Unit 10: Optics

Optics is the branch of Physics involving the study of sight and the behaviour and properties of light.

"Without light, there would be no sight." Everything that can be seen is seen only when light from that object travels to our eyes.

MIRRORS: There are two types of mirrors to consider: plane (or flat) and curved.

A. Plane Mirrors

A plane mirror is a flat, smooth surface that reflects light in a regular way.

Recall from our previous unit that light obeys the law of reflection (the angle of incidence equals the angle of reflection).

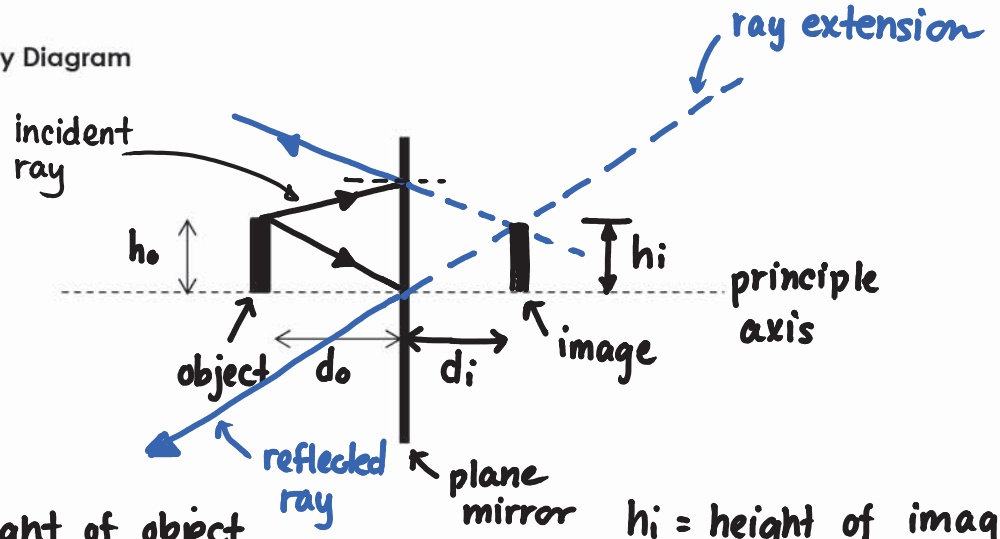
Image Formation in a Plane Mirror

1) Many light rays from an object will be incident towards a mirror.

2) Light will reflect off the mirror according to the law of reflection.

3) An image is located where all the reflected rays intersect (converge). In this case, it's behind the mirror.

Plane Mirror Ray Diagram



h_o = height of object

d_o = distance of object

h_i = height of image

d_i = distance of image

Plane Mirror Images have 'characteristics' that describe the **location**, **size**, **orientation**, and **type** of the image.

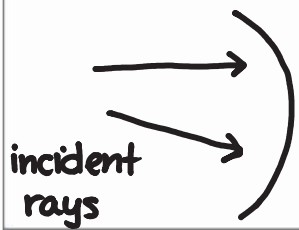
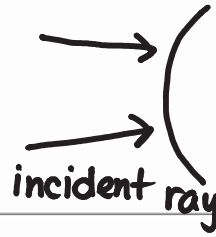
- The object distance (d_o) is __equal__ to the image distance (d_i)
- The object height (h_o) is __equal__ to the image height (h_i). In other words, the size of the image is the __same size__ as the original object.
- The image is __upright__.
- The image is __virtual__ (when an image is located behind the mirror).

(an image is real when it is located in front of the mirror)

B. Curved Mirrors

Most curved mirrors are portions of complete spheres. Their shape can therefore be defined by the __radius of curviture (C)__ of the sphere. The radius of curvature is the centre of the sphere.

The smaller the radius of curvature the __greater__ the angle of reflection; whereas the larger the radius of curvature the __smaller__ the angle of reflection.

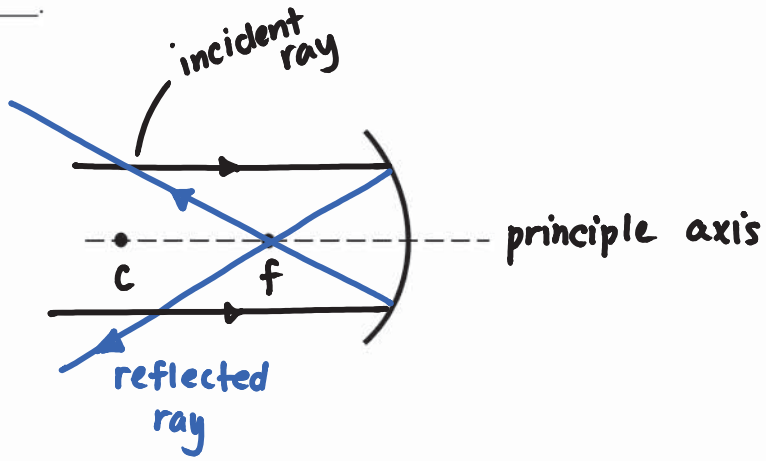
Concave Mirror	Convex Mirror
 mirrors that "cave in"	 mirrors that have a "pot belly"
satelite dish, spotlight, reflector telescope	security mirrors, vehicle's side mirror

For **concave** mirrors, the parallel incident rays __converge__ as they reflect off of the mirror. The point where the rays converge is called the __focal point (f)__ for the mirror. The focal length is the distance from the focal point to the surface of the mirror.

The focal point is half-way between the radius of curvature and the mirror.

$f = \frac{C}{2}$ or $C = 2f$

For **concave** mirrors, the focal length is ___in front___ of the mirror and the focal length is ___positive___.



For **convex** mirrors, the parallel incident rays ___diverge___ as they reflect off of the mirror. The focal point is ___behind___ the mirror and the focal length is ___negative___.