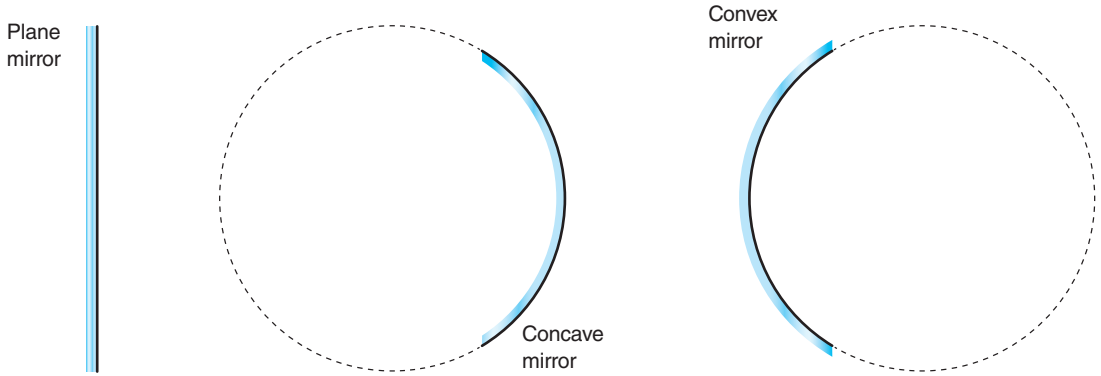
Mirrors

As you know, a **mirror** is a polished surface that **reflects all of the light that strikes it**.

Depending on the shape of their surface, mirrors are classified as either **plane** or **curved**. Curved mirrors are either **concave**, which means that the inside of the curved surface is polished, or **convex**, which means that the outside of the curve is polished.



Unit 12

Mirrors

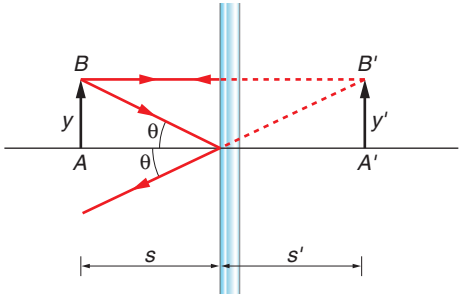
Images in plane mirrors

Images seen in a plane mirror are:

- The **same distance** from the mirror as the object.
- The **same size** as the object.
- **Symmetrical** in relation to the mirror.

In order to form the image of an object, we draw two rays for each of the object's points according to the laws of reflection. By extending the rays, we get the **image** of the point object.

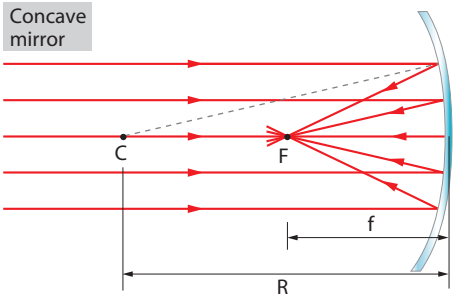
The extensions of the rays are **imaginary lines**. They are useful for obtaining the image, but they do not really exist; for this reason, we call the images they form **virtual** images.



Mirrors

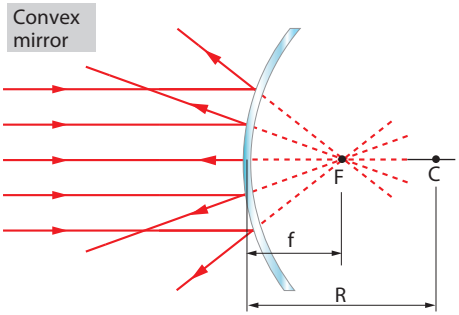
Characteristics of curved mirrors

When light rays strike a **concave** mirror, the mirror reflects them inward, making them **converge** on a point called the **focus**, which is located at a distance equal to half of the radius of curvature of the mirror (see figure on left).



Mirrors

Un espejo esférico **convexo,** por el contrario, hace **divergir** los rayos reflejados, pero de modo que son las **prolongaciones** de los rayos reflejados las que pasan por el **foco.**



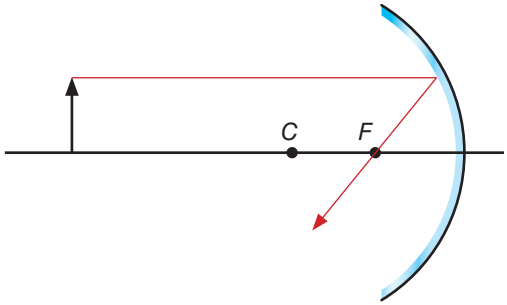
Mirrors

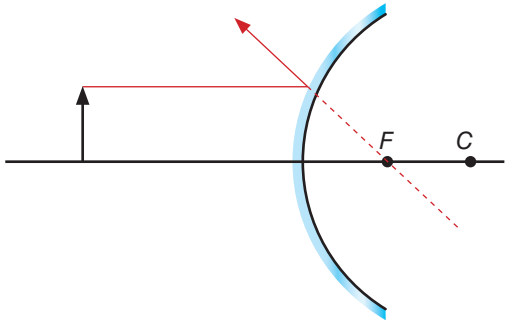
Image formation by curved mirrors

With a ray diagram, we can locate an image by drawing at least two of the three rays whose paths can be determined.

The three rays are::

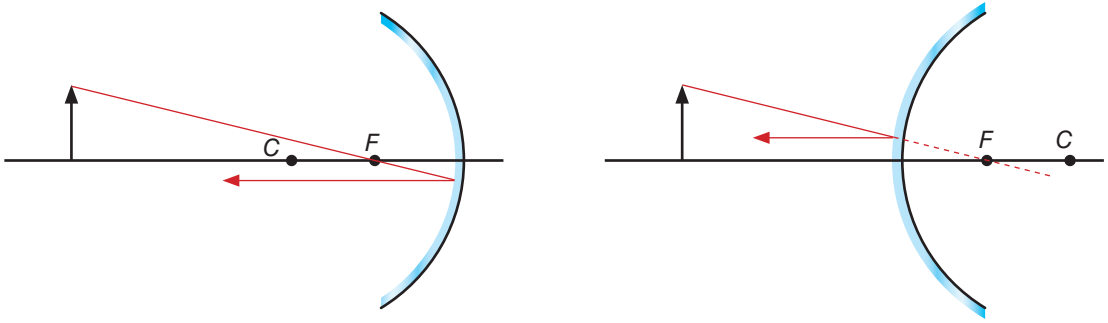
- A ray from the object that travels parallel to the optical axis. If the mirror is concave, the reflected ray passes through the focus. If the mirror is convex, it is the extension of the reflected ray which passes through the focus.





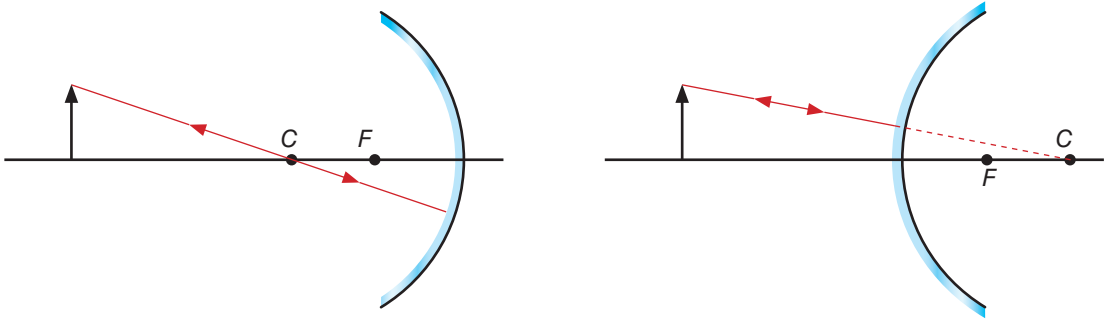
Mirrors

- A ray from the object that passes through the focus if the mirror is concave, or travels towards it if the mirror is convex. The ray is reflected back parallel to the optical axis.



Mirrors

- A ray from the object that passes through the centre of curvature of the mirror (or its extension passes through it). It is then reflected back along its original path.

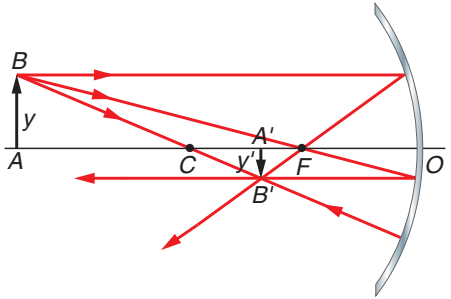


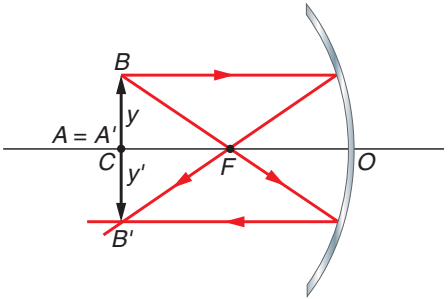
By following these rules, we can use a ray diagram to determine the characteristics of the image formed by a mirror in any situation. Let's take a look at some illustrative examples.

MIRRORS

Examples of image formation by concave mirrors

- The object is located at a distance **greater than the radius of curvature**. The image formed is real, inverted and smaller than the object; it lies between the centre of curvature and the focus.

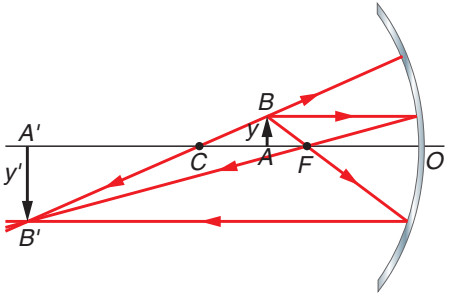




- The object is located at the **centre of curvature**. In this case, the image formed is real, inverted and the same size as the object; it lies at the same point.

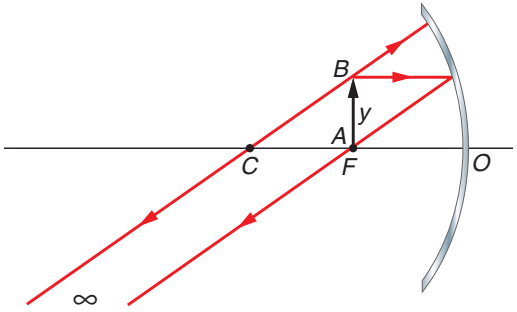
MIRRORS

Examples of image formation by concave mirrors



- The object is located **between the centre of curvature and the focus**. Here, the image that is formed is real, inverted and larger than the object; it lies to the left of the centre of curvature.

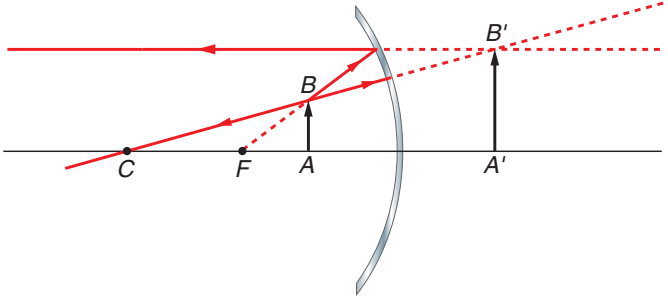
- The object is located at the **focus**. The image is formed at infinity because the reflected rays are parallel and therefore do not meet.



MIRRORS

Examples of image formation by concave mirrors

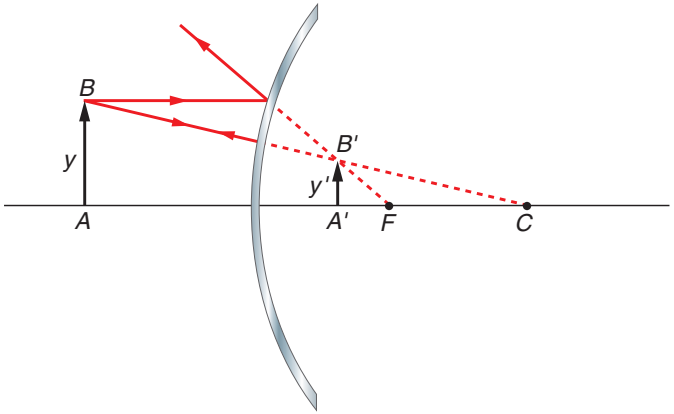
- The object is located to the right of the **focus**. This is the only case in which the image formed is virtual. It is upright and larger than the object.



Mirrors

Image formation by convex mirrors

Unlike images formed by concave mirrors, whose characteristics depend on the position of the object, images formed by convex mirrors are always virtual (because they are formed by the extensions of light rays), upright and smaller than the object.



Mirrors

Activities

1 Why are the images formed by plane mirrors always virtual?

2 Explain why your right hand looks like your left hand when you see it reflected in a plane mirror.

3 Find everyday objects which use each of the different types of mirrors you have studied. For each object, explain the benefits of using that type of mirror.

4 Which type of mirror is capable of producing both real and virtual images? What determines whether a real or virtual image is formed?