Chapter 23 Summary – Mirrors and Lenses

►Images are formed where rays of light intersect or where they appear to originate. A **real image** is one in which light intersects, or passes through, an image point. A **virtual image** is one in which the light does not pass through the image point but appears to diverge from that point.

►The image formed by a flat mirror has the following properties:

1. The image is located an equal distance behind the mirror.
2. The image is unmagnified, virtual, and upright.

►The **object distance** p and **image distance** q for a spherical mirror of radius R are related by the mirror equation:

$$\frac{1}{p}+\frac{1}{q}=\frac{1}{f}$$

where f = R/2 is the **focal length** of the mirror.

►The **magnification**, M, of a mirror is defined as the ratio of image height h' to the object height h; M is also equal to the ratio of image distance (-q) to object distance p:

$$M=\frac{h'}{h}=\frac{-q}{p}$$

►The object distance p and image distances q for a thin lens are related by the **thin-lens equation**:

$$\frac{1}{p}+\frac{1}{q}=\frac{1}{f}$$

The sign conventions are listed in Table 23.3.

►The magnification for a thin lens is

$$M=\frac{h'}{h}=\frac{|q|}{|p|}$$

►**Aberrations** are responsible for the formation of imperfect images by lenses and mirrors. **Spherical aberration** results from the fact that the focal point of a light ray far from the principle axis is different from that of a light ray near the axis. **Chromatic aberration** arises from the fact that the index of refraction varies with the wavelength of light.