses usually have performance problems when used wide-open. Stopping down helps a great deal, but once the aperture becomes too small then an optical phenomenon known as diffraction comes into play and the quality deteriorates once again. So most lenses work best at around *f*/8 or *f*/11 or so.

Naturally this sharpest point (some people call it the "sweet spot") varies from lens to lens, so some testing would be required to find what's actually best with a given lens. And the effect is generally more pronounced with less expensive lenses. Really high-quality lenses are often almost as sharp wide open as they are stopped down.

What is a focal length multiplier (or cropping factor) for digital and APS cameras?

35mm film has an image area of 24mm by 36mm. These are the exact dimensions of the area on the film to which an image is recorded.

Medium to low-end digital cameras sold today have sensor chips smaller than 24x36mm in size, since producing a 24x36mm image chip is still quite expensive to do. Similarly, APS film records to an area of film 16.7x30.2mm in size.

The upshot of this is that if you use such a digital or APS camera you'll be taking photos which do not record the same image size as 35mm film. So it's like taking a photo using 35mm film and then cropping out (snipping off) the edges. Imagine drawing a smaller rectangle within a given 35mm photo and then cutting it out - you've got a digital or APS photo.

This cropping factor is often confusingly referred to as a focal length multiplier. This is because the cropping makes, say, a 50mm lens on an APS camera behave rather like a 70mm lens on a 35mm camera. Not because the focal length has actually changed - it hasn't - but because of this cropping of the image. The cropping factor is sometimes specified as a numeric value - 1.3x or 1.6x, say.

If you want to use your lens to take photos of things far away then this might actually be to your advantage. But if you want to use a wide-angle lens then this cropping factor can be a problem, since wide-angle lenses yield less dramatic results when you crop out the edges.

Some people object to the term cropping factor as well, arguing quite rightly that the issue is a matter of a change in format of the image recording area and using lenses designed for a different size format. This is true, but people are so used to equating a given 35mm film focal length with a given coverage area (or field of view) that I think the concept of a cropping factor is convenient and easily understood.

To give an example, let's say you have a 100mm lens. When used on a 35mm film camera you get a certain coverage of the scene. But if you were to put the same lens on a digital camera with a 1.6x crop factor (ie: a smaller than full frame sensor) then you would not get the same view of the scene - you'd get less. The view you would see on your 1.6x digital camera would be the same as if you had a 160mm lens, were there such a thing, on your 35mm film camera.

There's dust inside my lens!

Unfortunately that's pretty normal. Only certain expensive L series lenses are sealed to prevent air from entering. All others have a lot of cracks and openings where air - and dust - can easily enter. Zoom lenses which extend in length when you alter the focal length are particularly vulnerable to this problem, since air gets sucked in every time you move the lens barrel.

Luckily a little bit of dust inside a lens isn't going to make much difference, so don't worry about it. It may be alarming to see the dust specks when you hold the lens up to a bright light, but it'll cost an awful lot of money to have a camera repairperson dismantle the lens and clean each internal element. And there's no guarantee that the elements will be properly aligned when he or she gives it back to you. So unless the lens is coated with a dusty grey film of dust you shouldn't have any problems.

There's a scratch on the front glass of my lens!

A tiny scratch or chip on the front glass of a lens, alarming as it may look, won't actually make much difference in image quality under most circumstances since it's far enough from the film or image sensor plane not to be in focus. It can, however, affect lens flare, so it's usually worth filling in the chip with black pen. Having said that, a large chip (more than a few millimetres long) is obviously undesirable. And chips on the rear glass of a lens are more of a problem.

I've seen ads for teleconverters or extenders. Can I put one of these onto my, say, 50mm lens and magically turn it into a 100mm lens?

Yes and no. The answer to this is complicated, but leans mainly towards the "no" side.

Teleconverters, called "extenders" by Canon, are optical accessories which fit between the camera body and the lens. They're essentially tubes with a few glass lens elements inside which multiply the focal length of the lens in use - typically by 1.4x or 2x. So a 50mm lens with a 1.4x teleconverter (TC) would take the same photographs as a 70mm lens, and a 100mm lens with a 2x TC. Think of TCs as magnifying glasses - they enlarge the central portion of the image and cut off the periphery.

Unfortunately you can't get something for nothing. And in the case of TCs there are three major tradeoffs.

First, using a TC cuts the amount of light entering the camera. A 1.4x TC costs you a stop of light and a 2x TC costs you 2 stops. This is particularly problematic if you have a slow lens. Since most Canon cameras (pro cameras notwithstanding) can't autofocus with lenses slower than f/5.6 you may lose autofocus, or at least reliable autofocus, if you use a TC. You can sometimes get around this by taping over the teleconverter's extra pins, thereby fooling the camera into thinking there isn't a TC on it at all, but obviously that'll only really work if there's enough light coming into the camera for the autofocus mechanism to function. Manual focussing will also be difficult if the view through the viewfinder is dark, as it will be with slower lenses.

Second, there's the question of compatibility. Canon manufacture two teleconverters - Extender EF 1.4x and Extender EF 2x - but they are specifically designed to work only with the handful of expensive telephoto lenses listed below. These extenders have protruding front elements and so physically can't attach to most EF lenses - the protruding element simply gets in the way. You could work around it by sticking an extension tube between the TC and the lens, but this would cut even more light and would also mean you lose infinity focus.

You can avoid this problem by eschewing Canon and going third-party for your TCs. Tamron and Kenko sell their own TCs which don't have these protruding elements and so can physically mate with any EOS lens (though TCs in general don't work very well optically with lenses which aren't telephotos). These third party TCs come in varying levels of optical quality. The better quality (more expensive versions, such as the Kenko Teleplus Pro 300 DG) models are generally held as having decent optics, though not quite as good as the Canon products.

Third, all TCs degrade image quality somewhat. First, you're adding a bunch more glass between you and the scene you're photographing and second, you're using only part of the centre of your lens. 2x TCs enlarge more of the middle of the lens than the 1.4x TCs, which makes 2x converters worse optically. Now, in the case of a fancy Canon L series lens and a Canon Extender, this optical degradation will be fairly minimal. However, if you take your typical cheap consumer zoom lens and slap a third-party TC on it you'll find that the results will be less than stellar. In fact, in such cases you're probably better off simply cropping and enlarging part of a photo taken without a TC and leaving it at that. The quality would be higher and you'd save money.

So. The answer to this question really depends. If you have a professional lens and a quality TC then, yes, you'll be able to increase your focal length at the cost of some light. But if you have your typical consumer lens then there's probably no point buying a TC - you'll end up with fairly crummy photos.

Canon extender compatibility list:

The Canon extenders are physically compatible with all prime (fixed focus) Canon EF lenses with a focal length of 135mm or longer except for the 135mm 2.8 SF. They are also compatible with a handful of recent L series zoom lenses. The full official list is:

- 70-200mm 2.8L
- 70-200mm 2.8L IS
- 70-200mm 4L
- 100-400mm 4.5-5.6L
- 400mm 4 DO
- 135mm 2L
- 180mm 3.5L Macro
- 200mm 1.8L
- 200mm 2.8L
- 300mm 2.8L IS
- 300mm 4L
- 300mm 4L IS
- 400mm 2.8L IS
- 400mm 5.6L
- 500mm 4L IS
- 600mm 4L IS
- 1200mm f/5.6L

Consult Canon when checking out newer L series lenses introduced since this list was written, and you're on your own if you use third party lenses. You can also use Canon extenders with Canon TS (tilt-shift) lenses, but it should be noted that the TS lenses can't report to the camera that the extenders are there.

Autofocus is not supported by non-pro EOS cameras when the 1.4x converter is used with 100-400mm 5.6L, 400mm 5.6L, 500mm 4.5L, 1200mm 5.6L, and with the 180mm 3.5 Macro when it's focussed closer than 0.8 metres, or when the 2x converter is used with the 70-200mm 4L, 100-400mm 4.5-5.6L, 180mm 3.5L Macro, 300mm 4L IS, 300mm 4L, 400mm 4 DO, 400mm 5.6L, 500mm 4L, 500mm 4.5L, 600mm 4L, and the 1200mm 5.6L.

Note that there are two generations of the Canon Extenders - the original 1.4x and 2x models and the mark II successors, which add improved weatherproofing. The 1.4x II is said to be optically identical to its predecessor but the 2x II has minor optical enhancements.

I want to take closeup (macro) photos. What do I need?

Closeup or macro photography is a lot of work, but it can also be extremely rewarding. Detailed closeup photos of tiny objects can literally introduce you to another world. Here are some reasons why it's a very challenging area of photography.

- Most camera lenses are not capable of focussing close enough to take decent macro photos. Even lenses marked "MACRO" can't necessarily be used for interesting macro photography - see the section above.
- The closeup exposure mode (indicated by a flower icon) on most EOS cameras does not really help macro photography at all. All it does is set certain camera characteristics, such as metering method and motor-wind settings, to make macro photography slightly easier. The icon mode does not alter the lens characteristics in any way.
- As noted above, depth of field is incredibly shallow when it comes to extreme closeup photography. This means that your focussing has to be absolutely dead-on.
- The usual solution to excessively narrow depth of field problems is to stop down the lens. The problem with that in macro photography is that stopping down the lens limits the amount of light coming into the camera, which can cause problems with lighting.
- In fact, since working distance (the distance between the end of the lens and the subject) is often really limited, lighting is usually a problem even if you don't stop down a lot. Simply because the lens itself blocks a lot of light. For that reason flash units are a very common macro photography accessory, particularly ring-shaped flash units which fit around the end of the lens itself. Such macro ring light flash units often have two tubes so you can control the relative brightness of one side of the image compared to the other. If you're on a really tight budget, however, you could try putting a translucent white milk jug around lens and shining really bright light onto it.
- Unfortunately, autofocus often doesn't work very well if at all under macro conditions, particularly if you're using an extension tube. A camera with a manual focus assist aid in the viewfinder screen is a useful accessory, as is a magnifying attachment for a viewfinder so you can see the camera's focus screen more clearly.
- Focussing is often so tricky that experienced macro photographers don't adjust focus using the manual focus ring on the lens. Instead they physically move the camera closer to or further away from the subject in order to focus. You can buy convenient adjustable rail systems (macro focus rails with one or two rails) that slide the camera back and forth for this type of precise macro focussing.
- When you're dealing with closeup work the tiniest motion is magnified. Let's say you're shooting a spider's web on a misty morning; the dewdrops clustered on the threads like tiny glass spheres. The problem is that the gentlest breeze can set the entire web bouncing, quivering and vibrating so badly that you get motion blur. This is also why you typically need a tripod to

do it right. Handholding a camera introduces too much camera blur unless you use a motion-stopping burst of light from a flash unit.

Here are your six basic choices if you want to take a closeup photograph.

1) Buy a true macro lens capable of reaching 1:1 magnification.

(see the previous section for an explanation of 1:1 magnification) This is the most expensive option, since true macro lenses aren't cheap. However, it's usually the most high-quality option. True macro lenses come in a variety of focal lengths, from 50mm to 90 or 100mm to 180mm. The advantage of the longer lenses is that they give you more working distance from your subject. A 50mm macro lens isn't very useful for shooting, say, dragonflies in the wild since you have to be really close to them. A 180mm macro lens, on the other hand, lets you maintain more distance so you're less likely to frighten them off. Of course, 180mm macros are pretty expensive. A 90/100mm lens is usually the better compromise in terms of working distance and cost.

There are six true macro lenses in the EF lineup which can do 1:1. There is the 50mm f2.5 Macro (which technically only goes to 1:2 or half-size and requires the optional Life Size Converter EF to reach true 1:1), the discontinued 100mm 2.8 Macro, the newer 100mm 2.8 Macro USM, the expensive 180mm 3.5L Macro USM and the EF-S 60mm 2.8 macro, which only fits EF-S-compatible cameras. There is also the unusual MP-E 65mm lens; see below. Another popular macro lens worth considering, though not from Canon, is Tamron's 90mm macro lens.

2) Buy a diopter (macro filter).

These are round screw-on lenses which fit on the end of a lens in exactly the same way as a filter and which act essentially like magnifying glasses. The amount of magnification you get depends on both the strength of the diopter and the focal length of the lens to which you attach it. Diopters cost no light but can degrade the image slightly, depending on the quality of the product. Still, they're lightweight and portable and, since they cost no light, usually permit autofocus to work. They're usually a good approach for beginners looking to explore macro photography.

You can buy both single-element diopters which contain a single piece of glass and two-element diopters which contain two. Two-element diopters are what you want - they cost more but provide vastly better optical quality by correcting certain optical aberrations. Diopters are available in a variety of physical sizes which match popular lens filter sizes, but can be adapted with step rings just like ordinary filters if necessary.

Canon sell two two-element diopters - the 250D and the 500D. The former is intended for shorter focal length lenses, from about 30-135mm. The latter is meant for longer focal length lenses, from about 70-300mm. You can also buy a 500 diopter which, since it's a single-element accessory, isn't as good. You don't have to buy Canon's diopters, of course - Nikon also sell highly-regarded diopters (the Nikkor 3T, 4T, 5T and 6T closeup attachments) which are actually usually less expensive than Canon's. Bob Atkins's Web site has a comprehensive table of magnifications available using different diopters on different lenses.

3) Buy an extension tube.

These are hollow plastic tubes which fit between the lens and the camera body, thereby increasing the distance of the lens to the camera and thus reducing the close focus distance of your lens. (ie: they let you move the lens closer to the subject while retaining focus) Attaching an extension tube means you lose infinity focus but that's obviously not an issue if you're using the tube to take closeup pictures. Tubes also reduce the amount of light reaching the film or image sensor (because moving the lens further from the film or sensor plane causes the light to spread out across a larger area).

Unlike diopters, however, they do not affect image quality at all as no optics are involved. The magnification you get depends on both the length of the tube or tubes used and the focal length of your lens - Bob Atkins' table lists some common combinations. Some lenses, particularly wide-angle and specialized lenses such as the 15mm 2.8 fisheye, 14mm 2.8L and MP-E 65mm 2.8, don't work properly with tubes. If you have EF-S lenses for newer EOS digital cameras then you'll need the mark II Canon extension tubes (the Extension Tubes EF 12 II and EF 25 II), since the earlier versions don't mate with EF-S lenses - EF-S lenses extend deeper into the camera body than EF lenses.

Canon sell a couple of extension tubes, but they're pretty expensive. The three-tube set from Kenko is a better deal - it's fairly well made and contains a 12mm, a 20mm and a 36mm tube. However, current Kenko tubes are compatible only with EF lenses - they do not physically mate to EF-S lenses.

Adjustable bellows are also used for closeup photography - they're basically adjustable tubes when you get down to it. Novoflex sell an EOS-compatible bellows or you could buy the old Canon FD bellows and adapt it using the FD to EOS macro adapter. Bellows are typically used with movable rails for precise focussing.

4) Reverse a lens by mounting it onto the camera backwards.

Doing so requires some sort of adapter with a standard EOS lens mount on one end and a filter ring on the other which attaches to the filter ring of the lens. People often make such things at home by gluing a filter ring to a drilled-out body cap. Reversing a lens like this is a very old photographic trick for doing macro photography.

This technique is a problem for EOS lenses, however, since EOS lenses require electrical connectors in order for the aperture diaphragm to operate. There are at least three possible solutions for this. First, you could set the lens aperture to whatever you want it to be, press the depth of field button on your camera to stop down the lens and then detach the lens. The lens diaphragm should stay wherever it was when you removed the lens and you can then reverse the lens and use it. This isn't terribly convenient, of course, since you can't adjust the aperture without remounting the lens. Second, you could use a non-EF lens. Any 35mm lens will do, really, since you're mounting it backwards and not using the normal lens mount. Third, you could buy Novoflex's rather expensive lens reversal adapter, which contains the necessary wires and connectors to let the electromagnetic diaphragm operate correctly.

5) Attach a reversed lens to an existing lens.

Another old macro trick is to attach a 50mm (normal) lens to the end of another lens, but backwards. (ie: the filter threads of the 50mm lens are attached to the filter threads of the camera-mounted lens by means of a special lens-reversing or macro-coupling ring) You won't be able to adjust the aperture of the reversed lens if it's an EF-type lens, but there's nothing stopping you from using a non-EOS lens in this way, as above. A 50mm lens reversed on a 100mm lens can give you 2x magnification, for example, albeit with a fair bit of light loss.

6) Buy the Canon MP-E 65mm lens.

This is an unusual and specialized lens that's designed solely with macro photography in mind. It can't be used for normal photography, unlike the other Canon macro lenses, as it *starts out* at 1:1 magnification. It goes from there to 5:1 magnification. At this magnification an object 5mm x 7mm in size will fill the entire frame of 35mm film.

Though intriguing, it has a number of drawbacks. First, you can use it for super closeup photography and nothing else since it lacks infinity focus. Second, it suffers from the usual problems of macro photography - very narrow depth of field and the difficulty in illuminating objects adequately given the short working range. Third, ambient light metering works only with EOS 1 series cameras - all other EOS cameras can only be used with TTL flash metering. And fourth, the focussing screen of your camera may not be precise enough for accurate focussing.

Can I use the Canon 100mm macro lens for portraits?

Absolutely. The 100mm 2.8 macro and macro USM lenses are both excellent portrait lenses in addition to being great macro lenses. The only problem is that they're extremely sharp lenses, and some people prefer softer lenses for portraiture, particularly of women. If you're in that camp you could always slap a soft focus filter onto the lens.

What happened to the solid all-metal lens barrels of yesteryear? Why is everything today made of plastic?

It's true that a lot of lens barrels of the 60s and 70s were solid finely-crafted metal masterpieces with smooth focussing spiral-shaped helicals and precisely-machined parts. Whereas today many lens barrels are made largely of plastic. There are a number of reasons for this - the rise of autofocus, rise in labour costs, lower SLR sales, improved plastics technology, a desire to make lighter-weight gear, increased profit margins for manufacturers and so on.

Certainly the rise of autofocus is a major factor. Autofocus lenses with geartrains (ie: ring USM lenses excepted) require a bit more looseness and play in the geartrain system. They also don't usually use long focussing helicals as that would take more battery life and time to focus. Manual focus lenses with helicals, by contrast, can be machined to very tight tolerances.

However, there are advantages to increased use of plastics in lens construction. Quality plastic is fairly resilient and doesn't dent like metal, plastic is obviously much

lighter than metal, plastic components are less expensive to produce and can in theory result in lower prices to the consumer and so on.

So, while the old manual-focus lenses may feel great to hold and use and exude that terrific sense of precise quality that plastic lenses simply do not do, it's unlikely that less expensive autofocus lenses will ever be made with metal barrels. Note, however, that many Canon L series lenses use solid metal barrels and have reasonably tight-feeling manual focus rings. So if you're willing to spend the money you can still get metal lenses and retain autofocus.

Grades of plastic

There's also plastic and there's plastic. Canon have used, very roughly speaking, three different grades of plastic shell material for their EF lenses over the years.

The first generation of EF lenses used a fairly brittle hard type of plastic, which I call type 1. (though that isn't, of course, an official Canon designation) This material was moulded with a slight rough texture and the lenses had basically parallel lines to their cylindrical barrels, with little if any tapering. Focus and zoom rings often did not have rubberized surfaces. The 50mm 1.8 mark 1 is an example of this late 80s type of design. In my experience, though this purely anecdotal, type 1 plastic is a bit more likely to crack upon impact than later plastics.
The second generation, particularly black L lenses and advanced amateur lenses, are made of a more resilient hard black plastic, which I call type 2. These lenses have relatively little texture - they're either quite smooth or have a subtle hammered finish. These barrels tend to have subtly tapered barrels rather than simple cylinders, and have rubberized zoom and focus rings. The 28-105 3.5-4.5 USM is an example of a midrange zoom of this construction, and the heavier 135mm 2.0L USM is an example of an L lens using this construction, albeit with thicker plastic and a generally sturdier design. Lenses of this type first came out in the early 1990s, and seem to me to be slightly less likely to crack upon impact - the plastic has a tiny bit more inherent flex to it.
Finally, inexpensive cheapie lenses over the past few years have been made of lightweight smooth plastic which I characterize as type 3. These lenses often have somewhat exaggerated rubber rings for zoom grips, and later models (late 90s on) have shiny chrome rings around the end to impress less experienced consumers. The EF-S 18-55 3.5-5.6 is a typical example of this type.

Lens-related technical terms and vocabulary.

What is focal length?

The focal length is a basic optical property of any lens, and the most important one to a photographer. The simple way to think of the focal length is to think of it as a numerical value, expressed in millimetres, which represents how much of a given scene (the coverage area) a lens can take in.

Focal lengths for Canon SLR lenses range from ultra-wide (14mm) to incredibly long telephoto (600mm and 1200mm). The typical range of an affordable lens or lenses is from 28mm to 105mm or so.

Why, then, these strange values in millimetres? Why not indicate the angle of view taken in by each lens instead? Well, partly for historical reasons and partly for practical reasons. The technical description of focal lengths is rooted in the mathematics of optics - it's the distance between the focal plane and the rear nodal point of the lens, given infinity focus. How this bit of Martian translates to the field of view depends on the size of the imaging area being used, which can be different between 35mm film cameras, APS cameras and some digital cameras. And as for practical reasons, the focal length of a lens is an innate property of the lens, but the actual coverage area of the scene depends on the size of the image format used.

So note that crucial point - all the examples I gave above are for a *35mm film* camera or full-frame EOS SLR only. If you were to use a 28mm lens on an APS camera or a digital camera with an image sensor smaller than that of 35mm film (ie: most digital cameras sold today) then you would have a much narrower field of vision than if you were to use the same lens on a 35mm film camera. For more details see the section on focal length multipliers/cropping factors.

The same focal length system is used to describe lenses for other types of cameras as well, such as medium format cameras. But the area taken in by a lens on a medium format camera will be totally different from that of a lens of the same focal length on a 35mm camera, because the area covered by medium format film is considerably larger.

What is a lens aperture or *f* stop?

The aperture of a lens is its second most important optical property after its focal length. Consider the human eye. It has a coloured iris with a pupil which can dilate or contract in order to let in more or less light, depending on ambient light conditions. When it's dark the pupil opens up to let in as much light as possible. And when it's sunny the pupil contracts to prevent the bright light from overwhelming the eye. Most camera lenses have a device analogous to the iris - a metal or plastic diaphragm which can be adjusted in size to control the amount of light entering the lens.

The variable-sized hole in the diaphragm is known as the aperture, is analogous to the pupil of the eye, and is indicated numerically by an *f*-stop or *f*-number value. This value, the relative aperture of a lens, describes the amount of light that a lens lets in. The value is relative because it is equivalent to the focal length of the lens divided by the size of the lens aperture, not the physical dimensions or anything.

For example, if you were to take a 50mm lens with a 6.25mm diameter aperture you'd have a lens set to *f*/8 (since 50/6.25 = 8). Generally each increase or decrease in *f*-stop value either doubles or halves the aperture size. Since *f*-stop values are relative to the focal length, each camera lens should let basically the same amount of light through at the same *f*-stop value regardless of focal length. (barring complex technical factors such as light loss from large numbers of elements and so on, but we won't get into that here)

The usual *f*-stop range on 35mm and digital SLR camera bodies is:

1.0 1.4 2 2.8 4 5.6 8 11 16 22 32

though most camera lenses are only optically capable of a subset of that overall range.

The relationship between these values involves halving and doubling the amount of light. Going from *f*/2.8 to *f*/4, for example, involves a halving of the aperture size. Each number is approximately 1.4x more than its previous stop since 1.4 is the square root of 2 (to one decimal place), though since the specific numbers derive from tradition they are not always spot on. Lenses for larger camera systems such as large format cameras usually have even smaller apertures - going to *f*/64, for example.

This series of numbers may look difficult to work with, but in fact there's a fairly simple way to recall it. Just remember that the first two values are 1.0 and 1.4 respectively. Each following value then doubles by every other value. So 1.0 becomes 2, then 4, then 8 and then 16. 1.4 becomes 2.8, then 5.6, 11 and 22. (the only minor glitch, of course, to this handy mnemonic scheme is between 5.6 and 11)

Confusingly enough, when the number is small (eg: *f*/2.8) then the lens diaphragm is open wider ("opened up") and thus more light enters the lens. If the number is large (eg: *f*/22) then the lens diaphragm is closed smaller ("stopped down" or "closed down") and thus less light enters the lens. In addition to altering exposure times, the aperture setting also affects depth of field.

The letter *f* is frequently italicized for good looks, and a slash is often placed between the letter *f* and the numerical *f* stop value to indicate that the *f*-stop value is a fraction of the focal length. eg: *f*/4 means that the aperture is a quarter of the focal length. The letter *f* stands for "focal," "factor" or "focal length" depending on who you talk to, and the number is also often stated as a ratio. (eg: 1:2.8)

Note that not all lenses have adjustable diaphragms. Many types of lenses, though not usually those sold for use with EOS cameras, have fixed apertures. Mirror lenses, for example, fall into this category since they lack (adjustable) diaphragms. Really crummy cameras - disposable cameras being one example - also have fixed apertures. These two examples aside, however, nearly all lenses sold for use with EOS cameras have adjustable apertures.

What is a slow lens or a fast lens?

These are colloquial expressions describing the maximum aperture value or values of which the lens is capable. Slow lenses have a very small maximum aperture, which means less light enters the lens and so longer time periods are required to expose the film or image sensor. Fast lenses have a very wide maximum aperture and so shorter time periods are required to expose the film or image sensor.

The larger the maximum aperture of a lens the more light it lets in. And so faster lenses are generally more desirable than slower lenses. First, fast lenses let you take photos in lower light levels using available light rather than blasting the scene with ugly light from a flash unit. Second, you can see through the viewfinder better since fast lenses let in more light and so the view through the finder will be brighter with a fast lens.

As explained above, lens *f* stops are ratios, and so smaller numbers indicate larger apertures. A lens with a maximum *f* stop value of 1.4 is, therefore, fast. And a lens with a maximum *f* stop value of 5.6 is slow by comparison. However, *f* stop numbers are the ratio between the focal length of the lens and the aperture, which means that it's very easy to design a fast 50mm lens (1.8 is a typical maximum aperture value) but very hard to design a long 200mm telephoto lens with a maximum aperture so large.

In fact, designing fast lenses in general is more complex and expensive than designing a lens with a small maximum aperture, so fast lenses tend to cost more than slow ones. It's also harder to design and build a fast zoom lens than it is a fast prime (fixed focal length) lens. Faster lenses are also usually physically larger than slower lenses of equivalent focal lengths. The reasons for all this are tied into the complex mathematics of optics.

Note that autofocus lenses for EOS cameras have the focus motor built into the lens, not the camera. And some lenses focus more rapidly than others. So sometimes you hear people talking about a lens having a fast or slow focus motor speed, which is a separate matter altogether from the optical properties of the lens.

What is depth of field?

When you focus on something, the subject isn't the only thing that's going to be sharply focussed. Certain objects closer to you and further away from that subject will also be in acceptable - though not quite as sharp - focus. The distance range within which these objects appear to be in reasonable focus in your final photograph is known as depth of field. Being able to control depth of field is an important photographic skill since it can affect the appearance of a photograph dramatically.

For example, let's say you're taking a portrait of someone outside. And let's say that the reason you're doing so outside is to get nice natural lighting, but you don't care so much about the background as such. Maybe you're in a park and you don't want to show a cluttered background of trees, grass and bushes. In this case you'll want a narrow depth of field and focus on the person's eyes since they're the key thing you want to have in focus. If you have a narrow depth of field then the background will be thrown nicely out of focus and you'll just have a pleasingly blurry green background to your portrait.

But let's say you want to take a nature photograph of a flower in a dramatic mountain landscape with an interesting sky. In this case you'll probably want everything from the flower to the sky to be sharply in focus. This would require great depth of field.

There are three factors which control depth of field on a given camera. They are as follows:

Aperture.
The aperture (*f* stop) to which a lens is set is a very important factor governing depth of field. The larger the aperture (smaller the *f* stop number) then the smaller the depth of field and vice versa. So if you're shooting something in low light conditions and open your lens up to *f*/1.8 in order to admit as much light as possible you'll find you have a really narrow depth of field, which can be a real problem

sometimes, since precise focussing is required. Conversely if you're shooting outdoors on a bright sunny day you may find you'll need to stop down a long way to get the shutter speed you want, but this can result in too great a depth of field for some applications.

Focal length.
The focal length of your lens also makes a tremendous difference. Lenses with short focal lengths (wide angle lenses) have wider depths of field available and lenses with long focal lengths (telephoto lenses) have shallower depths of field available. This is generally a good thing. If you're using a really wide lens for landscape shots you'll be able to get huge areas of scene in sharp focus. But if you're using a really long telephoto lens for bird photography then your depth of field will be really shallow and you'll be able to isolate the bird in the landscape nicely.

Subject distance.
Finally, the distance from the lens to the subject also affects depth of field. If you're really close to your subject, such as in macro photography, then depth of field will be shallow. But if you're taking a photo of something that's a long way away then your depth of field will be deeper.

Naturally all three of these factors work together, so you can adjust all three factors to achieve the effect you're looking for.

It should be noted that the size of a camera's image area also dictates the depth of field. A camera with a large image area - say a medium-format or large-format camera - is capable of a much more shallow depth of field than a camera with a smaller image area. This is why consumer digital cameras, which have tiny image sensors, have such deep depth of field. However, you can't change this particular factor without switching cameras. The other three factors above are adjustable on any given EOS camera.

It should also be noted that this is a very non-technical description of what depth of field is all about. To be more accurate about it you need to go into a lot of math and a definition of the circle of confusion and a consideration of the print size and so on. But the simplified stuff above is adequate to get a grasp of how to control depth of field adequately to make your photos look the way you want them to.

What is a bayonet mount?

Canon EF mount lenses are of the "bayonet" type. This means that the lenses have mounting lugs (three in the case of EOS lenses) which slot into the camera body mount. You then rotate the lens a partial turn to lock it into place with a click.

Most camera makers these days use bayonet-style mounts, though other types were popular in the past. For instance, older Pentax and Leica cameras used screwmount systems - you simply screwed the lens into the camera body's threaded mount. The lens system used by Canon prior to the introduction of EOS was the FD system, which used a "breechlock" mount system with a rotating friction ring.

Lens hoods often fasten by means of bayonet mounts. Some filters for certain European lenses also use bayonet mounts, though Japanese makers generally use threaded filter mounts.

It's not clear why the lens mounts are called bayonet mounts. The two theories I've heard both stem from bayonets, the knives which soldiers fasten to the end of their rifles. One theory, which is probably utterly apocryphal, suggests it's a gruesome joke deriving from the instructions given to soldiers on how to use their bayonet - thrust in and twist. The more probable and prosaic theory is that the term derives from the design of bayonet mounts on rifles.

What does a Roman numeral on a lens refer to?

Canon, like most Japanese lens makers, use the optical specifications of a lens to distinguish one model from another. (European makers have traditionally come up with fun names resembling Star Trek planets, like "Tessar," "Biogon" or "Super Angulon," to describe their lens designs) But sometimes a maker will produce new models later on which happen to have the same basic specifications as previously-made ones. To distinguish these lenses one from another Canon will add a Roman numeral to the end of the lens specification, starting with II. For this reason you will never see a lens marked with a I, though people often refer to "mark I'" lenses when subsequent models are released. You will, however, see lenses marked with II, III, IV, etc. These are commonly referred to as mark II, mark III, etc, lenses in common parlance.

Sometimes these later lenses are an improvement over the original, sometimes they're worse and sometimes they are almost identical bar some cosmetic changes. For example, the 50mm 1.8 II is markedly inferior to its predecessor in build quality but has the same great optics, the 28-80 3.5-5.6 USM II is entirely worse in every respect to the mark I edition, but the 28-105 3.5-4.5 and 28-105 3.5-4.5 II lenses are basically the same with slight cosmetic differences. There's unfortunately no way to tell from the Roman numeral designation itself whether or not a later lens is better or worse. I try to identify these differences between versions in my PhotoNotes lookup page, so that's a good starting point.

Canon also release updated versions of lens hoods using Roman numeral designations, as described above.

What is the difference between the various kinds of lens motors (AFD, MM, USM)?

Unlike most camera makers Canon chose to position the autofocus motor inside the lens barrel rather than in the camera body when they designed the EOS system. This was arguably a wise move, since it means autofocus motor can be tailored to the requirements of each lens. A big telephoto lens can have a large motor and a small normal lens can have a more compact motor. By contrast, systems which rely on the autofocus motor being only in the camera body don't have this flexibility - the motor is always the same regardless of the lens used unless you change camera bodies.

So. Canon employ a number of different motor technologies in their lenses. The first two types are never identified specifically on the exterior of the lens. You have to look up in Canon's product literature to see which type of motor a given lens uses.

Traditional electromagnetic motor drives.
Such motors contain tiny wound coils of wire and rely on electromagnetic principles to turn a shaft. Little cogwheels and gears are then used to translate this rotational motion into the movement needed to adjust lens focus.

Arc-form drive (AFD).
Generally used in a number of older lower-cost lenses, AFD motors are simply little electric motors which drive a geartrain. They're somewhat noisy - electric buzzing and grinding of gears - and not terribly fast. This isn't a big deal on smaller lenses since the distances the motors must move the focussing elements aren't very far. However, telephoto lenses with AFD motors can be quite sluggish.

Micromotor (MM) drive.
Generally used on a few older lower-cost lenses. Similar to AFD - slow and noisy and based around an electric motor driving a geartrain. Some particularly low-cost lenses use micromotor drives with rubber belts.

Ultrasonic motors.
Ultrasonic motors do not rely on magnetic coils like most electric motors. Instead they use extremely high-frequency vibrations which translate into circular motion. The result is a very fast and pretty well silent (to human ears, anyway) lens motor. There are two basic types employed by Canon.

Ring ultrasonic (USM) drive.
The kind you want. These motors consist of two metal rings which vibrate at a very high frequency. (have a look here for photos of these rings) Ring ultrasonic lenses are great because they focus quickly and silently and also support full-time manual (FTM). There are actually two variants of this design - see the FTM section below.

Micromotor ultrasonic (USM) drive.
This kind is less desirable. It's a form of USM motor that Canon designed for their cheapie lenses so they can bill them as ultrasonic for marketing purposes. An MM lens replaces the standard magnetic motor with an ultrasonic motor but retains the usual geartrain setup. Such lenses are still reasonably quiet, though not as quiet as ring ultrasonic motors, but usually lack FTM - see below.

Note that, while all lenses with "USM" in the name contain an ultrasonic motor, Canon do not distinguish between ring and micromotor USM drives in the name - you have to look up the specs for the individual lens to find that out. Also, most non-L lenses with USM drives have striped gold lines painted around the end of the barrel. However, all L lenses have red lines painted around the end, whether or not they use USM (ie: Canon never have two painted rings around their lens barrels, and the red L line takes priority over the gold USM line).

What is full-time manual (FTM)?

As noted above, Canon EF lenses with AFD (arc form drives) and MM (micromotor) drives use very simple autofocus mechanisms which rely on electric motors and geartrains - rows of tiny cogwheels. Unfortunately, turning such a focus system by hand can damage the geartrain, so such lenses have a switch mechanism which disengages the cogwheels when you focus manually. There is thus no way for you to focus manually when the lens is switched over to autofocus mode.

However when Canon introduced lenses with USM (ultrasonic motor) autofocus systems they also introduced full-time manual focussing (FTM). Such lenses allow you to adjust focus manually even when the AF/MF switch is set to autofocus. This is very handy, as it lets you adjust or touch up focus without having to flip the switch.

There are a few points to keep in mind here.

- There are actually three different types of USM motors, although there's no way to distinguish them apart by looking at them - the lenses are all simply marked "USM." (use the PhotoNotes Lookup page to find which lens uses which motor)

  The best USM motors are those used in most midrange and L series contemporary lenses - **ring USM** motors. A ring USM motor consists of two metal rings which vibrate at high frequencies, resulting in rotational energy. Full-time manual on a ring USM lens is easy - there's a simple friction clutch which means you're simply turning the whole motor by hand when you rotate the focus ring. This means you can focus the lens manually at any time, even if the camera is turned off or the lens isn't attached to a camera.

- The second type of USM is the earliest design, and seen only on a few older lens designs and some longer telephotos. These are **electronic focus ring USM** lenses which can only focus manually when the camera is actually turned on. This is because turning the focus ring sends electronic commands to the lens motor, ordering it to rotate. The following lenses are old-style electronic full-time manual USM lenses:

  EF 50mm 1.0 L USM
  EF 85mm 1.2 L USM
  EF 85mm 1.2 L USM II
  EF 28-80mm 2.8-4 L USM
  EF 200mm 1.8 L USM
  EF 300mm 2.8 L USM
  EF 400mm 2.8 L USM
  EF 400mm 2.8 L II USM
  EF 500mm 4.5 L USM
  EF 600mm 4 L USM
  EF 1200mm 5.6 L USM

- Finally, there are **micromotor USM** lenses. These are mostly inexpensive consumer lenses which do not support full-time manual, because they still use a mechanical geartrain. Arguably these lenses are barely USM, since the only real advantage they have over regular motors is that they're slightly quieter.

  There are a couple of exceptions to confuse matters, however. The 50mm 1.4 USM and the newer 28-105 4-5.6 USM lenses contain slip clutch mechanisms which let you use FTM in a fashion similar to a ring USM lens.

- Adjusting focus manually is a bad idea when the lens motor is in the process of turning, since you'd be fighting the motor and straining it. Wait until the lens motor has stopped operating before turning it by hand.

- Finally, adjusting focus manually is also a bad idea when the camera is in AI Servo mode, since the AF motor can kick in at any time.

Do USM lenses take better photos than non USM lenses?

No. USM (ultrasonic motors) are autofocus mechanisms. They in no way affect the optical quality of a lens.

Of course, since USM lenses focus faster and more quietly than non-USM lenses there's the possibility that using one might help you get a photo that you might not have got with a slower or louder autofocus lens. But that again is unrelated to the optical quality itself.

This confusion may come in because Canon only put ring USM drives into their midrange and pro (L series) lenses. You can't buy cheap Canon lenses with ring USM - only micromotor USM (see above). But again this is no guarantee of anything, since there are plenty of Canon lenses - particularly their older prime lenses - which lack USM but which have excellent optical quality.

What is image stabilization?

Image stabilization or IS is a Canon technology that optically corrects for camera motion when you take a photo. Since camera motion - caused by handholding the camera, for example - can result in blurring of the image at slower shutter speeds, IS can result in sharper photographs when fast shutter speeds are not possible.

IS is a fairly complex technology involving motion sensors, microcomputer chips and small motors to move key lens elements. There is, therefore, a price premium for IS-capable lenses. But they can be very convenient - when handholding a camera you can easily gain a stop or two over using a non-IS lens.

However, remember that IS does not increase the maximum aperture of the lens or anything. An IS lens with a maximum aperture of 3.5 still has a maximum aperture of 3.5. IS simply lets you use a slower shutter speed than would otherwise be possible when you're handholding the camera, by compensating for camera motion. So you won't necessarily be able to get that narrow depth of field that you could with a faster lens - which could be a drawback or a benefit depending on your point of view.

IS has a few other drawbacks over faster lenses as well. Earlier IS lenses tended not to perform very well when mounted on a tripod when the IS mechanism was engaged. Consumer IS lenses also do not work very well when panning (tracking a moving object), though pro IS lenses do. IS does not help you if the subject is moving - it compensates only for camera motion. IS doesn't help freeze subject motion and in fact will probably make things worse by letting you use a much slower shutter speed than a fast lens. Some people find the slight swimming motion in the viewfinder when using IS a bit dizzying and IS uses a little more battery power than no stabilization at all. Finally, some earlier film EOS cameras are not entirely compatible with IS lenses and have minor inconveniences, such as viewfinder shake once a photo has been taken (though this does not affect the picture quality).

Nonetheless, these drawbacks aside, most people find IS quite valuable, particularly on long telephoto lenses.

Canon were the first company to include image stabilization technology in SLR lenses, though Nikon actually pioneered the field with a stabilized-lens point and shoot (the Zoom-Touch 105 VR) in 1994. Today Nikon sell a range of VR ("vibration reduction") SLR lenses; the main difference being Nikon sell mainly to the high end lens market where Canon sell a variety of IS lenses covering the mid to high end markets. Sigma have also released a number of image-stabilized lenses. Canon IS technology is built into the lens, like the Mega Optical Image Stabilizer (Mega OIS) system used by Panasonic. These both differ from the Minolta-developed Super SteadyShot stabilization technology used by Sony, which is built into the camera body. Building anti-vibration technology into the camera has the advantage of making the feature available to any lens attached to a supported camera, but it has the disadvantage of not being tailored to each focal length range.

What is distance data and which lenses support it?

Many Canon EF lenses have the ability to send distance data to the camera. For example, if you're currently focussed on an object 4 metres from the camera then the lens would send that approximate distance data to the camera body.

Canon have built and sold lenses since 1990 with this data, but it wasn't until 2004, with the advent of E-TTL II flash metering, that Canon really put it to good use. E-TTL II has the ability to factor distance data into flash metering calculations under certain conditions. This distance data can improve the reliability of flash metering when it's available and appropriate.

For more information on this topic please consult my EOS flash photography article, which has a section on E-TTL II and a list of Canon EF lenses capable of returning distance data.

What is a lens element?

There's some confusion of terminology here. The word "lens" refers both to a single chunk of shaped glass (think of the single lens of a magnifying glass) and the tube-shaped device containing such lenses which you fasten to the end of your camera.

A lens *element* is a single piece of shaped glass or crystal. Camera lenses these days contain anywhere from 4 lens elements and up. They are frequently arranged in optical groups within the barrel. For that reason you may hear of a given lens having, say, 18 elements in 15 groups.

There are complex tradeoffs made in lens designs, so the number of elements and groups isn't always the most reliable indicator of image quality. Simpler lenses with just a few elements tend to offer good results because they are so simple. Flare in particular (light reflection between elements in this case) is vastly reduced. However, wide angle and telephoto lens designs generally require more elements to correct for various optical aberrations.

What is a lens coating?

As anyone who has looked through a window knows, glass both reflects light and lets light pass through. And reflections can easily happen at oblique angles as well as when you look at a lens straight-on. Camera lenses suffer from the same basic problem of reflections as windows. And excessive reflections within the lens can result in lens flare - either a generalized loss of contrast or bright reflected blobs appearing in the picture.

The invention of lens coatings by German lensmaker Carl Zeiss in the mid 1930s revolutionized lens design. Such coatings are fine layers of transparent material which are applied to the surface of lens glass and which minimize internal reflections within the lens. All modern camera lenses, including Canon EF lenses, are multicoated to reduce reflections. Canon refer to their technology as SSC, or Super Spectral Coating.

You can easily tell a coated glass surface from an uncoated one. An uncoated piece of glass reflects a lot of light, and reflected white light is also white. A coated piece of glass, however, reflects far less light and the light that is reflected is often greenish, purplish or reddish. These apparent colours, it should be noted, are artefacts of the way coatings absorb reflections, and do not mean that photos taken through decent quality coated glass are going to be tinted one colour or another.

Lens coatings have two drawbacks. First, they must be kept scrupulously clean at all times, as oils and dirt interfere with the way they work. Fingerprints are extremely obvious on coated glass. Second, many lens coatings are fairly fragile and are easily scratched, so care is required in handling and cleaning them. Some lens and filters include hardened surfaces over the top of the coatings to protect them, but this is not universal.

What do “aspheric” or “aspherical” mean?

The glass elements which make up a traditional camera lens can be thought of as cross-sections of a large sphere. That is to say that the curvature of each surface is even. The problem with spherical lens designs is that light passing through the outer edges of curved camera lenses focus at different points from light passing through the centre. This causes focus errors, or spherical aberration and other forms of optical problems. Spherical lenses work fine if the recording surface is also spherical (eg: the human eyeball), but in the case of cameras it’s not - the film surface or image chip surface is always flat.

One way to fix the problem is to add additional lens elements to correct for the aberration. A generally more efficient way to fix it is to make a lens element which is not a sphere in cross section. In other words the curvature of the lens varies from the middle to the edges. Such an aspherical lens element can help simplify lens design by minimizing the number of elements required and can result in a sharper image. Aspherical elements are particularly useful for correcting distortion in wide-angle lenses.

There are three basic ways to make an aspherical element. The expensive way is to grind a piece of glass down to the right shape. This is quite difficult owing to the extreme precision required to achieve the complex geometry, and so only some L series lenses use ground aspherical elements in Canon’s lens lineup. Another way is to mould a glass lens element. Such glass moulded aspherical lens elements are

used in a number of Canon's less expensive lenses. The cheapest way is to cement a plastic resin aspheric surface to the top of a glass spherical element. Such lenses are known as replicated aspherical elements and are particularly common among point and shoot cameras.

Note that some lensmakers, particularly Sigma, use the terms "aspherical" or "ASPH" as marketing labels. However many modern lenses made by other makers such as Canon also employ aspherical elements - they simply don't advertise this fact on the outside of the lens. It's important to remember that lenses with aspherical elements are not automatically and intrinsically better than lenses without. Sometimes they are, though this is usually for a variety of other factors, not merely the fact that they use aspherical elements.

What is low dispersion glass?

Low dispersion glass and its variants - ultra-low dispersion (UD) glass, extra-low dispersion (ED) glass - is expensive optical glass which can reduce unwanted colour fringing and other optical problems in lenses, particularly long telephoto lenses.

Dispersion is the rainbow effect seen with prisms and the like - white light being split up into a rainbow spectrum of its constituent wavelengths. Low dispersion glass does not disperse white light as much as regular glass, thereby reducing the amount of correction required to compensate for the phenomenon.

What is fluorite?

Technically, calcium fluorite isn't glass. It's actually a type of crystal produced synthetically by Canon and used in many of their top of the line L series lenses in place of low dispersion glass. It's an expensive material but is extremely useful for minimizing optical lens aberrations, particularly with telephoto lenses.

What are diffractive optics (DO)?

DO lenses contain a new type of lens element unique to Canon's product lineup. Such lens elements, multi-layer diffractive elements, are nearly flat lens elements with extremely fine grooves etched into them. They exploit the principles of optical diffraction rather than optical refraction.

The advantage of such DO elements is that they do a very good job of reducing chromatic aberration (colour fringing), a particularly significant problem in long telephoto lenses. They can also be made much lighter than regular low-dispersion or fluorite lens elements, thereby shortening the length and reducing the weight of a large telephoto lens considerably.

Unfortunately, lenses with DO elements are at present quite expensive, and have some issues with lens flare under some lighting conditions. Canon DO lenses, while professional products, are not sold as L lenses and are marked by a pale green stripe around the end of the lens rather than a red one.

What is rear or internal focussing?

Many lenses become physically longer or shorter when you adjust focus. In other words they have two nested tubes which telescope in and out as you rotate the focus ring. This design, while inexpensive to make, is generally undesirable because when a lens extends or contracts there will always be air and dust sucked inside it. And inevitably this yields a bit of dust buildup over years of use.

Many Canon lenses use rear focussing (RF) or internal focussing (IF) instead. In rear focussing the lens elements closest to the camera move back and forth when you focus but the frontmost elements do not. In internal focussing some glass elements inside the lens move within the lens barrel. In both cases the lens does not change length at all because all lens element motion is contained within the lens barrel.

Another advantage of rear and internal focussing is that the end of the lens does not rotate during focussing. Many lenses which extend when you focus also rotate, which can be a nuisance if you use polarizing filters or graduated neutral density filters.

What is bokeh?

A term borrowed from the Japanese, pronounced with short vowels. (ie: more like French pronunciation - bo-ké - versus long English diphthongs - bow-kay.) Essentially bokeh, which is derived from the Japanese for blurring, refers to the highly subjective quality of the out of focus areas of a picture. Good bokeh is generally held to be smooth and soft, whereas bad bokeh is generally held to be distracting in some way - perhaps clumpy or doubled-up bright spots and so on.

Bokeh can be important for portraiture - you want out of focus areas behind the subject to be smooth and as non-distracting as possible. Highly patterned or sharp-edged areas don’t look as good. Mirror lenses are notorious for bad bokeh - they have annular (ring or doughnut shaped) out of focus highlights.

Bokeh is also written without the H, but the H is usually added to remind English speakers that the word has two syllables and not one.

Part IV - Flash.

Which flash should I buy for my camera?

Choosing a flash generally comes down to four things: how much you want to spend, how much weight you want to carry around, how much power (light output) you need and how much control you have over the flash output. There are a number of other permutations as well, such as the type of camera you have, whether you want a dedicated flash (see next section) or not, whether you shoot film or digital or both, and so on.

Please consult the "which flash?" section of my EOS flash photography article for more details. Indeed, please note that this entire section is pretty well a distilled version of that article. It's a very long read, but it's also currently the most complete resource on Canon flash photography available anywhere.

What is a "dedicated" flash unit?

A dedicated flash unit is an electronic flash which contains computerized electronics and which is designed to work uniquely with one particular camera system. For example, Canon sell Speedlite E-series flash units. These flash units contain electronics which work only with Canon EOS cameras and which do not, for example, work properly with Minolta or Pentax cameras. Similarly Nikon sell Speedlite SB flash units which work with Nikon SLR cameras but which don't work properly with Canon EOS cameras.

The advantage of a dedicated flash unit is that it may be able to take advantage of features unique to the system in question. Note that a flash does not need to be made by the same company that made the camera body to be dedicated. The term refers to the capabilities of the device, not its maker. So it's possible to buy a dedicated flash unit for EOS cameras that is made by a company other than Canon.

I have an off-brand (non-Canon) flash unit. Will it work with my EOS camera?

Maybe. That entirely depends on the flash unit. If the flash unit was designed to work with EOS film cameras - if it's dedicated to EOS cameras - then it may support TTL (through the lens) metering and may work fine with most EOS film cameras. If the flash unit supports E-TTL metering then it may work fine with newer EOS film cameras and EOS digital cameras. If the flash unit is an older automatic but non-dedicated flash then it may work automatically by itself just fine. If the flash unit is a dedicated unit designed to work with non-EOS cameras then it almost certainly won't work. The only way to know is to try it or ask the manufacturer if it'll work.

However, there is one key thing you must check before attaching the flash unit to your camera. Many older flash units, even small battery-powered ones, use high voltages to trigger the flash circuit. Most Canon EOS cameras can use flash units with trigger voltages of 6 volts and no higher. So if your flash uses, say, 135 volts to trigger the flash then you may damage your camera by using it. You'll literally be frying the camera's circuits in this case.

So test the flash unit's hotshoe with a multimeter before using it with your camera. If you find that the unit uses a high voltage for its trigger circuit - or if you can't or don't know how to test for it - you can either use an optical slave trigger device or a protective adapter such as the Wein Safesync.

Why does my camera want such long shutter speed times when I'm using flash in Av mode?

This happens because you are trying to take a flash photo in low-light conditions and the camera is in Av (aperture priority) mode or the night PIC (icon) mode if your camera has it.

In Av, night icon and Tv (shutter speed priority) modes the camera meters for ambient (existing) light and fills in the foreground subject using the flash. It does *not* assume that the primary light source is the flash, and therefore the shutter speed it sets is the same as it would set if you weren't using flash at all. In low light this results in slow shutter photography. If the shutter speed is very long you will, therefore, need a tripod to avoid motion blur during the exposure.

Alternatively you can switch to full auto (green rectangle) or Program (P) mode, which automatically expose for the flash-illuminated subject and not the background. These modes try to ensure that the shutter speed is high enough to let you handhold the camera without a tripod. The drawback of P and basic modes is that photos taken in dimly lit areas usually end up with black or poorly lit backgrounds, as explained below.

My flash photos look like they were taken in a black hole. Why is the background totally dark?

This is the flip side of the previous question. In P (program) mode and all flash-using PIC (icon) modes except for night mode (if your camera has it) the camera uses the flash as the primary light source for the foreground subject. If the ambient light levels are low, therefore, the background will turn out very dark. This is because the flash is not illuminating the background and the shutter speed is too short to expose adequately for background areas.

Remember that the light from any battery-powered flash is somewhat limited. You can't expect a small flash unit to light up the Grand Canyon or Eiffel Tower. You can only reasonably expect it to light up people standing in the foreground or close backgrounds such as room interiors.

To avoid this problem of black backgrounds you will need to take a photo in Av, Tv or M modes, as mentioned in the previous question. If the ambient lighting is very low you may need a tripod to avoid motion blur for the time required to expose the background adequately. Using fast film or a high speed setting on a digital camera (eg: ISO 800) and wide lens apertures (the smaller the f stop you can get on your lens) will help bring up the background as well.

What is the difference between TTL, A-TTL, E-TTL and E-TTL II flash?

These four modes are all forms of through-the-lens flash metering used by Canon cameras. Older EOS film cameras support TTL and A-TTL metering only. Newer film models and almost all digital EOS cameras support E-TTL flash metering. E-TTL II is available on most EOS cameras from 2004 on.

- TTL (through the lens) and A-TTL (advanced through the lens) flash metering rely on small flash sensors inside the camera body. Flash metering occurs *after* the shutter has been opened - the sensors record the amount of flash-created light returning to the camera through the lens and automatically shut off ("quench") the flash when an appropriate amount of light has been produced.
- A-TTL adds a preflash (a brief pulse of light, usually invisible infrared, from the flash) which is fired before the shutter is opened. This preflash is used in P mode to adjust lens aperture, but that's really about it. In fact, A-TTL flash still relies on the TTL sensor to quench flash output after the shutter has opened. Sadly, therefore, A-TTL is a fairly pointless flash mode.
- E-TTL (evaluative through the lens) is quite different. It relies on the standard evaluative metering sensor used in ambient light metering. With E-TTL flash a visible-light preflash is fired by the flash unit *before* the shutter is opened. The camera records the effects of this preflash and uses it to calculate the appropriate flash output to be delivered once the shutter has opened. E-TTL flash does not use a separate TTL flash sensor, and no metering of flash occurs after the shutter has opened.
- E-TTL II is a variant of E-TTL. It's essentially the same as E-TTL but with two main refinements. First, rather than relying on a flash metering pattern it examines the scene before and after the preflash is sent, reducing the risk of highly reflective objects messing up the flash metering. Second, it can incorporate focus distance data from compatible lenses into the metering formula, which can also lower the chances of bright areas causing metering errors. E-TTL II camera bodies can use all E-TTL flash units without problem.

Remember that to take advantage of a given flash technology you need a camera and a flash which both support the flash technology you want to use. So if you have, for example, a camera body capable of supporting E-TTL and then you attach it to a flash unit which supports TTL but not E-TTL then you won't be able to use E-TTL.

For more information on these modes and how they affect your photography please consult my Canon EOS flash photography article.

What is a type A or a type B camera?

When Canon introduced the the first camera with E-TTL flash capabilities (the EOS 50/Elan II/EOS 55 in 1995) they introduced with it a new naming scheme to make it easier to identify whether or not a camera supports E-TTL.

- All EOS cameras which fully support E-TTL, high speed sync (FP mode) flash and flash exposure lock (FEL) are **type A** cameras.
- All EOS cameras which support only TTL and A-TTL flash are **type B** cameras.

Note a few points here.

- While all film-based type A EOS cameras also support TTL and A-TTL flash in addition to E-TTL, all digital-based type A EOS cameras support E-TTL only and do not support TTL or A-TTL.
- The specific date a camera was bought does not guarantee whether it's a type A or a type B, since Canon continued to design and sell type B cameras for many years after the introduction of the EOS 50/Elan II/EOS 55.
- Since this naming scheme was introduced in 1995, older type B cameras are obviously not described as such in their documentation.
- The type A/B naming system doesn't reveal whether a camera supports E-TTL II or not. (ie: all cameras with E-TTL II are type A bodies but not all type A bodies support E-TTL II)
- At present all Canon-built Speedlite flash units which support E-TTL are of the "EX" flash series. All other flash units are of the "E" or "EZ" flash series and support either TTL only or both TTL and A-TTL.

What is X-sync?

X-sync or flash sync refers to the highest shutter speed which can safely be used with flash photography on a given camera model. This can be as slow as 1/90 sec on low-end Canon cameras to 1/250 on high end film cameras or even 1/500 sec on the EOS 1D digital camera.

The flash sync problem occurs because of the way focal plane shutters used in most SLR cameras are designed. Such shutters contain two travelling curtains which open briefly to expose the film or image sensor. At slower shutter speeds the entire image area is exposed, but at higher speeds an interesting trick is used. Rather than exposing the entire image area in one go the two curtains form a moving slit which travels the length of the image.

With ambient light exposure this isn't a problem, since the lighting will remain constant as the slit travels across the frame. However, flash exposure is a problem since the subject-illuminating burst of light from the flash is so brief. If flash is used in conjunction with a high shutter speed like this then only part of the frame will be correctly exposed. The result will be a picture that's properly exposed in one area but which is dark in another - often like a dark bar across part of the frame.

All EOS cameras are programmed so that they cannot use shutter speeds higher than the maximum flash sync speed, so long as you're using either the internal flash

unit or an external shoe-mounted Canon Speedlite flash unit. However, problems can arise if you trigger a non-dedicated flash unit and try to use a high shutter speed.

The X-sync issue usually poses problems when it comes to fill flash outdoors. Let's say you're taking a photo of someone on a bright sunny day and you want to use a pop of flash to fill in the shadows a little bit. But you also want to shoot with a wide aperture so as to blur out the background somewhat (narrow the depth of field). The problem is that if it's a bright sunny day then you will have to use a very high shutter speed in order to do this, or else use fast film or a high ISO setting. But if you need to use a high shutter speed that exceeds the camera's X-sync then you won't be able to use flash. Unless, of course, your camera and flash support high speed sync, as described in the next section.

What is FP mode or high-speed sync?

FP mode, also known as focal plane mode or high-speed sync, is a way of circumventing a camera's X-sync limitation. FP flash lets you take flash photos at any shutter speed you like, and works by pulsing the flash bulb at an extremely high rate - 50 KHz - simulating constant light at the cost of total light output. FP stands for "focal plane," by analogy to the old FP flash bulbs, though a convenient way to think of it is "fast pulse."

Only E-TTL capable (type A) EOS cameras support FP mode. (except the EOS 1N, which can partially support FP mode flash via an optional upgrade)

More more information on FP mode, how it's often used and what its limitations are, please consult my flash photography article.

What is flash exposure lock (FEL)?

Flash exposure lock is a technology contained in all type A (E-TTL capable) EOS cameras and EX series (E-TTL capable) flash units. Think of it as the flash equivalent of auto-exposure locking (AEL).

Consider this example. Let's say you're taking a photograph of someone who's standing to the side of large object - say a white building. Normally you would turn the camera to focus on the person and also set ambient light metering, then recompose the image by turning it to include the large building as well.

The problem is if you're using flash then flash metering will be done on the large white building, not on your friend, since the camera's active focus point (to which flash metering is biased) is going to be over the large building. This problem with "focus and recompose" is one of the major reasons for flash metering turning out badly on E-TTL cameras.

What you really want to do is to lock in the flash exposure settings when you've got your friend as the main subject in the viewfinder. Then you can turn the camera to move your friend to the side while retaining the correct flash exposure settings. This is what FEL does - it locks in the current flash settings for a number of seconds. It does so by issuing a preflash burst of light when you press the FEL button, and setting the flash meter level based on that information.

FEL is thus technically independent of ambient light exposure locking, but on most EOS cameras the two functions are controlled by the same button. Top of the line EOS cameras, however, have separate FEL and AEL pushbuttons so the two functions can easily be set independently.

More more information on FEL, please consult my flash photography article.

Why do I have blurriness around my subjects in my flash photos?

You're probably taking a slow sync photo. In other words, your subjects are being illuminated first by light from your flash unit. Then, if you have a slow shutter speed (typically 1/30 sec or slower), your subjects will also be illuminated by ambient light. The result is a kind of double-exposure - a sharp bright image lit by flash and a blurrier secondary image lit by ambient light. Sometimes this is called "dragging the shutter."

Sometimes slow sync is a desirable effect, since it can add a sense of dynamic motion to a photo. However, it can also tend to look like a blurry mess. If you want to freeze motion with your flash unit you should set a faster shutter speed.

EOS cameras default to slow sync mode when in Av mode or the night icon mode if your camera has it.

What is second-curtain sync?

Normally a camera will fire the flash immediately after the shutter has opened - first-curtain sync. If this flash is combined with a slow shutter speed as above, and you're photographing a moving object, you'll get a ghostly light trail showing the motion of the object. Unfortunately, if the flash fires right after the shutter *opens* then the object will appear to be moving backwards in the photo.

The solution is to fire the flash immediately before the shutter closes. This allows the moving object to record motion onto the film or sensor and then you freeze it with flash just before the exposure ends. This technique is known as second-curtain sync (rear-curtain sync to Nikon), and is an option with certain EOS cameras and flash units.

More more information on second-curtain sync and whether your camera and flash support it, please consult my flash photography article.

What causes the dark crescent-shaped shadows at the bottom of my flash-illuminated photos?

You're probably using the internal flash on your camera in conjunction with either a large lens or a lens with a large lens hood. The lens or hood is blocking light from the internal flash unit.

Since you can't raise the internal flash any higher your only choices are to use a shoe-mounted external flash unit, skip flash altogether, remove any lens hoods or adjust the lens (if it's a zoom lens which gets longer as you zoom) so that you're shooting at the wide end where the lens may be shorter.

What causes redeye and how does redeye reduction work?

The interior of the human eye is lined with a fine mesh of blood vessels. If you shine a bright light into someone's eyes then this light can be reflected back and, since it's reflecting off blood vessels the light is going to be coloured red. Normally you don't notice this effect in real life for three reasons. First, the light source has to be really bright compared to the ambient lighting. Second, the pupils of the eye have to be fairly dilated for enough reflected red light to be noticeable. And third, the light source has to originate as close as possible to the viewing axis (ie: to your own eye).

Unfortunately these three conditions are often met handily when you do flash photography in dim lighting conditions. Flash units produce a tremendous amount of light for a split second and, since flash units are frequently attached to the camera or built into the camera body, they're often located very close to the lens axis. The result is the evil glowing red satanic eye effect that's the bane of snapshot photography. Point and shoot cameras are particularly vulnerable to the problem, partly since they tend to be used in low-light situations like restaurants and living rooms, and partly because their built-in flash units are located very close to the lens.

The best solutions for avoiding redeye are either to abandon flash altogether or, if you have to use it, to move the flash unit as far away as possible from the lens. A good technique for improving flash photos is to tilt the flash unit head so that light bounces off the ceiling or the wall. Unfortunately, neither bounce flash nor moving the flash are possible with a camera's built-in flash.

So camera-makers have come up with another idea - shine a bright light into the subject's eyes first. This causes the pupils of the eye to contract, lowering the risk of redeye. So many cameras come equipped with redeye reduction lamps - typically bright white lights or, on some cameras (notably point and shoots) epilepsy-inducing pulses of blinding light from the main flash tube (see also the next section). Unfortunately these redeye reduction systems usually have the effect of making your human subject look dazed and stunned. Stunned and glazed or evil and satanic - with onboard flash photography, the choice is yours!

Yargh! My camera fires blinding pulses of flash in low light! What can I do?

Unfortunately, most non-pro EOS cameras sold today employ the built-in flash as an autofocus assist light when shooting in low light levels. This means that when ambient light is dim the camera will suddenly start firing intermittent blinding pulses of epileptic seizure-inducing light in an attempt to provide enough light for the camera's autofocus system to work properly. Needless to say this is rather annoying and more or less eliminates any chance you might have of getting candid shots.

If your camera is in a creative zone mode (P, Av, Tv, M) and the internal flash is down then it shouldn't fire these flashes of light. However, in all icon zone modes except for landscape sports the flash may fire these pulses of light.

There are three options that can help with low-light autofocus. First, low-light sensitivity of lower-end EOS cameras, while regrettably poor to begin with, can be improved by using a faster lens. So if you have a choice between a 50mm 1.8 and a 28-90 4.5-5.6, always go for the 50mm 1.8 if it's dark. Second, you can attach an external Speedlite flash unit to the hotshoe. All Canon Speedlites for EOS cameras

have a red patterned light built in. This red AF assist light is still visible but is considerably less obnoxious than the built-in flash. Third, and this probably isn't a terribly helpful answer, you could acquire an older EOS model, such as the Elan/100, the Elan II/50 or A2/5, which all have discreet red patterned lights built into the camera body.

Some cameras, such as the EOS 30/33/Elan 7/7E, have the ability to use the Speedlite's AF assist light while not firing its flash. Other cameras may require you to turn off the flash once focussing has been achieved if you don't want flash illuminating your picture. For this reason some owners of cameras with poor low-light focussing (eg: the digital D30 and D60 cameras) have bought the ST-E2 wireless flash transmitter. It will fire an AF assist light without bathing the scene in the harsh light of flash.

Note, however, that differing flash unit models have different coverage areas. Not all of them have the ability to illuminate all the focus points of a multiple focus point camera - some will only cover the centre point, for example. Others can cover a 3-point or 5-point camera but not a 7-point one. For details, please consult my EOS flash photography document.

My flash unit doesn't work with my digital EOS camera.

Of the four types of flash metering technology used by Canon, only E-TTL or E-TTL II are supported by Canon EOS digital cameras. TTL and A-TTL are not supported, since they rely on recording light bouncing off the surface of film, and digital cameras have no film.

Of Canon's flash lineup only Speedlite EX series flash units support E-TTL. Therefore you must use an EX series flash unit with your digital EOS body if you want automatic metering. Earlier E and EZ series flash units will *not* fire with a digital camera. Note that if you have a flash unit like the 550EX, which can be switched between TTL-only and E-TTL modes, you must be in E-TTL mode for flash to work with such a camera.

Most third-party flash units which are billed as being EOS compatible only support TTL metering. Sigma and Metz do make flash units and adapter modules respectively which are E-TTL capable, however, so read the specifications carefully.

My flash unit keeps firing off bursts of light randomly.

This problem could indicate a failed unit, or it could simply mean the contacts need cleaning (on both the camera's hotshoe and the foot of the flash) or the batteries need replacing. Or it could be that your camera is using the flash as an autofocus assist light - see above.

What is a PC connector?

Some cameras, particularly some advanced amateur and most professional cameras, have a small round connector for hooking the camera up to external studio flash units as below. This is a PC connector. The "PC" stands for "Prontor/Compur" (two early camera shutter manufacturers) and not "personal computer." PC connectors

are not data connectors for computers or anything - they have nothing to do with USB or FireWire.

All beginner EOS cameras lack PC connectors since they're mostly used in professional and semi-professional studio situations. If you really need one you can add a third party hotshoe to PC cord adapter to your camera.

Most Canon Speedlite flash units do not have PC connectors. Those which lack them can be adapted via a hotshoe adapter, but generally do not work reliably when triggered by a PC cable. Even when they do work you lack all forms of automated metering, of course.

What is studio flash?

The term usually refers to large flash units used in indoor studios. These flash units are powered by AC (mains) power and are not portable, like on-camera shoe-mounted flash units. They offer far more light output than small battery-powered units, are usually mounted on telescoping stands and can be attached to various light-modifying devices for considerable flexibility. They're usually called "studio strobes" in the US.

Studio flash units are not, however, generally automated in any fashion. They can't interface directly with the camera's electronics the way Speedlite shoe-mounted flash units can and thus do not meter through the lens. They are typically triggered by simple electrical signals ("fire now!") from the camera or a slave trigger. Sometimes they connect to the camera by a simple electrical cable with PC connectors as above, and sometimes they are hooked up to optical slaves and trigger in response to a burst of light from a master flash unit.

The photographer dials in a power setting on a controller box and the flash pumps out the amount of light specified when triggered. Metering requires a separate device - a handheld flash meter - to measure flash output and determine the output setting correctly. Predicting the final look can be tricky so professional photographers often install Polaroid instant film backs onto their cameras so they can do some test shots with instant film before loading up the camera with regular film.

Such setups are thus only of value in slow-moving studio situations, not fast-moving situations like photojournalism or candid photography. Canon do not make or sell any studio flash units, and studio flash gear is rarely used by novices because of the complexity and expense.

Why do professional photographers have those great big umbrellas on stands?

Umbrellas in flash photography are simply convenient, collapsible reflectors. Lighting, including light from a flash, can be hard or soft. And the hardness or softness basically comes down to the size of the area emitting the light. The larger the area, the softer the light. So umbrellas are used as reflectors to bounce light onto the subject from a larger area than a small flash head. Softboxes - large rectangle frames with white fabric stretched over them - are used the same way.

Umbrellas in photographic studios are nearly always used in conjunction with large AC-powered flash units as above, not small battery-powered units.

Why do my flash photographs always look so bad?

Mastering flash and making it look as natural as possible is a difficult art to master. For more information on this topic have a look at the flash tips section of my EOS Flash Photography article.

Part V - Filters.

I bought a filter. Do I have to adjust something on the camera to use it properly?

Most SLR cameras, such as all Canon EOS cameras, do their metering directly through the lens. So if you put something like a filter in front of the lens you don't need to compensate manually at all. The filter reduces the amount of light entering the camera, of course, but the camera still meters through the lens as it always would. So it works just fine.

There are at least three special case scenarios where this is not strictly true, however. None of these are typical situations encountered by a beginner, but here they are for completeness:

1) If you use a handheld light meter (a separate device from the camera) instead of the camera's built-in light meter then you will obviously need to compensate for the presence of a filter.

2) If you use a linear polarizing filter rather than a circular polarizing filter you may experience errors in the metering and autofocus system. Then again, you may not. But best play it safe - when buying a polarizing filter for your camera buy only circular polarizers, sometimes identified as CPL filters.

3) If you are doing specialized infrared photography using a black filter which blocks visible light but which lets infrared energy pass through the camera's internal meter is likely not to work very well, since camera meters are designed with visible light only in mind.

My camera salesperson tried to sell me a protective filter. Should I get one?

This is another question with a yes and no answer. There are two schools of thought regarding clear glass or UV-blocking protective filters. Some photographers use them to reduce the risk of damage to the lens - if you bash your lens against the wall then having a filter lowers the risk of the lens itself suffering damage. Other photographers refuse to use them on the grounds that any extra glass on the end of the lens, no matter how good, degrades image quality.

So there are a number of points here. First, there's nothing utterly essential about "protective" filters. You're simply lowering the risk of lens damage by using one. Second, if you get a UV filter to serve as lens protection try to get the best quality you can afford and keep it assiduously clean. A cheap or dirty filter will degrade the quality of your photos dramatically. Third, remember that camera salespeople earn big commissions by selling you little accessories like this - don't necessarily buy whatever they're trying to push on you. Chances are they're trying to sell you a piece of junk that happens to earn them a bigger commission. Fourth, using a filter doesn't mean you don't have to use a lens hood. In fact, in the case of lenses with slightly recessed front elements, putting a filter on means you're going to run a greater risk of lens flare than without. Always use a hood.

Now, having said all this about theory, my views on using a filter on a lens changed last year somewhat. I was in Tunisia and taking some photographs in an old Roman amphitheatre. I didn't have a lens on my camera, had the hood off temporarily and somehow banged the lens against a stone column or something. The front element on the lens got badly scratched and gouged. If I'd had a filter or a lens hood in place then I'd still have a usable lens. As it is I have't, since getting a replacement front element from Canon is half what the lens if probably worth these days.

For more information on filters in general, have a look at my filters page.

Should I buy a coated or an uncoated filter?

Nearly all lenses sold today for 35mm SLRs are coated with optical coatings that are designed to reduce internal reflections. This is pretty critical for image quality - particularly contrast and flare. Some filters are monocoated, some are multicoated, and some aren't coated at all.

The argument in favour of coatings is pretty straightforward. You've got coated lenses - why spend money on putting uncoated glass in front of them? Regular filters mean you're putting two reflective surfaces in front of your lens. Surely you should go for the best image quality and get coatings.

The arguments against are that coated filters are harder to clean and easier to scratch. These are both demonstrably true. Fingerprints show up much more easily on coatings, and getting that fine layer of greenish shimmering finger oil off a coated surface can be a real pain. And some coatings are indeed easy to scratch.

Personally I go for multicoated filters for the most part. I buy the "reduce reflections" argument - I've had a few pictures suffer from lens flare - one from a really bad internal reflection - caused by uncoated filters. As for cleaning, yes. It is a pain. But keeping your lens clean is important for image quality regardless. And I try to keep the filters in their cases when they're not being used to minimize the chances of coating damage.

What does a polarizing filter do?

Light moves through space, vibrating as waves in many different directions. Light which is polarized, however, only vibrates in one plane. A polarizing filter or

"polarizer" is a lens filter which polarizes light along one plane. This can cut non-metallic reflections and enhance contrast under certain conditions.

Polarizing filters contain a layer of polarizing material which is laminated between two glass circles and mounted in a frame. You can then rotate this filter, which affects the amount of light passing through. Even at their "brightest" setting, however, polarizing filters reduce the amount of light entering the lens - they always cost a stop or so of light.

So what use are they? Well, polarizers are useful for cutting reflections from water and glass (ie: non-metallic) surfaces. They're commonly used for cutting reflective glare off of windows, or for taking a photo of a lake without a reflection on the lake surface, for instance. They can also be used to darken blue sky (technically, increase the colour saturation of the sky since light scattered by Rayleigh scattering is polarized) and certain types of vegetation. The effect of a polarizer on the sky varies depending on the angle to the sun (known as Brewster's angle). So a very wide-angle lens (wider than 24mm or so) with a polarizer will demonstrate differing amounts of polarizing across the frame, which may or may not be objectionable.

There are two basic kinds of polarizers - linear and circular. Linear polarizers work well with manual focus cameras, but they interfere with autofocus cameras. Circular polarizers contain another element - a "quarter wave" plate - which ensures compatibility of the filter with autofocus systems. So if you've got an autofocus camera - like any EOS model - be sure to use only circular polarizing filters. Note that polarization is one of the few visual effects provided by filters which strictly speaking can't be simulated digitally in an image editing program.

What common filter sizes do Canon employ?

Like most Japanese camera makers, Canon use threaded (screw-on) filters with metric measurements on most of their lenses. The exceptions are those lenses with very large front elements that are too big to accept threaded filters - the super-wide angle lenses and the really huge telephotos. These use internal drop-in filters instead.

Canon have standardized their filters to a common set of sizes. The sizes used by Canon are typically:

- 52mm. Used on the small primes, such as the 50mm 1.8 mark 1 and the 28mm 2.8, and on some earlier consumer/midrange zoom lenses.
- 58mm. Used on the vast majority of Canon's midrange zooms.
- 67mm. Fairly rare size for Canon. Used on a few midsized zooms - the EF 24-85mm 3.5-4.5 USM, the EF-S 17-85mm 4-5.6 IS USM and the EF 70-200mm 4 L USM, both IS and non IS versions. Unfortunate, as these are good lenses with an inconveniently unusual filter size.
- 72mm. Used on a number of larger pro/midrange zooms, and a few primes.
- 77mm. The most common filter size seen on larger L series lenses.

With the exception of the 67mm filter lenses it's convenient that Canon have relatively few filter sizes, as it means you can invest in a good selection of filters for

each type of lens that you own, and minimize the number of different sizes you carry with you.

Of course, if you have infrequently used larger filters you can use step rings to adapt them to smaller lenses. So if you rarely use a red filter, for example, you might buy a 72mm one and then adapt it to your 67mm filter size lens when needed.

What is a neutral density filter?

Neutral density (ND) filters are simply filters which block a certain percentage of light from passing through. In other words, they're darkening filters. The "neutral" refers to the fact that a proper ND filter does not colour the light inadvertently. (ie: a true neutral density filter does not introduce any colour casts to the image)

Such filters are useful for, for example, shooting outdoors in bright sunlight when you happen to have fast film. They're also handy for extending shutter times. For instance, nature photographers often like shooting waterfalls or moving water with very long shutter times in order to achieve the bridal veil effect of blurring motion. To do this with ordinary film requires an ND filter to cut back the amount of light hitting the film. Users of mirror lenses also use ND filters in the unusual case that they need to cut back on light, since mirror lenses lack adjustable aperture diaphragms.

ND filters are typically specified in either decimal values or numeric factors. 0.3 ND filters cut 2X the light entering, 0.6 ND filters cut 4x the light entering, 0.9 ND filters cut 8x the light entering, and so on.

What is a graduated neutral density filter?

A graduated neutral density filter is a specialized type of neutral density filter. Such a filter has a dark side and a clear side with a smooth transition line between the two. Such filters are useful for taking photos of scenes where one half is bright and the other less so.

For example, a classic case where GND filters are useful is that of a sunset. Light from the setting sun isn't as bright as the noonday sun but is still too bright for the range of film to accommodate. So if you meter to get the sky right then the ground or ocean portion of the photo will be wildly underexposed and look like a dark blob. But if you meter for the darker section then the sky will be completely blown out and overexposed. The answer is to use a graduated neutral density. You position the filter such that the darker section darkens ("holds back") the sky and the clear section is over the non-sky areas. You then expose for the darker area and the bright area will come through beautifully.

GND filters come in varying densities and also with hard or soft transition lines. Hard lines offer a fairly sharp transition between the dark area and the clear area and are useful for sky and ocean shots, etc. Soft lines offer gradual transition and so disguise the transition better for landscapes and the like. Unfortunately there is no standard for the distance over which this transition takes place, so each filter maker has its own idea as to what is a hard or soft transition.

Is putting more than one filter onto a lens okay?

This is a practice known as stacking filters. And generally it's probably not a good idea since the risk of vignetting goes up. By putting more and more filters on the end of your lens you're essentially making your camera look through a long tube. In addition each piece of glass you add has the potential to degrade image quality further.

Unless you really need to put two filters onto your lens to achieve a certain effect it's probably wise to stick with just one at a time.

Do I need a slimline filter for my wide angle lens?

Wide angle lenses are more susceptible to the problem of vignetting than other types of lenses. For that reason filter makers often make low-profile or slimline filters for use with wide angle lenses. Such slim filters may lack a front filter thread, so they may require press-on lens caps rather than normal ones. They also tend to cost more.

In my experience with a number of Canon lenses you can safely put any normal filter on Canon wide-angle lenses (I've used up to 20mm) without fear of vignetting. Obviously cheap filters with gigantic high-walled metal rings might be a problem, but typical Hoya or B+W filters haven't been a problem for me. Now, your mileage may vary, as they say. So it's probably wise to do a quick test if possible - take photos of the sky at different aperture settings to see if there's any darkening around the edges with and without the filter. But I wouldn't automatically assume you need to buy a costly slimline filter unless, perhaps, you like stacking filters.

I have filters which don't fit my lenses. Can they be adapted?

Yes. You need what are known as step rings - simple machined metal adapter rings which fit between the filter and the lens. Such rings are fairly inexpensive and readily available from camera shops.

If you have a large filter and want to attach it to a lens with a smaller filter diameter (eg: a 72mm filter on a lens with a 58mm filter thread) then you need a step-up ring. If you want to go from a small filter to a larger lens you need a step-down ring.

Adapting filters in this fashion often works fine but there are some points to keep in mind. First, attaching a small filter to a larger lens will usually result in vignetting - darkening around the edge of the photograph. The smaller the filter the higher the likelihood of vignetting. Second, attaching larger filters to smaller lenses often poses problems when you try to attach a lens hood. The filter might prevent the lens hood from fitting or might make it inconvenient to rotate polarizers, etc.

Naturally, the closer the filter and lens are in size the better. Using 58mm filters on 52mm lenses is rarely a problem, for example. Step rings are thus handy for minimizing the number of filters you have to carry around for a given lens set.

What are these numeric codes on my filter?

Unfortunately there is no universal specification for filter types. Luckily filter thread types are pretty well standard across all major Japanese camera makers, but filter colour and type are named on a manufacturer-specific basis.

There are two common systems in use, however. Most American and British filters are specified using Wratten numbers, an arbitrary series of numbers and letters created by UK photographer Frederick Wratten. And German and Scandinavian filters tend to be use a different system which include K (warming) and B (cooling) filters.

What about Cokin filters?

Ah, Cokin filters! Delightful rectangles of plastic sold by the millions during the heyday of amateur photography in the 1970s! No matter what cheesy effect you want - lurid pink skies, prismatic highlights, simulated motion blur - Cokin can help you! Every camera shop has a dusty rack in the corner laden with Cokin filters.

Personally I think they're pretty expensive toys, particularly given that they're just uncoated pieces of plastic resin. Photoshop has far surpassed Cokin's ability to alter images, and it does so in a far more flexible and versatile fashion. Cokin's P holder is useful as a standard filter holder compatible with wide-angle lenses (particularly if you saw off the outer two slots), though many people eschew Cokin's "grey" graduated filters as they aren't true neutral density filters and can lend subtle but unwanted colour casts. But frankly the day of these novelty filters has come and gone. Unless you still shoot exclusively on film, digital has made these filters largely irrelevant.

Why do black and white photographers use such brightly coloured filters?

Colour filters can achieve a variety of effects in black and white photography. They work by passing light that's the same colour as the filter and blocking much of the light that's the complementary colour. For example, a red filter lets lots of red light through but blocks blues and greens.

What does this do on black and white film? Well, such colour filters have the effect of brightening areas in a photo of their own colour and darkening areas of their complementary colours. So, our red filter will make a red T-shirt look almost white and a blue sky look dark grey or almost black. It's for this latter purpose that red filters are commonly used in black and white photography - they can be used to darken skies dramatically and smooth skin tones of lighter-skinned people.

This effect of sky darkening is particularly useful when there are clouds. Clouds and sky are often the same brightness on black and white film, which means that clouds can end up disappearing in the final photo. By using a red filter, however, you can darken the sky in order to heighten the contrast between the sky and clouds.

The main drawback of such colour filters is that they decrease the overall amount of light entering the camera. You don't have to adjust for this if you're using the camera's built-in light meter, but it does mean that you will need slower shutter speeds than if you didn't use the filter at all.

My pictures suck. I want to attach a magic filter to my lens to make them look great.

There is no such device.

Generally speaking, good photos tend to result from, in varying degrees, a good eye, good technique, good understanding of lighting, quality lenses, experience and luck. And you don't even necessarily need a quality lens, though they can obviously help a lot if you want to take a sharply focussed or high-contrast image.

VI - Miscellaneous questions.

Taking pictures.

The edges of my photos are dark. What's going on?

This is a problem known as vignetting (though it's technically sometimes peripheral darkening, which looks pretty well the same in the final photo), and has several possible causes.

- Some lenses always vignette no matter what you do - the vignetting is an inherent design issue with the lens and cannot be fixed. Usually the vignetting can be minimized if you stop down the lens to a smaller aperture.
- You've got something installed on the end of the lens which is blocking light from coming in around the edges. For example, you might have two or more filters stacked on the end - a surefire recipe for vignetting. Or you might have an incompatible lens hood which is too long for your lens. Or, especially if vignetting occurs in two corners and not all four, you might have a "perfect" (ie: petal-shaped) lens hood installed incorrectly on your lens - it might not be squarely positioned.
- If you shot with flash you might have been using a lens with too wide an angle for the flash to illuminate properly.

How can I get the sharpest photos possible using my equipment?

- Use a tripod. A heavy sturdy tripod is a pain, but reduces vibrations considerably. Handholding a camera results in very slight blurring caused by camera motion, even with really high shutter speeds.
- Stop your lens down to f/8 or f/11 or so. Most lenses do not perform at their best when the aperture is wide open.
- Make sure the lens - front and back - is spotless and free of fingerprints and smudges. The same goes for any filter you may use.
- Use a lens hood to prevent extraneous light from hitting the lens and causing lens flare.
- Don't use supermarket film. Professional film (eg: Fuji NP series film or Kodak Portra series film if you want to shoot prints) costs a bit more than cheap film, but costs the same to process, so the total cost difference isn't necessarily huge.
- Either use a good photo lab - not a random drugstore minilab - or else shoot slide film. Slide film means what you see on the slide is exactly what you shot. There's no processing lab to mess up the printing.

- When using a tripod use a self-timer or remote shutter release rather than pressing the shutter button with your hand. It's really easy to bump the camera if you press the button by hand.
- If you're handholding the camera be sure to keep your finger lightly pressing the shutter release, then slowly push down to take a photo. Don't lift your finger and stab down at the button as you're likely to cause camera shake.
- Use a tripod. Really.
- Use a prime lens and not a cheap zoom lens.
- If you have a lot of money, buy a nice L series lens.
- Another money-oriented answer is to buy an image-stabilizing lens.
- If you're serious about image quality, don't use 35mm cameras. Buy a medium format camera with good lenses instead.
- You'll notice that buying a new EOS camera is not on this list. Getting a fancier 35mm camera will not make your photos any sharper, all other things being equal. Canon pro cameras have more accurate autofocus sensors than other EOS cameras, but these really only make a difference when depth of field is very narrow.

What is the handholding rule for non-blurry photos when not using a tripod?

Taking photos with the camera mounted firmly on a tripod will always yield sharper pictures than if you were to hold the camera in your hand. No matter how steady you are you'll always move slightly during even a split-second exposure. You can mitigate this somewhat through a variety of means - bracing yourself, pressing the shutter release gently rather than jabbing it, trying to lean against a wall or a fence, holding your breath or gradually exhaling as you take the photo, using an image stabilized lens, and so on. But despite all these things a tripod is a safer bet.

However, tripods are obviously a nuisance to use much of the time. And if the shutter speed of the camera is high enough then camera blur shouldn't be too bad. The question is, how high a shutter speed is fast enough?

There's a basic rule of thumb in photography which says that you shouldn't use a shutter speed slower than the reciprocal of the focal length value. That sounds complicated, but it's actually really straightforward.

Let's say you're using a 50mm lens. The reciprocal of 50 is 1/50. So you shouldn't use a shutter speed any slower than 1/50 of a second when handholding a 50mm lens. Of course, most cameras don't have a 1/50 sec setting, so you round it up to 1/60 second.

It's as simple as that. Put the value of the current focal length as the denominator of a fraction with 1 as the numerator. When using a zoom lens use whatever focal length the zoom is currently set to.

Now you'll notice two important consequences of this rule. First, it means that when you're using long telephoto lenses you have to have relatively high shutter speeds. A 300mm lens, for example, requires at least a 1/300 sec exposure. Second, it means that you can get away with relatively slow shutter speeds when using a wide angle lens. A 15mm fisheye lens, for example, lets you use 1/15 second.

Of course, this rule is modified somewhat if you have image stabilization (IS) on your lens. IS lets you gain at least an additional two stops of shutter speed.

Now technically this rule of thumb is about determing the minimum shutter speed for a given field of view. By coincidence it just works out fairly well if you use the lens focal length when shooting 35mm film.

Do I really need a tripod? They're such a pain to haul around.

Yes, they are a pain. Good tripods in particular are heavy and clumsy to carry. But they're often the best way to take a sharp, clear photograph by providing a stable, relatively vibration-free platform. If image sharpness is important to you - as it is for studio photography and nature photography, for example, you need a tripod. And of course they're pretty well essential for night photography, where long exposure times (often many seconds or minutes) will cause hopelessly blurred photos if you try to handhold the shot. Try to get the heaviest one you can reasonably carry as lightweight ones vibrate too much, and consider investing in a quick-release head as the added convenience means you'll probably end up using it more.

Obviously tripods aren't an appropriate tool for candid or street photography where you need to move quickly, so this isn't an absolute rule. If you can't use a full-sized tripod try anything else that helps increase camera stability. For example, monopods are simple telescoping poles with camera mounts on the end. They're popular with some photographers as they're quite lightweight and portable, yet stabilize the camera in one direction (vertical) and help minimize movement in the other (horizontal). Some monopods even double as high-quality hiking or trekking poles, making them useful for rugged nature photography.

Another option is a tiny folding tabletop tripod sturdy enough to support the weight of your camera and largest lens. Such tripods can be used on flat surfaces like tables and car roofs quite effectively. Some even have velcro straps so the small tripod can be strapped firmly to a tree trunk or a fence.

Other options for camera stabilization abound. Beanbags are popular accessories for shooting out of car windows or when lying on the ground. Chainpods are simply lengths of metal chain (or non-stretchy rope) attached to the tripod mount. The end of the chain dangles to the ground, allowing you step on it and pull the camera up for stability. You can even get shoulder stock mounts with triggers which let you shoot your camera as if it were a rifle, though such devices are obviously highly unwise if you're taking photos of political figures or people in public. And so on.

My camera doesn't fit my tripod. The bolt is the wrong size. What can I do?

The vast majority of cameras sold today use a 1/4-20 tripod mount socket. This means that the bolt which fits into it is 1/4 inch in diameter and has 20 threads per inch. Even European and Japanese cameras and tripods use these non-metric measurements for historical reasons. Conveniently, most tripod heads also use the 1/4-20 size.

However, some tripod heads and some larger cameras use a 3/8-16 bolt size. If you need to go from one to the other you can purchase bushings which fit into the larger

hole, though for some incomprehensible reason these bushings are often sold in unhelpfully large packages, such as 25 to a pack. You can also buy adapters.

Note that since cameras use standard 1/4-20 sockets it's very easy to make your own homemade camera stand or tripod mount. 1/4-20 bolts are commonly available in hardware stores (though it may take some searching if you're outside the UK and North America). However, remember that the hole itself isn't very deep. If you try to force a bolt too far into the camera body you could seriously damage your camera. Especially if your camera has a plastic tripod mount, as most low-end cameras do. For that reason you should test the length of the mounting bolt very carefully.

What is the sunny 16 rule?

The sunny 16 rule is a simple rule of thumb for taking photos in daylight without a light meter. The rule is quite easy to remember - if you're taking a photo in bright daylight set the aperture to *f*/16 and set the shutter speed to be as near as possible to the reciprocal (1 / x) the film speed.

So if you're using ISO 100 film, for example, you would set the aperture to *f*/16 and the shutter speed to 1/100 sec. However, since most cameras don't have a 1/100 sec setting you would set it to the closest shutter speed, which is 1/90 sec.

If you want to use a different aperture calculate the number of stops away from *f*/16 you want to use and then adjust the shutter speed accordingly. For example, *f*/11 is one stop larger than *f*/16, so you'd need to decrease your shutter speed by one stop. So if you're using ISO 100 film you'd set the aperture to *f*/11 and the shutter speed to 1/200 sec.

This rule works from many locations on the Earth because the light output from the sun is a pretty constant value - the sun itself puts out a nearly constant amount of light at all times. Only precisely calibrated equipment can detect the light fluctuations of the sun.

What is the rule of thirds?

The rule of thirds is the compositional guideline (it isn't strictly a rule *per se*) which states that images with dominant points of interest usually look best with those points situated about 1/3 of the way along the image.

For example according to this guideline a horizon looks best 1/3 of the way down from the top of the image or 1/3 of the way up from the bottom. Or a picture of a field with a large tree in it will look best when the tree is situated roughly 1/3 of the way across the image from one edge. It's a useful starting point for composition, especially if you're a beginning photographer. A common novice mistake is to centre everything and try to get things right in the middle, which often results in rather static-looking photos.

This guideline is essentially a simplification of the golden section or golden mean.

I took a photo and the sky is white. Why is this, when the sky was actually blue at the time?

The basic problem is this: the human eye is capable of sensing a pretty wide range of light levels. Film and digital image sensors, however, are not.

So let's say you take a photo of something and your camera meters off the foreground to expose it correctly. If there's a fairly wide range of brightness between the sky and the ground then metering for the ground will cause the sky to be vastly overexposed. And if it's overexposed then it'll appear "blown out" or pure white - it's as bright as the film or sensor are capable of recording.

The same problem occurs at sunset. A common beginner experience is to take a photo of a glorious sunset and to be utterly disappointed when the picture returns from the lab. The difficulty here is similar - there's a wide range of brightness between the foreground (the ocean, beach, etc) and the sunlit sky. So you can either take two photos - one exposed for the sky and one for the ground - and glue them together digitally or you can put a graduated neutral density filter over your lens. A graduated ND filter is darkened at one side and clear at the other so you can darken the sky and still expose for the ground. Such filters obviously take a little experience to use effectively, however.

I need help! I'm shooting a wedding this weekend. What film and lens should I use?

Okay. The usual response to this type of question is as follows: if you're asking such basic questions then you shouldn't be taking photos of a wedding if you're supposed to be the photographer of record. Find a professional right now.

If you're just going to the wedding as a guest and you want to take some snapshots, and the wedding party are relying on someone else for the main photos, then sure. Grab some low-contrast professional film like Fuji NPH/NPZ or Kodak Portra NC, a fast zoom lens and a flash with a diffuser or flash bracket, and have fun.

Why is this the usual response? Isn't it kind of elitist? Well, people tend to place a massive amount of emotional importance upon their wedding pictures. A given wedding is a one-off event. You can't go and get everybody back in the church or synagogue or temple or garden and do some retakes if you screw up. People expect a certain level of production value from other people's wedding pictures (which are often taken with medium format cameras for extra image quality, not 35mm cameras) and will likely be rather disappointed by ho-hum pictures. And a sure-fire way to damage a friendship or family relationship is to mess up someone's wedding photos badly.

Of course, hiring a professional is by no means a guarantee of anything. There are tons of lousy pro wedding photographers out there who are incompetent or who overcharge or whatever. But at the very least if someone else does the photography you aren't risking your friendship or relationship.

Now, having said all this, that's the usual advice. And you don't have to follow it by any means. I didn't and managed to pull off some okay (but sadly not brilliant) wedding shots as an amateur. It was a combination of doing a lot of testing at the venue beforehand with different film and flash settings (and careful note-taking), renting professional-quality gear, and blind luck. And I did it because the wedding party in question couldn't afford even the lousiest pro photographer. But boy, was it

stressful! I also took the photos at my own wedding, but that's another story altogether. (yes, I'm still married)

Is it true that taking a person's photograph steals their soul?

Yes. This is why movie stars, fashion models, politicians and pop singers have such dreadful personality and relationship problems - their souls have been severely depleted by all the photographs which have been taken of them.

Film.

What is film grain?

A photograph may appear to be made up of smooth continuous tones but close examination of film or paper with a magnifying glass or microscope reveals a different story. The images on film and paper are recorded as tiny microscopic dots, dots scattered in a diffuse pattern across the emulsion surface. The larger the dot the darker it is, so many large dots indicates a dark area and smaller dots a light area. Unlike computer graphic pixels, film grain is not in a regular linear grid.

A picture with pronounced grain at normal viewing distance is very grainy. Highly obvious grain can be caused by processing problems, or can be simply an inherent property of the film. Generally speaking, slow film (film which does not react rapidly to light) has finer grain than fast film (film which reacts rapidly to light) - see the section below on film speed. Enlarging a picture will also enlarge the grain. Sometimes visible film grain is considered an undesirable thing, and photographers go to great lengths to use slow film to minimize its appearance. Other times photographers may deliberately use fast film and certain chemical processes in order to enhance visible grain. It all depends on the type of look you're trying to achieve.

What is film speed (ISO)?

Film reacts at different speeds when exposed to light. "Slow" film takes a relatively long time to respond to light and so requires longer exposure times or wider lens apertures or both. "Fast" film is more sensitive - it reacts relatively quickly and so requires less light. Film speed is thus a measure of film sensitivity.

Film speed is rated according to standards maintained by the International Organisation for Standardisation, confusingly known as ISO (not IOS). (old-timers may recall older film speed standards, such as ASA and DIN) These film speeds run from small numbers to large, with small numbers indicating slow film and large numbers indicating fast film. Here is a list of common film speeds, with boldface speeds being the most common.

64 **100** 160 **200** **400** 640 **800** 1600

The advantages of fast film are obvious. You can use them at lower light levels without flash, you can get faster shutter speeds, particularly with longer telephoto lenses, and so on. So why use slower film at all?

Well the primary reason is quality. Slower film typically has smaller and finer grain size (see previous question). Faster film is faster in large part because the silver halide grains are physically much larger. Unfortunately this mean that faster film is also more obviously grainy than slow. Technological advances over the past few decades mean that fast film available today usually has much finer grain than film of the past, but it's still the case that, all other things being equal, slower films have a quality edge.

Digital EOS cameras have adjustable light sensitivity that's calibrated to mimic the traditional ISO scale. Interestingly enough, digital cameras have similar issues to film when it comes to light sensitivity. Generally speaking, the faster the ISO setting on a digital camera the more digital noise you get in the final photo.

What do film codes like EI 100/21° mean?

These codes refer to the film speed of the film. EI stands for "exposure index," the first number is the old American ASA or modern international ISO film speed, and the second number is the German DIN film speed. Confusingly, the degree symbol refers to the DIN film speed and not to temperature.

So in this case EI 100/21° refers to what everybody calls ISO 100 film.

Note that this explanation is a vast oversimplification of the ISO film speed system, which has a complex backstory owing to political and technical reasons. It's just easiest to think of EI 100/21° as ISO 100, since that's the film speed labelling system that all modern cameras use these days.

What are C-41 and E-6?

C-41 is the code assigned to the most common colour print film processing system used for 35mm film today. E-6 is the code assigned to the most common slide (reversal) film processing system used today, developed for Kodak's Ektachrome product line.

While both processes were originally developed by Kodak, most other film manufacturers support the same C-41 and E-6 processes. That is to say, each manufacturer's product has a different chemical composition and colour/contrast attributes, but nonetheless the same chemical processing systems can be used on all compatible films.

What is DX?

DX coding is how modern 35mm cameras know automatically what film speed setting to use for each roll of film. Before the introduction of DX coding in the 1980s you had to set the film speed for each roll yourself, and it was easy to forget to change the camera setting when loading film.

DX is a loose acronym for "data eXchange," and refers to the series of black and silver squares on the side of most 35mm film canisters. These squares are a code, readable by most 35mm cameras including all EOS cameras, which tell the camera what film speed to use. The camera body contains a series of gold or silver pins in

the film cavity which reads the code via simple electrical conductivity. (ie: black paint does not conduct electricity and bare metal does)

All EOS film cameras have manual ISO controls so you can override the automatic DX film speed setting if you prefer. These manual controls can also be used to set the film speed for those few film canisters which lack DX codes. Infrared film and handloaded film in plastic canisters, for example, usually lack DX coding.

What is film latitude?

Latitude refers to the exposure tolerance of a photosensitive material.

Narrow latitude film, such as slide film and infrared film, has a very narrow range - your exposure has to be pretty well spot on for the image to be exposed accurately. Colour print film, by contrast, has very wide or forgiving latitude, which means that exposure requirements are somewhat less rigorous - you should still be able to get a printable picture from the negative even if the camera was set a stop or two out from the desired exposure setting.

What is infrared film?

Ordinary film is capable of recording the visible light spectrum. However, there's a lot of energy (specifically, electromagnetic radiation) out there at other wavelengths which our eyes cannot see. Ultraviolet (UV) and infrared (IR) energy are both forms of energy that are invisible to us.

Infrared film is thus film capable of recording a portion of the infrared spectrum. There are different types of IR film with different technical specifications - some can see further into the infrared spectrum than others. The most commonly used types of infrared film include Kodak HIE, Konica 750 and Ilford SFX (all black and white print) and Kodak EIR (colour slide).

Note that, contrary to popular misconception, infrared film is not really capable of detecting heat. Infrared photography is not the same thing as thermal imaging. Heat energy involves a different part of the spectrum - a section to which IR film is not sensitive. So you can't put IR film into your camera and see heat-loss patterns on a house or see someone's body underneath their clothes or anything exciting like that. Sorry. For more information on this and other popular myths please have a look at my Infrared Myths article.

IR photography does, however, let you see the world in strange and unusual ways. Deciduous leaves, for example, reflect a lot of IR energy and so glow a beautiful white on black and white IR film. Clear (non-cloudy or non-hazy) skies are jet black. Colour infrared film results in strange and bizarre colour shifts. There's a surreal quality to IR photography that many people find very intriguing.

Unfortunately most Canon EOS film cameras contain small internal light-emitting diodes (LEDs) which produce IR energy. These LEDs are used for counting film sprockets as part of the motordrive mechanism, but have the unfortunate side-effect of fogging the edge of high-speed (Kodak HIE and Kodak EIR) infrared film. For more information on this problem have a look at my EOS and IR article.

Note that most digital cameras can also be used for infrared photography if light-blocking and infrared-passing filters are installed. However, nearly all digital cameras sold today, including the current Canon EOS lineup, include infrared-blocking filters as part of the image sensor assembly to keep reddish IR fringing to a minimum. This means that they can be used for IR photography, but only with inconveniently long shutter speeds. The cameras can, of course, be modified but at the cost of lowered quality for regular light photography.

I have some expired film. Can I use it?

Film, like milk, doesn't instantly drop dead the moment the expiry date arrives. Especially if the film has been stored in low temperature, low humidity environments.

There's no harm at all in using older film, assuming it's not decades old, say. Even if the film has an ancient expiry date you'll probably just notice more grain and worse contrast than usual.

Should I buy professional film?

Depends on your photographic priorities and goals. If you're taking snapshots of friends in restaurants, using inexpensive lenses and on-camera flash and developing the prints in a drugstore minilab, you probably won't notice much difference. But if you're going for more composed photos using slightly better gear then it may well be worth it.

The most noticeable thing is that cheap consumer film of the supermarket variety has inconsistent colour and tends to be of high contrast. Film manufacturers seem to think that consumers spend most of their time taking photos of clowns and balloons and optimize their film to produce extremely vivid and bright colour. Which is fine if you are, in fact, taking pictures of clowns and balloons. But high-contrast film isn't so great for portraiture, for example. It tends to make people with lighter coloured skin rather ruddy looking in the cheeks, etc. Cheap film also tends to sit around in shops for long periods, often in warm locations, and that all accelerates film ageing.

For that reason it may well be worth it to pick up some decent pro film. Fuji's NP series (NPS - ISO 160, NPH - ISO 400 and NPZ - ISO 800) is popular colour print film, as is Kodak's Portra series. Both lines are popular with wedding photographers because their lower contrast and smooth tonality make taking wedding photos (often with high contrast blacks and whites) easier. If you want higher contrast but pro-level sharpness, Fuji's Velvia slide film is popular with many nature photographers.

Professional film, especially when bought in bulk, doesn't really cost that much more per roll than cheap drugstore film. And it costs just as much to develop a roll of crummy film as it does good film. So why not spend the small percentage extra and go for good film?

Why do photo shops store some film in refrigerators?

All film exhibits slight colour shifting as it ages. It also gets grainier as it gets old. These changes are not acceptable for professional photographers, particularly those in commercial photography who require absolutely dependable colour stability.

Professional film is thus stored at cool temperatures in order to slow the ageing process. By contrast, consumer film is shipped out pre-aged and generally sits around in shops for who knows how long, and so its colour rendition is considerably less reliable.

Is it true that film contains animal gelatine?

Yes. It appears that all film manufactured commercially today contains silver halide crystals suspended in a gelatine emulsion, which is animal-derived protein - boiled animal bones and hides. I believe all major film manufacturers use animal gelatine, but please email me if you know of any which don't. This is obviously a problem for people who, for ethical, religious or philosophical reasons, want to avoid animal-based products.

If you find this a matter of concern you might want to consider digital photography. Digital cameras and printers have obvious environmental issues surrounding their production and eventual disposal, but animal gelatine is not, to the best of my knowledge, used.

What is "chromogenic" black and white film and why can it be developed in colour photo labs?

Traditional black and white film was usually silver-based for most of the 20th century. To be more accurate, silver halides were and are used to record and show images. Other metals were used as well, but silver became dominant.

Colour film uses silver to record the image as well, but the silver is typically washed out of the film during processing and colour dyes used to store the final colour image. Standard colour print film, known as C-41, uses a complex chemical process with "chromogenic" dyes. (the word chromogenic comes from the way the colour dyes are generated in the film during processing) And of course someone realized one day that instead of using these chromogenic dyes to record colour information you could use a simplified chromogenic process to record black and white information.

So that's what chromogenic film is - black and white film which uses chromogenic black dye rather than silver. The advantage is that you can take chromogenic film to any minilab or wherever and have them process your black and white photos using standard colour chemistry. Minilabs cannot process traditional silver halide black and white film using their automated colour processing machines because of the incompatible chemical processes.

Printing and processing.

I got an enlargement made and tons of stuff is missing off the edges!

There are two possible issues here. First, labs tend to crop off a small amount on all sides when making enlargements. That's how the printing machines work. The amount trimmed off is fairly minimal, however.

Second, you may be having an issue with differing aspect ratios. The ratio of the tall to wide dimensions in regular 35mm film is exactly 2:3. Unfortunately a lot of popular print and picture frame sizes do not have this aspect ratio for random historical reasons. If your photo is missing stuff from the sides but not the top and bottom then you probably have an aspect ratio issue.

For example, in North America 8"x10" is a popular picture frame size. And 8"x10" obviously doesn't have an aspect ratio of 2:3. If you want an enlargement containing all the stuff that's on the negative you'll have to choose an enlargement size that can accommodate this. In the example above 8"x12" is probably your best bet. Alternatively you could ask for the image not to be cropped, but a non-cropped 8x10" photo will have white strips along the top and bottom edges to make it fit, much like a movie on TV is letterboxed.

My pictures all look lousy! Why?

This is such a general question that it's hard to know where to start. There are so many possible reasons why a photo could look bad. Maybe there's a problem with the camera's focus or metering. Maybe it's a poor lens. Maybe the lens or camera are out of alignment. Maybe your technique is bad - too much camera shake, perhaps. Maybe your composition is bad. Maybe you focussed on the wrong thing. Maybe you need to learn about lighting and using it effectively. Maybe you used onboard flash, which tends to make things look flat. Maybe you took the film to a lousy lab. And on and on.

The first thing I would do if your photos look sort of bad is to see if it's the lab. The lab is the final link in the chain that determines the quality of your photos, especially if you're making prints. A lab with badly maintained printing machines operated by poorly-trained monkeys, like the typical drugstore, will produce really crappy prints.

The standard recommendation, therefore, is to try shooting a roll of slide film. When you look at the slide you're looking at the first generation image up there on the wall. There's no lab between you and your film messing things up. If your slides look poor then it's time to look into other possibilities.

My pictures look grainy. Why?

If you have noticeable grain or speckles on your film-derived prints it's very probable that your negatives are highly underexposed (ie: they were not exposed to sufficient light). When photo printing machines encounter underexposed negatives they tend to boost the brightness to compensate, which tends to reveal bad speckly grain. Take a look at your negatives by holding them up to the light. If they seem very transparent and light then they're underexposed. There isn't much you can do about the existing negatives but it suggests that perhaps you need to meter more carefully - or apply some exposure compensation - in the future.

If you shot digitally then you may have used a high ISO setting. This is particularly the case with older EOS digital cameras. ISO 100 is pretty well noiseless, but the higher you go with your ISO settings for low-light photography the more random rough-textured "noise" appears on the image.

There are other possibilities. It's possible that you had the ISO film setting on the camera wrong, for example. It's also possible that the lab messed up the development of the film.

What is colour temperature?

The definition of colour temperature is highly technical - it refers to the colour of light produced by a theoretical "black body" object that's heated to a certain temperature, measured in Kelvin temperature units.

Though based on physical theory there's nothing abstract about this. The concept is crucial for colour photography. Essentially it boils down to the fact that white is not an absolute concept.

White light produced by a light source with a low colour temperature such as a tungsten light bulb is very orange compared to the bluish white light produced by a light source with a high colour temperature , such as the sun. This isn't really apparent to the human eye under normal circumstances because our brains adjust automatically to changing colour conditions. It's only usually noticeable when light sources with different colour temperatures are seen together. For example, the incandescent light spilling out of the window of a house looks remarkably yellow or orange at dusk, when everything outside is lit with the very blue light from the darkening sky.

Unfortunately, film is not so flexible. Film emulsion must be designed from the start to assume a certain colour temperature as its white point. Most films are daylight-balanced, which means they assume that the light from the noonday sun (in a temperate place) is white - roughly 5500K. So if you take a photo indoors under tungsten lighting using daylight film you'll find everything looks very orange or yellow. You can also buy film that's balanced to tungsten light - typically 3200K. If you take a photo outdoors using such film you'll end up with a picture with a very blue cast.

Digital cameras generally do not have a problem with colour temperature in the same way. Since digital data can easily be reconfigured it's a simple task to alter the white point of a digital camera - a process called white balance. Most digital cameras and all EOS digital cameras have preset white balance settings for common light sources - daylight, tungsten light bulbs, shade, etc. EOS digital cameras also let you set your own custom white balance. However, if you forget to set the white balance correctly when taking a photo you might end up with similar problems to film colour casts, assuming your camera wasn't using automatic white balance.

My pictures have strange colour tints. Why?

The most obvious possibility is, of course, a problem at the lab. This shouldn't be a problem with labs that demonstrate a modicum of care, but strange things happen. Once I took a test roll of film into a local corner one hour photo lab and got back a stack of pictures of my green fiancée. Green. Really. It was like "I Married a Martian." I took the same negatives to another lab and came back with a stack of nicely coloured pictures - Martian princess no more.

The most likely possibility after that is colour temperature issues. Here are some common scenarios, expanding on the colour temperature section above:

Photos, particularly indoor photos, have a yellow-orange tinge to them.
You probably used daylight-balanced film under tungsten (incandescent) lighting. Tungsten light records as yellow-orange on daylight film.
To avoid this problem either use tungsten-balanced film, use flash, turn off tungsten lights and rely on daylight coming in through windows, or put cooling (blue-tinted) filters on your lens.

Foreground stuff looks fine but background stuff is tinged yellow-orange.
You probably used flash under tungsten lights with daylight-balanced film. The light from flash units is designed to be the same approximate colour temperature as sunlight. So all foreground objects illuminated by flash will appear normally coloured on daylight film.
There's no real way to avoid this problem if you're shooting with flash. You could either not use flash or turn off any tungsten lighting. Or you could use tungsten-balanced film and put a warming filter on the flash head.

Photos, particularly outdoor photos, have a blue tinge to them.
Less common, but you may have used tungsten-balanced film under sunlit conditions. Regular daylight records as blue to tungsten-balanced film. Switch to daylight film or put a warming (yellow) filter on your lens.

Indoor photos look greenish.
Most likely the pictures were taken under fluorescent lights. There's no such thing as fluorescent-balanced film, but you can buy magenta-tinted filters (FL filters typically) which can help colour-correct fluorescent light. Note that many modern fluorescent bulbs don't have this same problem.

Which is better? Matte or glossy?

Neither. The choice of matte or glossy print surfaces is a matter of personal preference.

Some people prefer matte because it's less reflective - so there's less glare - and because fingerprints tend to show up better on glossy surfaces. Other people prefer glossy since the lack of texture can make the image look a bit sharper. Many others prefer pearl or semi-matte surfaces as a compromise between the two.

What is cross processing?

Cross processing refers to developing a film using a development process that was not intended for it. It usually means developing slide film using a print developing process or vice-versa.

Cross processing is sometimes done because it yields interesting, albeit unpredictable effects. Contrast tends to be enhanced and colours tend to shift. Edgier fashion and commercial photography is sometimes done using cross processing. Note that many labs won't do cross processing, sometimes because their automated machines refuse to let them do it, sometimes because they're concerned

about their photochemicals getting contaminated and sometimes because they have no idea what it is.

What does "archival" mean?

The ravages of time are cruel, though more cruel to some materials than others. Archival media is paper, film, etc, which is supposed to hold up reasonably well to the passage of time. How well it does is dependent on a host of factors, and there's no universal definition as to what is truly archival quality material and what is not.

Paper.
Paper is probably the main area of concern when it comes to archival materials. Standard commercial papermaking processes result in paper with a high percentage of acidic materials. And unfortunately this acid causes paper yellowing and deterioration (crumbling) - sometimes in months, often in years and always in decades. For that reason archival papers must be "acid-free," or have a neutral or slightly basic pH. Papers are also often "buffered," which involves the addition of an alkaline material such as calcium carbonate to help ensure long-term pH neutrality.

Another problem with papers made from wood pulp (as opposed to higher quality papers made from cotton) is the presence of lignin. Lignin is a naturally occurring part of a plant cell, but is an undesirable substance in paper as it can contribute to the long-term deterioration of the material. Higher-quality paper has had most of the wood fibre's lignin removed during manufacture.

Binders.
Photo binders must also be designed with archival properties in mind to avoid damaging photographs. Many photo binders use thin plastic sheets to keep photos in position. Mylar sheets appear to be pretty stable, but cheap products may use lesser quality plastics which actually stick to the photos, ruining them. The pages of the binders must also be made of acid-free paper if they come in contact with the photographs, or else you're defeating the purpose of using acid-free paper in the first place.

Colour dyes in film.
Dyes are another area of concern when it comes to archiving photographs. Traditional silver-based black and white processes are generally remarkably stable - a black and white picture taken a century ago can look just as good today. Colour dyes, however, are notoriously difficult to keep stable. Colour dyes used in motion picture film in the 60s and 70s, for example, are fading at an alarming rate.

The same problem applies to the colour dyes used in many forms of colour still film. Some colour film technologies, notably Kodachrome, have proved to be very stable in dark storage, but typical cheap colour print film (chromogenic film) doesn't have particularly good archival properties. It might be worth doing high-resolution scans of important photographs now, before the colour has deteriorated at all. You then have the problem of preserving the digital data (see below) but at least the colour in the digital scans won't fade.

Computer prints.
Dyes used by inkjet computer printers have similar problems with colour fading. Some early inkjets, in fact, were notorious for severe colour fading and colour

shifting problems, particularly when exposed to ultraviolet light. Many inkjet makers indicate that their products are "colourfast" or "archival," but these claims don't follow any particular standards.

Computer data.
Computer data itself is a complex problem as well. Binary data itself can be duplicated over and over completely error-free, but the media upon which the data is stored is subject to failure over time. Floppy diskettes, for example, suffer from what's jokingly called "bitrot" - they lose their magnetically-encoded information over time. Hard drives pack a huge amount of data into a tiny area on disc, and it's unclear how long they can retain their data.

Recordable CDs (CD-Rs) are a technology heavily relied upon for archiving digital data. Accelerated tests performed on the cyanine (typically green or blue-green), metal-stabilized cyanine (also typically green or blue-green), phthalocyanine (typically gold or greenish gold) and metallized azo (typically dark blue) dyes used in different types of CD-Rs suggest that CD-Rs will enjoy many decades - perhaps even a century's worth - of reliability, but only time will tell how stable they really are.

Not only are the dyes a factor but the stability of the polycarbonate plastics, the environmental storage conditions (eg: abrasion, water vapour, airborne pollutants such as sulphur, and shock can all degrade CDs), the chemicals used in any adhesive labels or felt-tip markers, and the burn power of the CD burner itself are all elements which will determine how long the discs remain readable. Not only that but 550 MB/63 minute CDs, which use a slightly wider track spacing than 650 MB/74 minute CDs, are often more reliable in many older burners and readers.

And of course who knows whether the actual equipment to retrieve data from a given medium will be around in decades or centuries hence. How many people today have the gear required to retrieve data from a computer cassette recorded in 1977, for example? Or a Bernoulli cartridge from the 80s? Will it be easy to copy that precious digital photograph from a CD in 2050? Will anybody be able to retrieve data from a corrupted flash memory card in a century's time? From this point of a view a photographic negative may well have longer longevity.

What to do?
Well, it's basically impossible not to have some colour or data loss over the years, but there are a few things you can do to help minimize the problem.

- Use acid free or pH-neutral papers whenever possible, though since most photo labs don't use archival papers for printing your best bet is to view machine-produced prints as disposable and focus on preserving the negatives. You can always make another print.
- When framing valuable prints use acid free or pH-neutral backing paper and mats.
- Store 35mm negatives in archival sleeves - the cheap drugstore plastic sleeves are probably not archival. Buy higher-quality sleeves from professional photo stores.
- Repeated exposure of slides to the high-intensity light used in slide projectors causes the colour to break down rapidly. If you're using a slide repeatedly (eg: in a permanent slideshow installation) use a duplicate rather than an original.

- Keep photos - and negatives particularly - in cool, dark, dry storage areas. Heat and dampness are both quite destructive, as is light. Ultraviolet light, present in large percentages in both sunlight and fluorescent light, is particularly harsh, though visible light is destructive too. If you live in a humid climate invest in a storage box with a dehumidifier or use plastic storage boxes with moisture-absorbing silica gel, and replace or dry out the gel regularly.
- This should go without saying, but keep photographic images away from chemicals and insects and other dangers. You don't want to be storing your photos in the same closet as cans of oil paint or floor cleaners, say.
- Many people advocate using hanging file systems for sleeves so that negatives aren't flattened out and squashed.
- Make backups of all your data frequently, regularly and religiously, preferably to longer-term storage media such as optical media (CD-Rs) or high-quality tape. Don't rely on storing pictures on camera memory cards or computer hard drives.
- It may be worth burning duplicate copies of your CD data to CDs produced by different companies in case one brand turns out to be less stable than the manufacturer hoped.
- A good source of information on archival testing is wilhelm-research.com.

Digital.

Why are Canon EOS digital cameras so expensive?

Very simply, it's because it costs more to build a digital camera than a film camera given today's technology. Technology is, however, changing at an incredible rate, and it's just a matter of time before the two technologies are reversed when it comes to cost, just as CDs once cost considerably more than vinyl records.

Canon have produced a number of digital cameras compatible with the EOS system over the years. The first generation of these cameras was built in conjunction with Kodak. They were modified Canon EOS film camera bodies (the top of the line 1N) with film transport components taken out and Kodak-designed digital equipment stuffed inside the body and its add-on grip. This DCS series of cameras - the DCS3, DCS1, D2000 and D6000 - was mainly aimed at professional photographers who needed to be able to send photographs from the field rapidly and were at the cutting edge of digital photography at the time. They were thus very expensive - the 1.3 megapixel DCS3, for example, listed at over $15,000 US when it came out. Today you get better resolution than that (though not better lenses, admittedly) in ordinary mobile phones.

The second generation of Canon's EOS digital cameras were and are wholly built and designed by Canon and are digital cameras from the ground up - they aren't retrofitted film bodies like their predecessors. Unlike digital point and shoots the D30, D60, 1D, 1Ds, 10D and so on are all fully compatible with the EOS line of lenses and accessories and offer excellent image quality. But they too are considerably more expensive than point and shoot digital cameras.

Why is this? Well, there are many reasons involving R&D costs, high market demand and so on, but a significant factor is the cost of making large digital image sensors. Point and shoot digital cameras all have really tiny image sensors which are quite

cheap to produce. Digital EOS cameras, by comparison, use much larger image sensors, from the full-sized 24x36mm sensor of the EOS 1Ds and 1Ds mark II to the smaller APS-sized sensors used in the other cameras.

Still, prices are falling rapidly and used digital cameras can be had today for a fraction of what they cost new. The cheapest Canon digital EOS camera is a few times the price of a cheap film camera, but you can make that back in film processing costs very quickly. Digital EOS cameras are nearly as affordable as midrange film cameras, though it'll probably be a while before they're as cheap as low-end film cameras.

Why doesn't the back screen on my EOS digital camera display a live video preview?

Unlike point and shoot digital cameras, Canon EOS digital cameras are SLRs, which means they use mirrors. The image sensor is situated behind the mirror, so no light reaches the image sensor normally but is instead deflected up into the viewfinder. When a picture is taken the mirror flips up out of the way, blacking out the viewfinder and letting light reach the image sensor. Using this design means there is traditionally no way to have live image previews on the rear screen of the camera and have a working optical viewfinder at the same time, since the mirror is normally down and blocking the light path to the image sensor.

Canon (and other makers of digital SLRs) have historically designed their cameras this way since digital SLRs are meant to appeal to the same sorts of people who bought film SLRs and want their digital cameras to work the same basic way as film cameras. There are also technical reasons why live image previews are tricky with digital SLRs. A few approaches are:

- The camera could use a fixed half-silvered "pellicle" mirror so light reaches both the viewfinder and the image sensor. Such pellicle mirrors are used in some film cameras, but they're unlikely to be used in many digital cameras because of their drawbacks.
- The camera could use a second digital image sensor in the viewfinder that would feed the real-time display. This would be difficult to add without losing light to the viewfinder display, and would add cost.
- The camera could have a preview mode which would flip up the mirror and feed live video to the rear panel. This would, of course, mean that the viewfinder would be blacked out while preview mode was on. It would also mean that the image sensor would be exposed to dust since the mirror and shutter would no longer be in the way. Point and shoot digital cameras have no such problems with dust landing on the image sensors, since they're nearly all sealed units. When you have an interchangeable-lens camera then you have much greater problems of dust entering the body.

As it turns out, there has been enough demand for this sort of live preview that Canon and other digital SLR makers have come up with ways of implementing it. Sony have announced a camera which uses the second technique above. Canon now sell cameras using the third technique, which they call LiveView.

The first EOS camera to support a form of LiveView was the limited edition EOS 20Da, intended for astrophotography. It flipped up the mirror and permitted a

preview, but it only worked in low light levels and you couldn't meter or autofocus when the mirror's up, so it wasn'tin the least bit useful for the casual photographer. The next cameras to support LiveView did so in a more useful fashion. The 40D and 1D mark III allow live previewing with the mirror up. However, autofocus is not available.

Why are the pictures from my digital camera soft-looking?

Digital EOS cameras assume you're going to be applying sharpening filters to the images once they arrive on your personal computer. In other words they don't do much by the way of sharpening inside the camera so as to give you lots of control over the image.

So all you need to do is to apply a little sharpening (eg: "unsharp mask") to your pictures and they should look quite sharp and crisp.

What are RAW and DNG and why is there a controversy about them?

Film cameras output information in a fairly accessible and universal format. You have a transparent piece of film negative and that's it. You can store the negative and retrieve the image any time you like using standard equipment.

Digital photography is very different, since images are captured using computers and stored as computer files. The problem is - what format should be used for the file? Just as word processing documents can be stored in a variety of different and incompatible formats, (plain text, RTF, Microsoft Word, Wordperfect, Wordstar, HTML, etc, etc) digital pictures have to be stored in a file format.

JPEG is the most common format used for storing digital pictures. It's an open standard, meaning no one company has total control over it, and it efficiently compresses files to keep them small. (strictly speaking JPEG - the for Joint Photographic Experts Group - refers to the compression method and JFIF - JPEG File Interchange Format - the file format, but that's getting obscurely technical, since everybody lazily refers to the files as JPEG files)

The problem with JPEG is that it does not store all the information gathered by the camera. It compresses the image in a lossy fashion, which means it discards picture information that people are unlikely to notice. That's great for minimizing storage requirements, but the drawback is that a serious photographer isn't going to be very keen on losing picture quality even to save space.

So most decent digital cameras also store pictures in RAW format or something similar. RAW isn't an acronym, but simply refers to the raw, largely unmodified data sent straight from the camera's image sensor. This is often referred to as a "digital negative" since it's the most basic and primal way that digital picture information can be stored.

The problem with RAW is that it isn't a universally defined format of any kind the way JPEG is. Each camera outputs picture data in its own unique way. Camera manufacturers have generally not been interested in adopting any form of common standard - in fact, RAW image formats frequently vary from model to model from the

same manufacturer! You then need to use the software supplied by the camera maker to transform the RAW image data into a more universally useful format, such as JPEG or TIFF.

Unfortunately most proprietary software made by camera makers has tended to be sluggish and inefficient to use, particularly in a professional context. So third party applications have stepped in to provide more useful file conversion utilities to the digital photography market. Adobe's Camera RAW, Phase One's Capture One and Bibble are the most common third-party RAW processing programs. Having such programs works well, though of course it does represent an added expense to digital photographers.

The controversy here is twofold. First, as noted, camera makers keep releasing new cameras with new RAW formats, and the makers of third party programs keep having to update their applications. For example, Canon have variously used CRW, TIF (though customized) and .CR2 files; all of which are incompatible with each other and require updated image viewer and converter programs. This lack of openness is troubling. What happens if you decide to take a look at some of your photographs in 20 years and find that there is no longer any image processing software for it? All of a sudden your pictures are gone and useless. Meanwhile you can still take that shoebox off the shelf and rescan your film negatives all you like.

And second, and even more problematic, at least one camera maker has taken steps to block access to their internal file format. In 2005 Nikon introduced the D2X digital camera, which brought with it encrypted white balance data. What this means is that Nikon deliberately lock away white balance information for no reason other than to prevent other applications from opening the files. This is a step beyond the usual practice of camera makers arbitrarily altering lookup matrices for colour and white balance data and so on from camera model to camera model.

From a technical perspective there's nothing to prevent someone else from cracking the encryption and providing software to open these files. But legislation in a number of countries - most notably the Digital Millennium Copyright Act in the United States - may make it illegal to do so. So most third party RAW readers don't have the ability to open these files because their developers don't want to be held legally liable for a violation of the DMCA. Therefore laws which were designed to shield large Hollywood studios and record labels from losses incurred by movie and music piracy are also preventing individuals from legitimately using the files that they legally own.

Adobe have created a fairly open standard for storing digital camera data, DNG (digital negative) which addresses some of these concerns, though it does permit manufacturers to store proprietary data and so does not entirely eliminate the concerns of many photographers. Unfortunately DNG has yet to gain much support from the major camera manufacturers. Hasselblad and Leica are the only camera makers thus far to give their support to the format. The groundwork has been set, however, in that most major image viewing applications now support DNG.

A group of photographers and interested users have formed a group, OpenRAW, to promote open standards for digital RAW files. If you're interested in this issue you should probably take a look at their Web site.

Can my digital camera shoot black and white or multiple-exposure images?

Not all digital EOS cameras are capable of these effects in-camera. This is because users of digital EOS cameras typically use a personal computer for post processing, and apply the necessary filters and effects after capturing to achieve such effects on the computer, not in the camera. However, EOS digital cameras introduced after the EOS 350D/Digital Rebel X/Kiss N Digital do have the ability to apply simulated colour filters to capture a black and white image. Canon have not, however, seen any reason to build multiple exposure capability into EOS cameras.

If you haven't got one of these cameras, both of these effects are easily accomplished with image editing software. In fact, many image cataloguing programs include the ability to convert an image to black and white at the touch of a button. And you have far greater control and flexibility over a multiple exposure image in Photoshop than you do in-camera.

Desaturated colour digital photos don't look quite the same as black and white film-based photos. Why not?

Black and white film is not equally sensitive to all colours across the spectrum. Different films have different spectral sensitivities (ie: respond more to some colours than others), and experienced black and white photographers are very familiar with the tonal qualities of such films and papers.

For that reason taking a colour picture and removing all the colour information (ie: desaturating it) will not yield exactly the same results as using actual photographic film and paper. The differences are subtle but noticeable to the experienced eye. You can, however, simulate the effect of using traditional black and white film by desaturating colour channels independently in Photoshop or some other image editing program. There are also third-party plugin modules offered by various small software developers which can achieve this effect as well. And, as noted above, the EOS 350D/Digital Rebel X/Kiss N Digital can also apply colour filters algorithmically to achieve traditional black and white effects.

What is aliasing and anti-aliasing?

Digital images are made by displaying tiny dots on a (usually) rectilinear grid. Straight lines which go in either horizontal or vertical directions on this grid will always look fine, but diagonal lines can be a problem. Since such lines essentially cut across the grid pattern they can appear as rough jagged stair-step lines rather than smooth diagonal lines.

There are three common ways of reducing this effect. First, if the resolution of the image is high enough (ie: each individual pixel is small enough) then the aliasing will not be readily apparent to the human eye. Second, the jagged lines can be smoothed out by filling in the stairsteps with intermediate (eg: grey rather than black and white) values. Computer software that performs this function is commonly known as an "anti-aliasing algorithm". Third, most digital cameras contain optical filters situated between the lens and the image sensor which smooth out the jaggies optically *before* it's recorded by the sensor. Such "anti-aliasing filters" soften the image somewhat, so you lose a little sharpness, but the reduced aliasing is generally considered to be worth it.

What does "interpolated resolution" mean?

It's a fancy way of saying "faking it." Let's say a scanner is capable of scanning 300 pixels per linear inch. Wouldn't it be great if you could say it's capable of producing 1200 interpolated pixels per inch? Well, that's what scanner makers do! They take the 300 ppi data, quadruple it and then mathematically smooth it all out. No information is added to the original scan, but the image can (depending on the sophistication of the software algorithms used) look much better nonetheless since jagged aliasing lines can often be minimized.

Does it look as good as a true 1200 ppi scan? Nope. Could you take your 300 ppi scan and enlarge it in Photoshop using Photoshop's bicubic interpolation software and get pretty well the same results? Yep.

What is a "digital" lens?

That depends on what is meant by "digital." There are three main ways in which the term "digital" is applied to lenses.

1) The most common use by far is stupid marketing. "Digital" is one of those words, like "professional," "next-generation," "natural," "multimedia," "advanced," and so on, which may have a pretty specific meaning in some ways but which is tagged onto a wide range of disparate products just to make them sound desirable. I mean, what's particularly "digital" about a tripod? A camera bag? The word has been stripped of any real meaning in these cases. It's a hollow buzzword of the day.

2) Second, and more meaningfully, the lens could have a focal range that's useful for digital cameras with subframe (ie: smaller than equivalent film) sensors. For example, a lens with a focal length range of 24-85mm, when used on a subframe sensor digital camera, might have roughly the same field of view as a 38-135mm lens on a 35mm film camera. In this case the camera marketers might want to emphasize the usefulness of the lens for subframe cameras by dubbing it "digital."

3) Third, the lens might genuinely possess optical characteristics intended for use with the current generation of digital cameras. The most common way in which it could be thus designed would be to have a reduced image circle since most digital cameras have small sensors that don't benefit from larger image circles. The EF-S lenses are an example of this. Some lenses also attempt to produce more collimated light. Film is fairly responsive to light hitting its surface even off the perpendicular (as is often the case with wide angle lenses towards the edges of the frame). Digital image sensors, however, don't fare as well - they work best when the light striking the sensor is precisely perpendicular to the image plane. Imagine the sensor being placed at the bottom of a shallow well - light is more likely to strike the sensor and not the well walls if the beam is perpendicular. So a lens which tries to keep light striking the image sensor in a fairly perpendicular orientation across the whole image area may indeed be better suited to a digital camera than a regular lens. Assuming, of course, that the optical gymnastics required to collimate the light don't degrade other aspects of the lens performance.

So. In the first case the term is meaningless marketing nonsense. In the second case the lens is just a regular lens that might offer certain advantages when used with digital cameras. And in the third case there are genuine reasons why the lens might be particularly suited or (in the case of lenses with reduced image circles) only compatible with certain digital cameras.

At present Canon are not marketing any of their current lenses as "digital" products - even the EF-S lenses - though some third parties are. Canon do claim, however, that some of their newer lenses have optical coatings optimized for digital lenses, whatever that means.

What is "Err 99" on my digital EOS camera?

This error condition is analogous to the "bC" error with film cameras. It's most likely caused by using an incompatible lens or dirty lens contacts.

Try a different lens and see if the camera works normally. Many older Sigma lenses in particular do not work with digital EOS cameras. Try also lightly cleaning the lens and camera metal contacts - this frequently clears up the condition. Sometimes rubbing the contacts with an immaculately clean pencil eraser (rubber) can do the trick, but be extremely careful not to let any crumbs or dust fall into the lens or camera. If you have a Canon lens which generates this error and cleaning does nothing then you may need to send it back to Canon for servicing. It's possible the lens mount needs some adjusting if the lens contacts don't reliably touch those on the camera body.

What is front focussing and what's this about the EOS 10D having this problem?

Ideally when you use your camera to autofocus on something the item you're focussing on should be sharply in focus. Simple enough. But if the camera consistently and erroneously brings the plane of focus ahead of the film surface (or image sensor surface on a digital camera) then you've got a problem, since everything will look slightly out of focus.

Unfortunately it appears that many samples of the EOS 10D digital camera have this problem. Not all do, and many cameras which seem not to be producing sharp results are probably not being used correctly. But some do. For more information on the problem and a simple way to test for it have a look at this Photo.net article by Bob Atkins.

Why does my EOS 300D/Digital Rebel/Kiss Digital rattle when I move it?

The metal struts which hold the popup flash on this camera are sort of loosely mounted and do rattle when the camera is moved. This is normal for this model.

How can I turn off the shutter noise on my Canon digital EOS camera?

You can't. The sound you hear is the real thing. All Canon digital EOS cameras contain moving parts which click and clack when you take a photograph. They aren't like mobile phones and consumer cameras which play simulated shutter release noises through tiny loudspeakers so that people know when the camera has taken a photo.

There are two components which make up the characteristic sound of an SLR in operation. One is the clack of the mirror flipping up to allow light through to the

surface of the film or image sensor. The other is the click of the shutter opening, to time precisely the exposure of the film or sensor.

All Canon digital EOS cameras to date contain electromechanical shutters, just like film cameras. The only digital EOS camera with a digital shutter is the EOS 1D, which uses a CCD chip and not a CMOS chip for its image sensor. However, even the 1D has a moving shutter, since it's there in part to protect the image sensor - an important thing for a camera with a removable lens. According to Canon the 1D's shutter is also used in bulb exposures.

What is noise?

Noise has two basic meanings in the context of photography. First, there's the obvious meaning of sound - acoustic noise heard by the human ear - mechanical shutter clicks and so on. Second, there's electrical noise. All digital image sensors are subject, to varying degrees, to this second type of noise. This is essentially the result of individual transistors in the sensor chip erroneously saying they can detect light when there actually isn't any, and adding spurious dots to an image.

In communications theory, noise is any disturbance which disrupts or affects or interferes with a signal in an unwanted fashion. In other words, the devices are actually responding to unwanted electrical fluctuations in their components, in much the same way that you can hear a hiss in telephone conversations or tape recordings. (hence the term electrical "noise" - it's a term stemming from research into audio recordings, telephony and radio) Sometimes the noise actually originates from electricity flowing through the camera's components and is thus intrinsic and unavoidable. Other times the noise originates from external sources of interference, such as radio transmitters and other electrical devices, and can be reduced by metal shielding.

Noise appears in a digital photograph as a sort of random texture of dots. Imagine the snow on an old-style TV set and imagine that snow being superimposed over top of a picture. Unlike film grain, which can have an intriguing texture of its own, digital noise generally doesn't look very good, and camera makers go to great lengths to minimize it. Noise in a digital camera is related to image sensor sensitivity. At a simulated ISO 100 setting most digital cameras display little if any noise, but at ISO 800 or 1600 most cameras have noticeable noise. Fortunately Canon have been quite successful in minimizing digital noise over time. Earliest EOS cameras are like any digital camera and are very noisy at high ISO settings. But the most recent models are considerably less noisy.

Can my choice of memory card affect picture quality?

No. Digital cameras use binary data. A given bit of data is either true or it is false. Memory cards either work reliably under ordinary conditions or they don't. The only points to consider between one card and another are speed of read and write access and overall reliability of the product.

Is it true that flash memory used in memory cards wears out?

Yes. The memory cells that make up flash memory cards, used in nearly all digital cameras today, do indeed have a finite lifespan. Estimates vary from product to product, and manufacturers tend not to want to talk about it, but each cell can be erased and reused anywhere from 10,000 to a million times before internal insulators start wearing out and errors start creeping in.

Does that matter? Well, for the average user, no. Even the low estimate - 10,000 times - is quite a few rounds of photography on a card. And better memory cards contain special controllers which evenly distribute which sections of a card are used in order to minimize wear.

The finite lifespan might, however, be a factor for intensive use, particularly with older memory cards. Some card manufacturers promise replacement guarantees of 1 to 5 years, but of course getting a corrupt memory card replaced for free does little to resurrect any valuable photographs which may have been lost. Still, all things considered, flash memory seems to be a pretty reliable and stable form of data storage. This is particularly the case when you compare flash memory to its main competitor - hard disk drives - which are susceptible to shock and vibration.

A related factor is how long flash memory can retain data without power. This is particularly difficult to pin down, but I've heard figures of around 10 years. So if, in the distant future, your grandchildren discover a box of your old memory cards it's possible that any data on it will be long gone. That is, of course, assuming that they could find a way of reading the cards. That will probably be as difficult as getting 126 cartridge film printed today.

There's a small irregular black blob on all my pictures. What is it?

Dust on the sensor. Unlike film cameras, which expose a fresh chunk of clean film every time you wind the camera, digital cameras use the same glass sensors. And naturally dust on the sensor will appear in the same spot on every single photo you take.

This problem will be more apparent if you shoot at a small aperture (larger f/ number) than if you shoot wide open (smaller f/ number). So sometimes shooting at a wider aperture setting will minimize the problem.

But fundamentally you need to clean the sensor. And this becomes problematic, because the sensors are quite fragile and easily scratched. You don't want to be sticking paintbrushes or cotton swabs or whatever in your camera and wrecking the image sensor. Pressurized air bottles (technically gas under pressure, not air) also tend to leave residue, and are best avoided.

Canon themselves recommend to use nothing more than a squeezy rubber blower brush to remove dust, but that doesn't always do it. A lot of people recommend special sensor swabs, assembled in cleanroom situations, for cleaning the sensors. These are usually dipped in pure alcohol. But if you don't want to risk messing around that way you'll need to take the camera to an authorized repair shop for cleaning.

And as for the source of the dust, it's best to try and avoid changing lenses outside when it's windy, or in dusty situations. Try as much as possible to change lenses under circumstances which will minimize the junk building up on the sensor.

What is dark noise subtraction/long exposure noise reduction?

Dark noise subtraction is a method for reducing noise in long exposures. First, the camera takes a photograph without the shutter open for the duration of the real exposure. This gives a map, as it were, of noisy pixels. Then the camera opens the shutter and takes the actual photograph. Once the photo has been taken the camera subtracts any noise present in the dark frame. Since both frames are taken under very similar conditions within moments of each other this is a reasonably successful technique of minimizing, but not eliminating, noise.

Dark noise subtraction thus reduces noise from long exposures - typically night-time photography - at the cost of doubling exposure time and thus halving battery life. Some EOS digital cameras can use this technique automatically to reduce digital noise in exposures longer than a second or two. If your camera lacks this feature you can do it yourself manually using image editing software. A lot of amateur astronomers apply dark noise subtraction techniques manually, using image editing software, to achieve surprisingly good photos of the night sky from inexpensive consumer cameras.

What is the EOS 20Da?

The EOS 20Da is an extremely unusual digital camera intended for a very small target market. Essentially the 20Da is a regular EOS 20D digital camera which has been modified to suit the needs of astrophotographers - people who like taking pictures of the night skies. Originally announced for the Japanese market only, the 20Da is available worldwide but only through specialized dealers and only for a limited time. The modifications are somewhat arcane, but for completeness they are:

1) The low-pass (infrared) filter has been altered to increase the transmission of 656nm wavelength light. This wavelength is also known as the Hydrogen Alpha wavelength, and improving the camera's sensitivity to this type of light means it's better for taking photos of diffuse reddish nebulae. Wow. Sadly it appears that this modification does not make the camera much better for taking regular infrared pictures. It also means that you can get slight reddish tints to photos taken in daylight when using the camera normally.

2) The camera is the first EOS digital SLR to permit a live image preview by locking up the mirror. You can magnify the image preview and output it to video. Unfortunately this feature is only useful at low light levels, so it won't help you take photos during the day. Making it even less convenient is the fact that you can't focus or meter during a live video preview, and you can't use any USM lens which uses an electronic manual focus system, such as many longer L series telephotos.

About online discussions and this FAQ.

How is PhotoNotes.org funded?

This site and its extensive content are funded entirely out of my own pocket and reader donations. The server hosting these pages is in Islington, London, England.

At this time it isn't supported in any way by advertising or corporate sponsors. So if you found any material here useful or interesting please consider making a donation to keep it on the air. Thanks!

What are some common photography-related spelling errors?

Here's a short list.

Incorrect	Correct
Amature	Amateur
Aperature, apature, etc	Aperture
Cannon	Canon (the camera company)
Copywrite, copyrite, etc	Copyright
Flourescent	Fluorescent
Infared, infered, inferred, etc	Infrared
Lense*	Lens
Marco	Macro
Manuel	Manual
SRL	SLR (ie: single lens reflex)
Wide angel	Wide angle

* Oddly, Merriam-Webster claim that "lense" is an acceptable alternative spelling for "lens." However, I have never seen "lense" in print and the Oxford English Dictionary lists only "lens," so I'm presuming it was a temporary lapse of judgement on their part, like claiming that "cigaret" is correct spelling.

Why are people on discussion groups such mean snobs?

That's a good question and there's no one answer to this. First off, yes, some people on discussion groups can seem like mean snobs. They may be generally cantankerous, they may be disgruntled wannabe photographers bitter about anyone else having fun, they may be insecure jerks and so on. They may also be experienced photographers who have simply forgot the type of perfectly reasonable questions that novices may ask.

But it's also possible that they may be responding to something else. If you get a strongly negative reaction to your online post, consider some of the following points:

Did you post in uppercase or use a lot of punctuation?
In the online world, UPPERCASE LETTERS ARE INTERPRETED AS YELLING. So if you posted a question like, "HELP ME MY CAMERA IS BROKEN!!!!!!!!!!!!!!!!!" you might annoy a lot of people. Rather than posting big solid blocks of text, try to break up longer pieces into easier-to-read paragraphs. This may sound trivial, but online your words are who you are. Posting in uppercase is like lurching up to someone in real life and bellowing or belching in their ear. First impressions matter.

Did you have a concise and specific question?
Photography is a precise field in many ways. Don't expect a helpful response if you post a question like, "my flash won't work!" Be as specific as you can. A question like, "I have a Canon EOS A2. It takes photos fine, but its built-in flash no longer pops up" is much more likely to garner responses. Similarly, a vague question with no context - eg: "is the Canon 28mm lens any good?" - is very difficult to answer. Good for what? What do you want to do with this lens? And which lens? Canon make two 28mm lenses for the EF mount. Or a completely open-ended and general question like, "Canon EOS Rebel - any comments?" How is anybody supposed to know what you mean by that? Another really annoying thing is to formulate a subject line as a statement when it's actually a question. Compare the difference between "Company X going bankrupt" and "Is company X going bankrupt?"

Also, try not to post rambling novels. Short, succinct and specific questions are usually the best, assuming you actually want an answer.

Did you ask a question that's been asked zillions of times before?
Now, to be perfectly fair, as a novice you may not know that the question has been asked before. So have a look. It's really irritating for regulars to a discussion group to have newcomers barging in every day and asking the same question over and over. It's only polite to do a quick search of the archives (nearly all discussion groups have some form of archive system, and Google has a pretty complete Usenet archive) to see if your question has been asked before. Chances are it has. Not only will you not annoy regulars but you'll probably learn a lot of useful information too.

Did you come across as demanding?
Sometimes people post belligerent posts with a pushy tone as though they were entitled to an answer from an underling. Remember that online discussion groups are full of ordinary folks who like chatting with other photographers about their hobby, vocation or passion. They're not paid flunkies or whatever - they want to help other folks for the sheer fun of it. So be polite and friendly and people will be polite and friendly right back.

The other day I came across a post from a guy who started out, "I know this has been answered here before, but I don't have the time to look it up...". Well. Why should *I* waste my valuable time helping him if he can't even take a moment to scan the archives? He's obviously decided that my time is less important than his.

Did you follow the posting guidelines?
If you have a question about Canon lenses then you shouldn't post your question to the medium format photography forum. If the forum's posting policy specifically bans advertising then you should respect the rule and not post ads. Posting the same identical question to multiple forums on the same site tends to make a lot of people

irritated - especially if your previous question has already been answered before. And so on.

And if you've gone over this list and you still got a rude response to your post then, yes, you probably just ran into a cantankerous oldtimer who had a bad morning. Ignore him or her and move on.