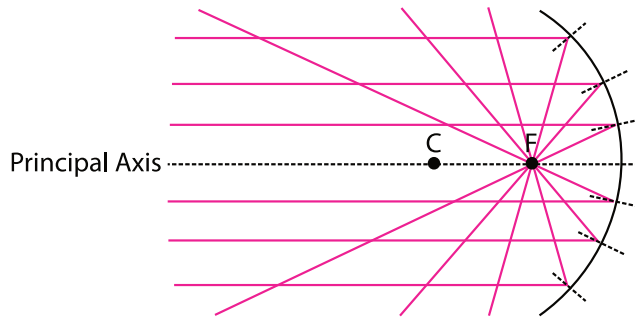
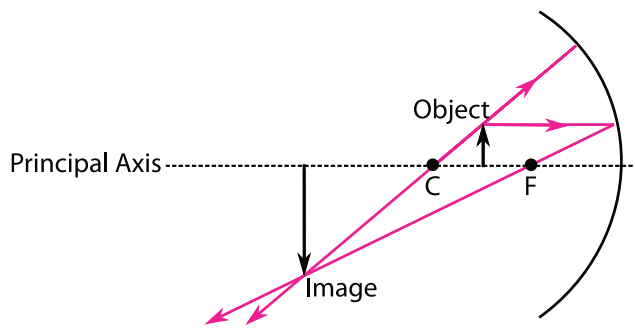
40 Reflection – Concave Mirrors ♡

The most commonly encountered curved mirrors are spherical. Spherical mirrors are either concave or convex.

Concave mirrors produce a real image at the focal point (labelled F in the diagram below) when parallel rays are incident parallel to the principal axis, which passes through the centre of curvature of the mirror (labelled C). The distance from the mirror to C is always double the distance from the mirror to F for spherical mirrors. In the diagram, arrows have not been included because the rays would follow the same geometric path in the reverse direction. An object at F will produce an image at infinity.



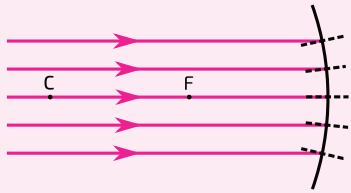
An object placed at C produces a real image at C because the rays are always incident on the mirror with zero angle of incidence. Combining these two ideas, the image of an object placed anywhere between C and F can be found graphically thus:

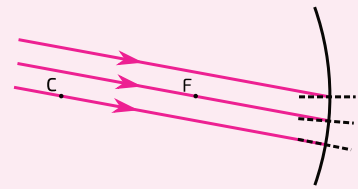


The three rules:
1. Rays passing through C reflect back through C.
2. Rays parallel to the principal axis reflect through the focal point.
3. Rays passing through the focal point reflect parallel to the principal axis.

For each of the questions, sketch the ray diagram.

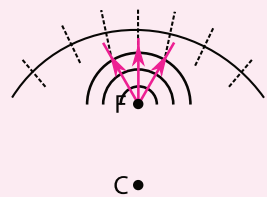
40.1 Copy and complete the following ray diagrams, each showing rays incident on concave mirrors, by drawing in the reflected rays at the correct angles.

(a) 

(b) 

40.2 What is the name for the point to which wave fronts parallel to the principal axis converge after being reflected from a concave barrier?

40.3 The diagram below shows circular wave fronts approaching a concave barrier, having been generated at the barrier's focal point. Draw a diagram to show what happens to the wave fronts after reflection from the barrier.



40.4 An object placed at the centre of curvature produces an image.

(a) What type of image is produced? [Real or virtual]

(b) Where is the image produced? [Between the mirror and F, at F, between F and C, at C, or between C and infinity]

(c) What is the orientation of the image? [Upright or inverted]

(d) What is the size of the image? [Diminished, same size as the object, or enlarged]

40.5 An object between C and F produces an image.

(a) What type of image is it?
(b) Where is the image?
(c) What is its orientation?
(d) What is its size?

40.6 An object placed between C and infinity produces an image.

(a) What type of image is it?
(b) Where is the image?
(c) What is its orientation?
(d) What is its size?

40.7 An object placed between F and the mirror produces an image.

(a) What type of image is it?
(b) Where is the image?
(c) What is its orientation?
(d) What is its size?

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