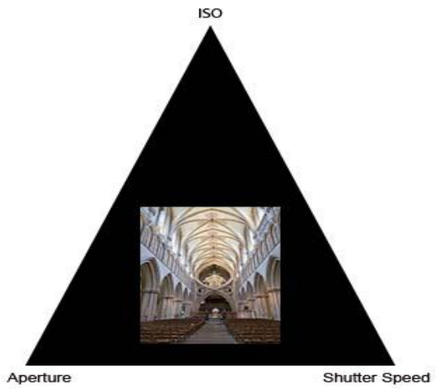
Exposure and the Exposure Triangle

Achieving the perfect exposure relies on setting three elements in camera. These are ISO, Aperture and shutter speed. These three elements can be represented as a Triangle.



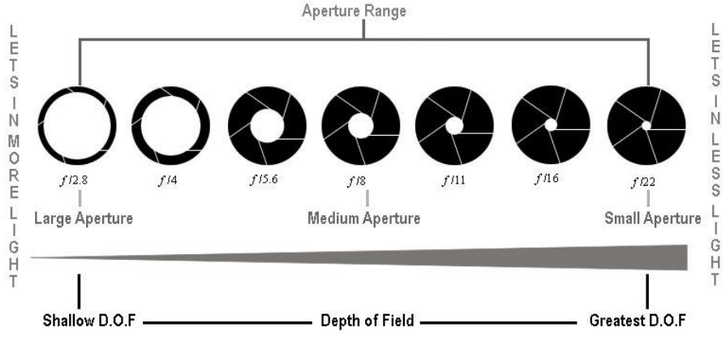
ISO

The lowest ISO setting on most cameras is an ISO of 100 up to around an ISO of 800 or above. However, on some cameras ISO can be set as low as 50 and as high as 102400. The higher the setting the lower the light levels a photograph can be taken in. However, the disadvantage of using a high ISO setting is that the resulting image tends to be affected with image "*noise*". Some cameras will have a noise reduction facility and it can also be removed to varying degrees by the use of software such as Photoshop or Lightroom.

Aperture

A lens's aperture controls the amount of light that enters the camera through the lens and is represented by an f number (f stands for the mathematical term factor). The smaller the number the larger the aperture and larger the number the smaller the aperture. It is calculated by dividing the size of the aperture by the focal length of the lens being used e.g. an aperture of 25mm and a 100mm lens will produce an aperture of f4.

For modern DSLR lenses this is usually controlled by overlapping blades that when moved create a larger or smaller opening. The diagram below shows typical aperture settings and also shows how these affect "depth of field".



The DOF is the extent of the image that is in focus at a given f number. The wider the aperture the shallower the DOF becomes, the narrower the aperture the greater the DOF becomes. A lens's focal length will also have an effect on the DOF. One use of a narrow DOF is to isolate a portrait from the background. A wide angle lens will have a greater DOF at a given f number than of a telephoto lens.

Shutter Speed

A camera's shutter speed governs the amount of time the film or cell is exposed to light. A shutter speed of 1/125 of a second or faster is considered to be fast and anything longer than this is considered to be slow. The chart below shows a list of typical shutter speeds in full, half and third stops:

Shutter Speed in Full Stops		Shutter Speed in Half Stops		Shutter Speed in Third Stops	
1/8000	1/15	1/8000	1/15	1/8000	1/15
		1/6000	1/10	1/6400	1/13
				1/5000	1/10
1/4000	1/8	1/4000	1/8	1/4000	1/8
		1/3000	1/6	1/3200	1/6
				1/2500	1/5
1/2000	1/4	1/2000	1/4	1/2000	1/4
		1/1500	1/3	1/1600	1/3
				1/1250	1/2.5
1/1000	1/2	1/1000	1/2	1/1000	1/2
		1/750	1/1.5	1/800	1/.6
				1/640	1/.3
1/500	1 second	1/500	1 second	1/500	1 second
		1/350	1.5"	1/400	1.3"
				1/320	1.6"
1/250	2 seconds	1/250	2 seconds	1/250	2 seconds
		1/180	3"	1/200	2.5"
				1/160	3"
1/125	4 seconds	1/125	4 seconds	1/125	4 seconds
		1/90	6"	1/100	5"
				1/80	6"
1/60	8 seconds	1/60	8 seconds	1/60	8 seconds
		1/45	12"	1/50	10"
				1/40	13"
1/30	16 seconds	1/30	16 seconds	1/30	16 seconds
		1/20		1/25	
				1/20	

The best use of shutter speed is to freeze or show movement in an image by choosing a fast or slow shutter speed.

How These Three Elements Work Together

The three elements of ISO, aperture and shutter speed can each be set depending on the type of photograph to be taken and the lighting conditions. So, for example, when taking a still life image the best settings would be a low ISO and a narrow aperture in order to get the best DOF. If, on the other hand, the photographer is taking photographs at an event like an air show, then a fast shutter spend needs to be set together with either a wide aperture and/or a high ISO.

When setting a particular aperture and shutter speed combination one thing to consider is that each stop the lens is opened up the shutter speed needs to be increased by one stop and vice versa. The chart below shows this in table form. It also shows how setting a low or high ISO affects the exposure:

	ISO 100	ISO 200	ISO 400	ISO 800	ISO 1600
f1.4	1/250	1/500	1/1000	1/2000	1/4000
f2	1/125	1/250	1/500	1/1000	1/2000
f2.8	1/60	1/125	1/250	1/500	1/1000
f4	1/30	1/60	1/125	1/250	1/500
f5.6	1/15	1/30	1/60	1/125	1/250
f8	1/8	1/15	1/30	1/60	1/125
f11	1/4	1/8	1/15	1/30	1/60
f16	1/2	1/4	1/8	1/15	1/30
f22	1	1/2	1/4	1/8	1/15

The images below demonstrate how a careful choice of ISO, aperture and shutter speed have helped produce the desired effect for the two very different subjects. Both images have been taken with a Canon EOS 60D DSLR.

The first image was taken with a Tamron 90mm macro lens with an exposure of 1/60 sec at f2.8 and an ISO of 800. The use of a wide aperture and telephoto lens has isolated the subject by blurring out the people in both the foreground and background. The second image was taken with a Sigma 120 – 400mm telephoto zoom lens with an exposure of 1/250sec at f13 and an ISO of 200. This time the use of a fast shutter speed has frozen the action while a narrow aperture has kept the aircraft in sharp focus.