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Canon eos lenses guide

Canon EF 400mm f2.8L IS II USM lens Andrew S. Gibson is the author of Understanding Lenses Part II: A Guide to Canon Normal & Telephoto Lenses, on 40% now at Snapdeals for a limited time only. With so many lenses to choose from, it's little wonder that photographers become confused about which option is the best. In this article I'm going to take a look at some of Canon's best or most interesting normal and telephoto lenses, to give you a head start when it comes to understanding just what Canon offers in this part of their lens range. But first, let's take a quick look at the state of Canon's lens line-up. I have no inside knowledge about which lenses Canon may introduce this year, but I do see a couple of emerging trends. Trends in Lenses The first is that Canon is not afraid to take an old lens and update it with a newer version. Good recent examples are the new EF 24mm and 28mm f/2.8 IS USM lenses. Both replaced older versions and included an Image Stabilizer (IS) which the previous models didn't have. The second trend is that newer lenses tend to be more expensive than the ones they replace. This is reasonable, as the newer lenses are better quality. If a new lens comes out and it seems expensive, you can be patient and wait a year or so for the price to drop if you don't need it urgently. The two wide-angle lenses mentioned above have dropped in price by over 30% since their release. That does mean it is possible that Canon will replace some of their aging normal and telephoto lenses in the near future. If you're thinking about buying one and are worried about this, it's up to you to decide how badly you need the current version. While the rumour website like to speculate about forthcoming lenses, and are sometimes accurate, you never really know what will happen as Canon keep the details of new releases under wraps until the official day of release. A good example of this is the EF 50mm f/1.4 lens. Some rumours sites are saying this is due for an update. But if this is true, and how far in the future it will happen, no-one really knows. Plus the replacement is likely to be more expensive than the current 50mm f/1.4 lens (but it may have IS). In the end, it's up to you, but my advice is don't spend too long waiting for new lenses - you could be waiting a long time. Canon EF 200-400mm f/4L IS USM - the beast! Let's start off with this beast. It's fun to speculate who would buy such an expensive lens. A professional sports photographer? Agencies like Getty or Reuters? This L series, super telephoto zoom, comes with a built in 1.4x extender (the only Canon lens to do so), a four stop Image Stabilizer, and a fixed f/4 aperture throughout the zoom range. It weighs over three and half kilos (7.9 pounds), but is not Canon's heaviest lens. That honour belongs to the Canon EF 800mm f/5.6L IS USM lens (below), which weighs four and half kilos (9.9 pounds) and is another option for those of you with \$13,000 to spend on new glass. Canon 40mm f/2.8 STM At the other end of the scale is one of Canon's lightest, smallest and least expensive lenses. This 40mm pancake lens delivers excellent image quality, and excellent value for money. However it doesn't have IS or a distance scale on the lens, features which may be important to some people. How does this lens give such excellent quality for such a low price? It contains just six optical elements that measure little more than a centimetre across (0.4"). They are cheaper to manufacture than the larger elements found in Canon's other lenses, and the result is a lower price. This focal length is a short telephoto on an APS-C camera or a normal lens on a full-frame camera. Canon 50mm f/1.4 USM EF 50mm f/1.4 USM Canon users aren't lacking for choice when it comes to 50mm lenses. Canon makes four models, including the 50mm f/1.8, the 50mm f/1.2L and 50mm f/2.5 macro. But my favourite is the EF 50mm f/1.4 USM. It's a third of the price of the more expensive L series 50mm lens, but has better autofocus and smoother bokeh than the f/1.8. 50mm lenses make great portrait lenses on APS-C cameras and deliver value for money in terms of image quality and versatility. You can use a 50mm lens with extension tubes or close-up lenses for close-up photography, or with a reversing ring on a longer lens for macro photography. Read more about 50mm lens in my article Nifty Fifties - Why I Love 50mm Prime Lenses. Canon 85mm f/1.8 USM Another of my favourite lenses is the 85mm f/1.8. It's an ideal portrait lens for owners of full-frame cameras. It's also great for close-up photography with the addition of a 500D close-up lens. It's a shame it doesn't have IS, but that would push the price up. If you have deep pockets you can also consider the EF 85mm f/1.2L II USM lens, but bear in mind the wide f/1.2 aperture means it has a large front element (to let in the more light) and that makes the lens heavier and slower to autofocus. Read more about this lens in my article How a Humble 85mm Lens Became My Favourite. Canon 70-200mm zooms Canon has four 70-200mm zoom L series lenses. Two of these have maximum f/4 apertures and cost less. The other two have maximum f/2.8 apertures. For each aperture setting there is both a non-IS and an IS model. This gives you plenty of choice, for what is a very versatile focal length. The EF 70-200mm f/4L USM lens is Canon's cheapest L series lens and a great option for anyone wanting to experience L series quality on a low budget. The EF 70-200mm f2.8L IS II USM (above) is the most expensive and comes with a collar so you can mount it on a tripod. Canon 70-300mm f/4-5.6L IS USM If 200mm isn't long enough for you then Canon's trio of 70-300mm zooms may appeal. The only drawback of these lenses is the variable aperture, but it's hard to avoid this along such a long focal length range. The EF 70-300mm f/4-5.6L IS USM is the most recent model, but also the most expensive. The EF 70-300mm f/4-5.6 IS USM lens is the least expensive and ideal for those on a tight budget. The EF 70-300mm f/4-5.6 DO IS USM lens is an interesting alternative. DO stands for Diffractive Optics. The construction of the lens elements in DO lenses means they are smaller and lighter than their non-DO equivalents, making this a good option for photographers concerned with size and weight. In every other respect DO lenses are equivalent to L series lenses. Will Canon make more DO lenses in the future? I hope so, because they are a great idea. The only other DO lens in Canon's range is the EF 400mm f/4 DO IS USM. Hopefully that has given you a good overview of some of Canon's more notable normal and telephoto lenses. It's impossible to include every model, let alone those made by other manufacturers, but that's where you come in. What normal or telephoto lenses have you purchased? How have they performed and what would you recommend? Let us know in the comments.

Understanding Lenses Part II: A Guide to Canon Normal & Telephoto Lenses My ebook Understanding Lenses Part II will teach you how to get the most out of Canon's normal and telephoto lenses. It contains a buying guide, takes a deep look at aperture and bokeh, and shows you how to focus accurately with telephoto lenses. It's offered for a special price now on 40% off at Snapdeals for a limited time only. All photographers know what a camera lens is. If the camera is the 'brain', then the lens is the 'eye'. It lets us view and capture our environment. Some photographers find that the lens is more important than the camera. Others believe that the camera body functions and limitations are more important. Either way, read on to find out all the information you could possibly know about camera lenses. Isn't a Lens Only as Good as the Camera Body? A camera lens is a very special item. It's absolutely necessary to capture great images. You could use a pinhole and get great results. But you would have little to no control over the final image. Camera lenses, like it or not, are the most important part of your kit. A camera lens denotes the aperture range you can use, the possible depth of field and the focusing distance. A camera can't focus without a lens or capture any image at all. You can, however, capture images without a camera body if you were so inclined. I know camera bodies are important. They allow other settings such as ISO and shutter speed. They influence the quality of the image through resolution. But they aren't as important as lenses. The first digital camera I ever owned was a Canon EOS 400D (Rebel XTi / Kiss X). The lens I had was not very special. It was the actual kit lens that came with the camera. This was 13 years ago. I then picked up a Canon 7D just over 8 years ago, and have used a Canon 5D Mark III ever since. The lenses and camera bodies were different, but there was no way I could tell which camera I used for any given image. Especially not just by looking at them. I could tell you which lens I used though, based on crop factor, focus and depth of field. Are Lenses Really That Important? As long as you get along with your lenses, you'll find that you update your camera body rather than your glass. The cameras change in resolution, features and a great many other ways. The lenses you own today could well be the ones you own for the longest period of time. If you look after them, they will last a lifetime. A camera has shutter actuations, meaning a shelf life. But once you find that great lens, you'll want to hold on to it. As I said before, many photographers chase glass. They realize that to get the best out of a scene, the glass is the most important. They then build their system around it. One of the biggest debates between Canon and Nikon is about lenses. Nikon is said to have higher quality glass, creating a better overall image. That isn't to say that Canon doesn't have great lenses or other benefits. There are also huge conversations and debates over third-party lenses, but we'll delve into that later. If you keep hold of your lenses, you'll notice they will get slightly better with every camera upgrade. The camera helps bring out the most of the lens. Better colors and less noise mean improved output and a happier photographer. What Does a Camera Lens Do? A lens is a device that contains lens elements. These elements are shaped glass pieces that bend light in specific ways. Each element within the lens has a different function, and they work together in harmony. Their task is to create a sharp image on your film or sensor. They do this by helping light beams focus. It sounds simple, but designing and building these lenses is very complicated. Science and mathematics all the way. One of the biggest challenges with a lens is the need for sharpness across the entire width of your scene. This includes the corners. And then you also have zoom lenses. These have to focus light rays to converge and focus at an array of different focal lengths. We won't go into that here. Just know this - lens designers and creators are amazingly smart. Parts of a Camera Lens Here we have the anatomy of a lens. As you can see, there is a lot of glass that makes up a lens. Some of these pieces are fixed to the barrel of the lens, and others are movable. These allow you to zoom, focus or assist in image stabilization. We will look at this in greater depth later on in the article. The outside of the lens is something we are more or less familiar with. Do you know what all the controls, attachments and text mean? Lenses differ between manufacturers, but the general information is the same. A Lens is the Sum of Its Parts This information is somewhat different between analog and digital systems. Focusing ring (both systems) Zoom ring (both systems) Focal length information (both systems) Aperture size (analog) Distance indicator (both systems) Depth of field indicator (both systems) Lens mount (both systems) Image stabilization controls (digital) Manual/Autofocus switch (both systems) Focal Length Explained One of the most important aspects of a lens is its focal length. The focal length and widest aperture are two of the most important reasons for buying a specific lens. What Is Focal Length? Focal length often confuses photographers, especially newbies. Let's keep it simple. When light travels through your camera, the image is flipped upside down. This is the same way our eyes see the world. Inside the camera is a pentaprism that flips the image the right way. As you can see from the image, there is an intersection inside the lens. This intersection is the convergence between the lines of light that we get from our subject. In optics, this crossing point is called the 'nodal point'. The distance between this nodal point and your image sensor or film is the focal length. Why Is Focal Length Important? The focal length of a lens describes how wide its field of view is. This is what makes a lens wide, standard or telephoto. Consider the placement of the converging nodal point. The closer it is to the imaging sensor, the smaller the object appears in the image. Imagine the nodal point was much further away from the imaging sensor. This would make the subject seem much larger. As you can see, a low focal length creates a wide field of view. Lenses with a low focal length are known as 'wide angle' lenses. The opposite is true. The A long focal length creates a narrow when used in view. These lenses are known as telephoto lenses. Difference Between Zoom and Prime Whether wide angle, standard or telephoto, every lens falls into one of two categories: zoom or prime. The first lenses only had a fixed focal length. Engineers knew it would be a great idea to make them more versatile. Having one lens with an array of different focal lengths has benefits. Photographic lenses were configured and created to allow the nodal point to move closer or further away from the sensor. In doing this, they created the variable focal length - the zoom lens. The other lenses became known as prime lenses. And the rest is history. Lens Apertures Aperture is another reason why photographers choose one lens over others. The word aperture means opening, and describes the size of the hole in a lens. This is where the light passes through, making its way to the camera sensor. Apertures might seem a little strange. They are a fraction of the focal length of a lens. We see f-stops written as f/2 or f/11. The 'f' in f-stop comes from focal length. The preceding slash is a mathematical expression of the pupil's diameter. If a lens's focal length is 10 mm and its entrance pupil diameter is 5 mm, the f-number is 2. The fractions are important here. If you are capturing a scene with a 100 mm focal length lens at f/2, the diameter of your lens is 50 mm across. Likewise, if you're shooting at f/4, then the diameter is 100/4 = 25 mm. The f-number gets bigger but the aperture gets smaller. This is important, but normal as we are talking about fractions. f/2 is bigger than f/4, which is bigger than f/8. How Do Apertures Affect Lenses? A larger aperture (smaller f-stop number) means that more light passes through your lens. More light is better in low light situations. When it comes to choosing a lens, the most important factor is the maximum aperture. This number is written on the lens, and included in the lens' specifications. The biggest-size aperture is an expression of how 'bright' the lens is. Brighter is better. Lens Markings The numbers you'll find on a lens are all very important. The first number you'll come across is usually the lens' focal length. This number is represented in millimeters. If you see one number rather than a range, it means you are holding a prime lens. It could say 24 mm, 35 mm, 50 mm, 85 mm, or something similar. A focal length range will have two numbers separated by a dash. 24-70 mm is a good example and means you are holding a zoom lens. The second number you'll find on a lens is usually the lens' maximum aperture. If you have one number, it means your zoom lens has a fixed maximum aperture. Prime lenses do not have a variable maximum aperture. If you have two numbers separated by a dash, it means your zoom lens has a variable maximum aperture. It will look something like this 'f/4-5.6'. Other Markings There are other markings you might find on your lens. ∞ - 0.5 m - Sometimes you may find an infinity symbol, then a dash and then a distance indicator. This is the operating range of the lens. This indicates the closest focusing distance of the lens. It can be in meters or feet, or even both. ISO/IS/VR - This stands for Image Stabilisation, Optical Image Stabilisation or Vibration Reduction. This means that your lens has a built-in floating lens element, along with motors and electronics. These lenses sense and counteract any movement or shake. 0 - The e symbol on a lens is usually followed by a number. This is the diameter of the front of the lens. It will be useful in purchasing screw-in filters in the future. Asph / ASP - This stands for Aspherical. It shows that the lens has non-circular lenses inside. These lens elements can be used to reduce spherical aberrations. Macro / CRC (Close Range Correction) - This marking means the lens is specifically designed to be sharp at close ranges. These are great for photographing flowers, bugs, and other minute items. Not all macro lenses are the same, and some are much better than others. USM/HSM/SWM - UltraSonic Motor, High-Speed Motor, and Silent Wave Motor are all ultrasonic vibration motors that allow you to autofocus faster. The ones used in higher-end products are much quieter than those in cheaper lenses. DX (Nikon) / EF-S (Canon) - These lenses were specifically created for camera bodies that are smaller than full-frame. APS-C size sensors have a crop factor. These lenses give you a focal length, taking in the smaller sensor into account. These are smaller and lighter to their siblings, but can't be used on full frame cameras. Other - Lens manufacturers use a slew of markings on their lenses. Canon likes to mark their professional lenses with a red 'L', and Sigma uses EX for their expensive glass. Remember that an aperture is the size of the hole in which the light passes through. It is expressed as a fraction of the focal length. For example, f/2 with a focal length of 300 mm is a 150 mm hole. Aperture can cause some obstacles when it comes to zoom lenses. Let's use the Canon EF 70-300 mm f/4-5.6 as an example of the maths. At 70 mm, you can use the f/4 aperture. 70 divided by 4 gives us 17.5 mm. By zooming all the way in, we go from a 70 mm to 300 mm focal length. The images you capture are magnified by 4.3%. At 300 mm, your maximum aperture is f/5.6, where the diameter is 53.57 mm. But why can't a telephoto lens be f/3.5 throughout the zoom range? At 300 mm, an f/3.5 aperture would be 85.71 mm. This is too big to fit into the slim body of the lens. Usually, there isn't enough space for this wider aperture only in an exceptional telephoto lens construction. Is It a Deal-Breaker? Many photographers see these lenses as inferior and avoid them. But there is no reason to do so. These lenses, apart from offering great quality lens designs, give you a compromise. Every lens is a compromise between every single one of its usabilitys. Non-variable aperture (fixed minimum aperture) lenses offer some great advantages. They are lighter and smaller than their counterparts, and therefore cheaper. The other problem with variable apertures is that they are worse for low light conditions. Focusing a Lens All lenses have some sort of way to focus the scene in front of you. If you're looking for a technical definition, the focus is "the point where light rays originating from a point on the object converge". An area of your image needs to be in focus. Perhaps you were to capture a tree. To gain a sharp focus, the light rays from that dot need to hit as few pixels as possible on your digital sensor. When it comes to your image, there are areas in focus and areas out-of-focus. If you see sharp edges on an object, the object can be said to be in focus. Focusing happens within the lens. This happens by moving one or more lens elements closer to or further away from your camera's imaging sensor. The lens 'bends' the light and forces it to converge at different distances from the sensor. The ideal convergence needs to fall exactly on your imaging chip. When you achieve that, you have a perfectly focused image or subject. AutoFocus Autofocusing is just one way to gain a sharp focus. With this mode, the camera sends a signal to the lens, forcing it to change its focal placement. How much of your scene is in focus falls on three different things. Your aperture setting, the distance between you and the elements in the scene, and their special relationship. What is placed in focus is down to where you set your camera to look. Many modern cameras have tens of focus points spread over your viewfinder. They can be moved or even work in groups to select a more progressive focus blanket. Manual Aperture from leaving the focusing to the camera, which it's pretty good at doing, there is the manual focus option. This can be a better option depending on what you are photographing. If you're capturing a subject that is on the same focal plane, that is to say, not moving closer or farther away from you, refocusing is a waste of time. Your camera might have trouble autofocusing in other situations too, like very low contrast or low light scenes. Shooting through glass is a great example of autofocus issues. Some cameras are better at manual focusing than others. Rangefinders have a great way of focusing. This is done by superimposing a ghost image over your viewfinder scene. They come together when an object is correctly focused. Other, older cameras had a focusing screen that helped the manual focus. Modern cameras, such as the Lumix GH5, places a red halo around objects when they are in focus. DSLRs let you focus in live view mode, which is magnifiable, making it easier to focus on far-away subjects. Using Autofocus with Manual Many lenses have a special feature, allowing you to autofocus the camera, then tweak the result manually. Some lenses will not let you manually adjust the focus when in autofocus mode. If you would like to test if your lens supports these manual adjustments, follow our steps. First, set your focus to manual mode. Turn it back and forth to get a feel for the resistance. Now set it to autofocus, and gently turn the focusing ring. If you feel more resistance than the manual mode, or hear any crunching sounds - stop. Internal and External Focusing There are two different types of focusing, internal and external. You will know if you have external focusing since the front element of the lens will extend when you focus. This is handy to know for filters, especially polarising filters. If your lens turns when focusing, you'll need to focus before setting your filters to their desired effect. Distance Indicators Lenses, especially those for film and analog, have built-in distance indicators. These are for the purpose of focusing, especially when you need to focus to infinity. They aren't exactly precise. But they are a good guide for knowing which way to turn the lens to focus at a particular distance. Depth of Field Indicators The lenses that have distance indicators usually have Depth of Field indicators too. These are marked as '22', '11' and '8'. The numbers may differ, depending on the lens, its design, and properties. What these markings designate is how much of your scene will be in focus at a particular aperture. When capturing at f/22, with your focus set to infinity, you'll see that everything from 3 meters onwards is in focus. Lens Mounts Your lens connects to your camera body via lens mounts. There are two main types of mounts: screw and bayonet fitting. The former is very rarely used in these days, yet you may encounter them with film and analog lenses. The benefits of bayonet fittings allow lenses to change much faster. They secure on the camera body in a much safer way. The most important aspect of these mounts is they allow for electronic connections between the camera and lens. This is what allows autofocusing and electronic control of the aperture. Canon uses EF or EF-S bayonet lenses. EF lenses can be used on EF-S cameras, but not vice versa. This is due to the EF-S lenses designed for smaller sensors. Each camera manufacturer has their own lens mounts. This is with the exception of the Four-Thirds mount, which is backed and used by several manufacturers. It is possible to buy and use adapters so that lenses from one manufacturer can be used on other manufacturer's camera bodies. This is especially true for all cameras with smaller sensor sizes, as it's easier to adapt any lens mount. Third-Party Lenses Canon lenses can not be used on Nikon bodies, and vice versa. This means you're stuck buying from the same manufacturer. There are quite a few third-party manufacturers that create lenses for all top camera body manufacturers. Sigma, Toki, Zeiss, and Tamron all create lenses for an array of lenses. You may think these lenses don't hold water to the Canon and Nikon counterparts. Some of these lenses are found to rival or better the largest DSLR manufacturers. If your budget is tight, opting for a third party manufacturer is a great option. My Sigma 85 mm f/1.4 is half the price of the Canon version, and the sharpness is unparalleled. Image Stabilization Many modern camera lenses have built-in image stabilization. This feature allows you to capture scenes handheld that was previously challenging. This technology utilizes the latest gyroscopic sensors and motors to stabilize any movement in the lens elements. Camera shake is a thing of the past. Telephoto lenses are the ones that feature image stabilization. This is because longer focal lengths suffer worse from camera shake than from shaky hands. The rule is to shoot at a shutter speed no lower than your focal length. A 50 mm lens has a limit of 1/60th of a second, and a 300 mm lens has a 1/250-1/300 range. IM allows you to bring this setting down to something more friendly. Some cameras, such as the Canon R mirrorless have image stabilization built into the camera. This turns every one of your lenses into a stabilized eye. What to Consider Image stabilization is a wondrous technology. But, not all vibrations are reduced by this feature. There is a limit to how far this floating lens element can move. On top of this, camera movements that you'd like to keep might be removed. For example, panning shots wouldn't work so well. Image stabilization is quite power hungry. Your batteries might not last as long as they would normally. Turn it off when not using it. How Do Crop Sensors Affect Lenses The film plane in 35 mm film cameras came in one size. This 24 x 36 mm hole allowed the film to be exposed correctly. Nowadays, with modern digital cameras, these sensor sizes have quite a range. The Leica S2 SLR has a huge 30 x 45 mm sensor. Whereas the Sony RX 100 only has a 1" sensor measuring at 13.2 x 8.8 mm. Here, we will be talking about how the size of the camera's sensor affects the cropping of your scene. Crop Factor You may hear the terms full-frame, 35 equivalent, APS-C or cropped sensor thrown around. The big difference is what you are actually capturing from your scene. A full-frame or 35 mm equivalent is the same thing. If a camera is listed as being full frame, it means it has the same size sensor as 35 mm analog cameras have: 36 x 24 mm. APS-C, Four-Thirds and 1" sensors are all cropped when compared to a full frame sensor APS-C (Except Canon) has a size of 22.5 x 16.7 mm. To get to 36 x 24 mm, you need to multiply the number by 1.5. This gives APS-C a crop factor of 1.5x. APS-C (Canon) has a size of 22.5x15 mm. To get to 36 x 24 mm, you need to multiply the number by 1.6. This gives APS-C a crop factor of 1.6x. Four-Thirds has a sensor size of 18 mm x 13.5 mm. To get to 36 x 24 mm, you need to multiply the number by 2. This gives four-thirds systems a crop factor of 2x. The way a crop sensor works is that it magnifies the focal length of the lens. A 35 mm lens becomes 50 mm with a Nikon 1.5x crop factor. A four-thirds camera with a 70-200 mm zoom lens would become equivalent to a 140-400 mm lens. The general idea behind these different sizes is cost. Not everyone needs, or can afford a full frame sensor. Camera manufacturers have created a range of sensor sizes to suit all budgets. Filters Most lenses have a filter thread in the front bezel. This allows you to screw in a filter. The filters cover a range of different ideas, including adding tints or darkening a scene. Filter Threads Every threaded filter has a different size, so it is crucial to choose the right size. On the filter, you'll see the size of the threading that will look something like Ø=68 mm. The big benefit here is you can use these filters as lens protection. Many photographers add a skylight or UV filter at the front. This stops any scratches, paint, dirt or bumps affecting the front lens element. A filter is much cheaper and easier to fix or replace than a lens. These filters will add a little image quality degradation, but the alternative doesn't add the peace of mind this solution proposes. You could always take away the filter when photographing cityscapes or shooting towards direct light. Drop in Filters Drop in filters or square filters are a type of filter that fits into a holder. The holder screws into the lens' bezel at the front. The benefit here is that each filter you use doesn't have to be screwed into the lens. This is a cheaper option, and easier to use than filter threads. These are of higher quality and more versatile. Rear Filters Some lenses do not accept filters at the front of the lens. This is especially true for specialty lenses, such as extreme wide angle/fisheye lenses. The front of these lenses is rounded, which leaves no space for to take into account. The lens has a focal length of 100 mm, meaning you have a 20° field of view and can't get closer to your subject anyway. The second thing is that 30 cm is pretty good in comparison. The Canon 135 mm has a minimum focusing distance of 90 cm, three times further away. Using macro lenses are just one way you can get closer to your subject. There are three other ways you can capture small objects at a ration of 1:1 and closer. Close-up Lenses A close-up lens (also known as a close-up filter or macro filter) is another way you can get close to your subjects. This secondary lens enables you to capture macro shots without the need for a specialty lens. Close-up lenses work the same way as reading glasses. They allow the lens to focus more closely that it would normally. These are easy to use, just screw on the thread at the front of the lens and away you go. The benefit here is that you can stack them and use multiple filters together. A +1, +2 and +4 will give you +7 steps of closeness. Some single-element close-up lenses can cause challenges, such as severe aberrations. Achromatic doublets are capable of producing great images with a small loss of sharpness. The Hoya 46mm Close-up Multi-Coated Filter Set is a good place to start. Extension Tubes Macro extension tubes are lens spacers. They don't have optical elements inside them like the teleconverters do, which means they are a cheap option. They normally come in three different sizes, 7 mm, 14 mm and 28 mm. The biggest benefit with these is that you can stack them together. 7 mm + 14 mm + 28 mm = 49 mm extension spacer. Extension tubes work by reducing the focusing range of the lens you are using. Here, you can bring your subjects much closer to your camera. However, you lose the possibility of focusing to infinity. You can make them yourself if you don't have the budget for purchasing them yourself. For further reading, macro extension tubes work well with a process called focus stacking. The Kenko Auto Extension Tube Set is a great extension tube kit to use. Reversing Your Lens The other cost-effective option is to reverse a lens you already own. This might be strange, but it works well. Literally, take the lens off the camera and turn it around so the front lens element is facing the inside of your camera. You'll be able to focus on items very closely. This is best used with a tripod as you'll need one hand to hold the lens and another to change the distance of the camera and tripod. There are lens reversing rings, allowing you to connect your camera mount to your reversed lens. This process works as a normally used lens focuses light from far away. Here, the image is much smaller. By reversing the lens, the opposite occurs. The lens magnifies what it sees, giving near life-size reproduction. Aberrations & Distortions Lenses are never perfect. They all make a compromise between weight, versatility, size, focusing, and cost, among many other things. Due to these compromises, the lens can suffer due to challenges it wasn't made to encounter. Aberrations When light travels through a lens, it hits and bends when encountering the glass inside. Not all light bends the same way. Some colors are affected more than others. They could be down to minor imperfections, diffractions or refractions of the light. There are a few different aberrations you need to be aware of, they fit into two concepts; those that work with color (chromatic aberrations) and those that work with single points of light (monochromatic aberrations). This area needs its own article. A Guide to Types of Lens Aberrations in Photography is what you're looking for. Distortions Every lens has a varying degree of distortion. Generally, you'll find smaller amounts of distortion when using prime lenses. This is down to fewer elements needed for the lens to work. Constantly improving technology helps keep distortions to a minimal, especially with newer, more modern zoom lenses. There are two main types of distortions. Barrel distortion makes the center of the image appear closer than the edges. Pincushion distortion makes the center appear much further away than the edges do. Wide-angle lenses are plagued with distortion as their wide field of view needs to fit on a small, rectangle surface. It's like trying to squeeze a fat cat through a relatively small cat flap; the edges need to squash, you'll notice the center seems unaffected. But, expect straight lines to curve as you extend to the edges of the frame. And if you have a mixture of the two, you'll get a mix of barrel and pincushion distortion. For more information on what they are, what causes them, read our What Is Lens Distortion? You might also enjoy our How To Correct Lens Distortion in Lightroom: Step-By-Step Guide too. Sharpness Sharpness is the great bane of annoyance to photographers. It's easy to capture something you think is in focus. It might even look to be the case on the small LCD screen on your camera. Getting home to check on a larger screen can have us gritting our teeth. Centre Vs. Edges The sharpness of your images comes down to how good your lens is, and "ahem" how good you are at focusing. For optimal sharpness in your images, you need to know how to use your lens properly. When we do talk about sharpness, we measure it in a whole bunch of ways. Lenses tend to be sharper in the center. The edges and corners are furthest away from the sensor and can, therefore, suffer some loss. Zoom Range One of the biggest problems with variable focal length or zoom lenses is its sharpness range. A zoom lens has to make a compromise between many features, so versatility pushes the sharpness from the top spot. It isn't always clear where the optimal sharpness lies. Some lenses are sharpest at the extremes of their range. This shows that designers placed importance on sharpness when fully zoomed in or out. Other lenses can be sharper around the center of the range. There are a few lenses whose sharpest areas come and go throughout the focal length range. To find out if your lens does this or not, you need to get used to reading MTF curves. These scientific charts let you know the optimal sharpness areas of your lens. They can be handy but can take a while to understand how they work. Aperture Range The other big thing you need to understand is that a lens curve of sharpness changes with its aperture range. Shooting wide open, your lens is less sharp generally. Go down a few stops and you'll notice a huge difference. After this peak, your lens becomes less and less sharp, but it's a gradual change. This is something I learned about a long time ago but never knew why. Every time I needed a wide aperture, I would go to the lens' limit (f/1.4 for my 85mm Prime) and then add two stops down. This brought me to f/2.8 for optimal sharpness. When we talk about more less sharp, the comparisons are subtle and gradual. Going from f/2.8 to f/4 isn't going to show you a huge amount of difference. Going from f/2.8 to f/16 will. On top of this, the quality of your images isn't just down to sharpness. You will achieve beautiful images even when using the zoom lens' least sharp aperture or focal length. MTF chart for Sigma 85 mm f/1.4 lens Specialty Lenses Apart from zooms or prime lenses, even stepping out of the wide-angle, standard or telephoto lens realm, there are other lenses we need to talk about. These specialty lenses have been created for specific reasons. You'll notice that these lenses might act similar to the ones we have already looked at, but have very unique qualities. Let's touch on them briefly. Tilt-Shift Lenses A tilt-shift lens is a lens created to mimic the possibilities a large format camera gave us. If you ever tried to photograph a building, only to see it fall away from you towards the top, these lenses are what you need to fix it. This feeling is created because the large building is at increasingly different distances away from your camera. The top is farther away from you than the bottom is. A parallax error is created. What these lenses let you do is change the focal plane to match the relative distance of the building from the camera. This change from a perpendicular focal plane to a parallel one fixes the problem. The Canon TS-E 24mm f/3.5L is a great choice. If you're looking for more information, read our What Is a Tilt-Shift Lens and How to Use One article. Fisheye Lenses Fisheye lenses are ultra-wide angle lenses. They fall into the focal length category of anything below and including 14 mm. These lenses create a very unusual perspective in photography, usually resulting in a circular image. When we use lenses that cause barrel distortion, we try to correct them to create a more realistic image. We embrace the distortion and use them to create something creative. Macro Lenses Macro lenses are specific glassware that allows you to capture small subjects and blow them up to bigger-than-life size. These lenses are more commonly used for scientific or medical purposes but also used in nature and wildlife fields. These cheat sheets are the perfect visual tool to help you master photography. They're always there when you need them... on your phone or in your camera bag... and they've been expertly designed so that you can understand everything at a glance. Never again will you forget a key photography tip!

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