Camera, Lens and Film

A camera is a light tight box, which contains a lens, shutter and a variety of controls. There are two technical conditions necessary for the existence of photography. One is chemical; that is that some chemicals are light sensitive. The other is optical/mechanical; that is the pinhole phenomena and how it relates to the formation of the image in the camera.

Chemical
Photographic film has a plastic base on one side and a photographic emulsion on the other side. The emulsion consists of a colloid (gelatin) and silver halide crystals (silver salt). Upon exposure to light the silver halide crystals undergo an invisible change. When a photon of light strikes the light sensitive molecules in photographic film, it undergoes physical and chemical changes that form a latent image. Once this invisible change takes place, the silver halides undergo a visible change by being chemically reduced to metallic silver by developing them out with photographic developer. Without being exposed to light the silver halides cannot be reduced to metallic silver.

Optical
Camera images result from light patterns projected onto light sensitive surface by the lens or aperture.
• Film exposed directly to light will not form an image.
• Film in a camera is shielded from most of the light and only a single ray from any given direction is allowed to strike the film. The light rays are bent so that they cross one another and an image that is upside down and backwards is recorded on the film.

Pinhole cameras are impractical because they require long exposures. In theory pinhole cameras are always in focus, but practically never do they form focused images. A lens can focus light rays into much finer points than a pinhole camera can.

Camera Types
1. Pinhole – The most basic of cameras, which is a light tight box with small hole or aperture.

2. Range Finder - Uses a two-mirror system, which lines up two separate images of the same scene and at the same time corrects for parallax error.

3. Twin Lens reflex – This camera has two lens one that is used for framing and focusing and the other focuses the light rays on to the film plane to make the exposure.

4. SLR – Single lens reflex camera bounces the image is seen through the same lens that records the image to the film.

5. View Camera/ Field Camera – The image is projected onto a ground glass focusing system. Both the front and back standards shift, tilt and swing. The lens board and focal planes are separated by a flexible bellows.
**35mm Cameras**

35 mm cameras are usually classified according to their viewing system. The viewing system is how you see and compose the picture before releasing the shutter.

**35mm Viewfinder** – the scene to be photographed is viewed directly through an optical device separate from the lens. A viewing problem occurs with this system if a correction is not made called parallax error; that is a discrepancy between what the photographer sees through the viewer and what is recorded on the film. Parallax error is more of a problem the closer the camera is to the subject.

**35mm rangefinder** – this is essentially a viewfinder system that has been corrected for parallax error by the use of two mirrors. The advantage is its speed and quietness compared to a single lens reflex camera.

**SLR – Single Lens Reflex** – You view the scene or image directly through the lens that will be used to take the Picture. Reflex – derived from the word reflection refers to a mirror located inside the camera body in front of the film plane, which reflects the light from the subject up through a prism, which in turn exits through the viewfinder.

When viewing a scene, the film is protected from light by a shutter located directly in front of the film plane.

When you press the shutter release button to take the picture, the mirror lifts upward out of the way, while the shutter opens allowing light to reach the film in the camera. It is at this moment when the mirror blocks the path of light through the viewfinder, that you can no longer view the scene, while at same time the film is being exposed.

**Focal Plane** – This is the surface where light rays fall and come together to form an image.

The film inside the camera is at the focal plane.

**Viewfinder**

- **Mirror** - reflects the image into the viewfinder for framing and focusing.
- **Focusing Screen** – displays the image from the lens onto a ground glass used to aid in framing and focusing of the image.
- **Pentaprism** – causes you to view the image oriented correctly.
- **Viewfinder Eyepiece** – allows you to focus your eye on the image displayed by the focusing screen.
- **Information Displays** – Such information displayed inside the viewfinder may be: Light meter readings, f-stop and shutter speed.

**Light Meter**

Most cameras have a built in light metering system. Light meters are designed to calculate a suitable exposure setting based on aperture size and shutter speed. Light meters read for 18% gray or middle gray. Based on the subject’s brightness, aperture settings and shutter speeds are adjusted in relationship to the meters indicated exposure.
Camera Lens

The lens on our camera is very important in producing the quality of the image you are going to create. Each lens has its own set of characteristics, from image sharpness, and focusing features, to its speed and focal length.

**Focal Length** – The focal length of the lens is the distance from the center of the lens to the face of the focal plane.

**Fixed Lens** - A fixed lens has only one focal length. For example, a 50-mm lens is a fixed lens. Fixed lenses have a much sharper focus because they designed to provide only one angle of view.

**Zoom Lens** – A zoom lens has more than one focal length and can change the angle of view. Such as a lens that has a 27mm – 80 mm zoom.

**Lens Aperture** – The aperture works with the shutter to control the amount of light that hits the film. The aperture consists of thin metal leaves, which overlap to make an adjustable diaphragm within the lens. The larger the diaphragm opening the more light passes through. The scale of the openings is indicated in terms of f-stops. The larger the f-stop the smaller the opening.

**F-stops** – 1.4, 2, 2.8, 4, 5.6, 8, 11, 16, 22, 32, 64

These numbers are fractions, which indicate the ratio of the focal length to the diameter of the lens. Each f-stop is approximately 1.4 times larger than the proceeding value. The aperture scale is arranged so that each aperture setting transmits twice as much light as the next smaller f-stop. In addition to controlling the amount of light entering the camera, the aperture size also determines the depth of field.

**Lens speed** – The speed of the lens is determined by the lenses largest available aperture. For example a lens with its largest f-stop opening at f-5.6 is considered to be a slow lens. A lens with its largest f-stop opening at f-1.4 is a fast lens. f-1.4 lets in more light to reach the film allowing for faster shutter speeds.

**Depth of Field** – The aperture not only controls the amount of light entering the lens, it also focuses the light on its way to the focal plane. Depth of field is the amount of available focus in an image and is determined by the aperture size within the lens. A large aperture lets in a lot of light but has a shallow depth of field, whereas a small aperture lets in much less light and will have a very deep depth of field. The closer a subject is to the camera, the shorter the depth of field will be and the farther away a subject is from the camera, the greater the depth of field. You can control depth of field by setting the aperture size to give the desired effect and choose a shutter speed to give correct exposure.

**Law of Reciprocity** – This is the correlation between the aperture and the shutter speed. Consecutive shutter speed settings are related to one another the same way f-stop numbers are. Each consecutive lower number lets in approximately twice as much light as the preceding number.

F-8 at 1/500 is the same as F-11 at 1/250.

**Reciprocity Failure** – This occurs when exposure times are too fast or too slow. Most films experience reciprocity failure at shutter speeds of 1/1000 of a second or faster and at one second or slower. To compensate for this failure time must be added to the exposure.
Shutter System

Proper exposure is achieved through adjusting both shutter speed and aperture size according to an indicated light meter reading.

35mm cameras generally have a focal plane shutter. It is located directly in front of the film. This allows for camera systems with a wide variety of interchangeable lenses. Another type of shutter is a leaf shutter, which is located inside the lens and works much like the aperture.

**Shutter Speed** - The shutter system controls the amount of time that the film is exposed to light. Shutter settings refer to fractions of a second. Shutter settings should be set exactly on one of the numbered settings.

**Shutter settings** – 8, 15, 30, 60, 125, 250, 500, 1000 etc.

1/8, 1/15, 1/30, 1/60, 1/125, 1/250 of a second etc.

Each shutter setting allows the shutter to remain open approximately half as long as the one before it, and twice as long as the one after it.

There are two shutter settings which allow for extended exposure times.

B – bulb – this setting allows the shutter to remain open as long as the shutter button is held down.

T – time – the shutter opens when the shutter button is pressed once and remains open until the shutter button is pressed again.

One reason to use a long exposure would be to get enough exposure in very dim light. If you anticipate shooting in low light conditions, considering your desired outcome, using a high-speed film is generally better than making long exposures.

When photographing stationary objects the shutter speed only needs to be fast enough to avoid blurring from shaky hands. 1/60 of a second will stop most motion.

When photographing moving objects, setting the shutter speed is more complex. Moving objects shot at slow shutter speeds will appear blurry on film. Fast shutter speeds will stop motion.

**How to freeze action:**

- Use a shutter speed fast enough so that the subject doesn’t move perceptively while the shutter is open.
- Use a film with a higher film speed so that you can use faster shutter speeds.
- Pan the camera along with the subject.
- Move back and accept a smaller subject size within the frame.
- Shoot at the peak of action.

**Panning with the subject** – With a horizontally moving subject traveling at a fairly uniform speed, swing or pan the camera horizontally. Move the camera smoothly so that the subject stays centered in the viewfinder. Panning transfers the motion blur from the subject to the background.
Film Exposure

Once you have composed and focused the image, the next step is to set the exposure so that the image will be correctly exposed on the film. Correct exposure depends on three factors:

- **Brightness of the light reaching the film** (aperture setting)
- **Length of time the light is allowed to strike the film** (shutter speed)
- **Light sensitivity of the film** (ASA / film Speed)

**Aperture** controls the amount of light that enters through the lens. Larger apertures let in more light and have a shallower depth of field. Smaller apertures let in less light and have a greater depth of field.

**Shutter Speeds** effect total exposure of light to film. Short shutter speeds let in less light and stops motion, whereas longer shutter speeds let in more light and creates motion blur.

**Film Sensitivity / Film Speed** is a numbered system which allows the camera or light meter to estimate how much exposure the film needs to place the brightness range of an average scene at the correct location on the films characteristic curve.

- **ASA** – American Standards Association
- **ISO** – International Standards Organization
- **DIN** – Deutsche Industry Norm

**FILM / SPEED RATINGS:** 25, 50, 100, 125, 200, 400, 800, 1600, 3200.

The difference between film speed rating numbers 400-200 is that 200 speed film needs twice as much light (1 stop more light) as 400 speed film to give it the same exposure.

**Fast Films** have an ASA of 400, 800, or higher. These films require less exposure than slow films and will have larger grains of **silver halide**.

**Slow Films** have an ASA of 200, 100, or less. These films require more exposure than fast films and will have finer grains of silver halide.

**Setting film speed manually** When loading film into your camera you must be certain to set the film speed on your camera / light meter, otherwise an incorrect exposure will result.

**Using the Light Meter**

Light Meters give an indicated exposure based on middle gray. This is not always the correct exposure. The general rule of thumb is that if your subject is Brighter than middle gray you should over expose one or two stops. If the subject is darker than middle gray you should under expose one to two stops.

**Film Types**

**Black and White negative Film** - Produces a B&W negative. In a negative brightness is reversed. White areas record as black and black areas record as white. To make a print the negative image is exposed to photographic paper, when developed the brightness is again reversed.
Color Negative Film – The colors are reversed. Color film is usually labeled as color print film because color prints are the end result.

Color Slide film or Reversal Film – The image formed is a color positive image on the film and separate processing is necessary.

**Camera Controls**

**On/off Switch**

**Shutter Button** – When the camera is on and the controls are set, press the shutter button to release the shutter.

**Mode Selector** – The mode selector enables you to select one of the exposure modes offered by the camera. Most cameras offer manual, aperture priority or shutter priority modes.

**Shutter Speed Dial** – use to set the shutter speed manually (some cameras use A for automatic).

**Lens Aperture Ring** – for automatic settings, set to A for the smallest aperture.

**Lens Focusing ring** – Use to focus manually.

**Film Advance Lever** – Each time the film advance lever is used, the next frame of the film is brought into place behind the lens. Also the shutter mechanism is reset so that it can make the next exposure. (After loading the film advance film so that the frame indicator is set to the first frame of the film)

**Rewind Button** – To prepare the camera for rewinding of the exposed film back into the cartridge, depress this button.

**Rewind Crank** – Tip this crank up and turn clockwise to rewind film.

**Depth of Field Button** – Because viewing is done with an open aperture and you do not see the actual depth of field that will record on the film. This button allows you to see the image as it will be recorded on the film.

**Mirror Lock up Controls** – This eliminates vibration.

**Hot Shoe** – This provides a place to mount an external flash unit.

**Flash Connector** – in addition to the hot shoe, some cameras have a connection to accept an electrical cord for the flash unit. This is called a P.C. cord.