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ADDIS ABABA

2012E.C (2019/20) ACADEMIC YEAR

4TH QUARTER PHYSICS 1ST HAND OUT FOR GRADE10

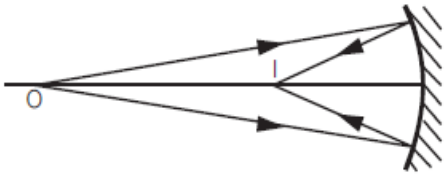
NAME_____GRADE _____SECTION_____

Images formed by curved surfaces

Curved surfaces are of two types. A given curved surface is called **concave** when it is viewed from the **inner side** and **convex** when viewed from the **outer side**.

Concave mirrors

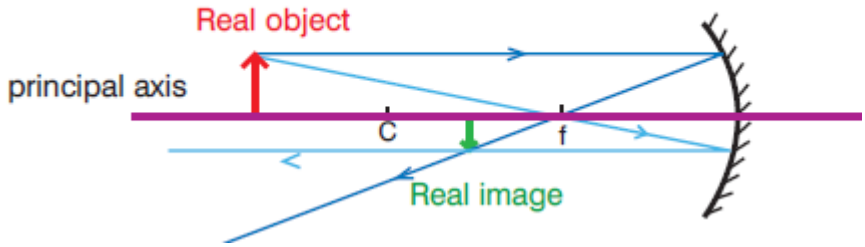
A mirror with a reflecting surface that bulges inwards, away from the light source.



Terms used in a curved mirror

1. **Focus** the point at which light rays converge.
2. **Focal length(f)** the distance from the centre of acurved mirror to the principal focus
3. **Principal axis(p)** the line passing through the optical vertex and centre of curvature of the face of a curved mirror
4. **Principal focus** the point at which all light reflecting from a curved mirror converges.
5. **Radius of curvature(R)** the radius of the sphere that forms the basic curve of a concave mirror

   The three reflected rays and image formations by a curved mirror
   1. A ray parallel to the principal axis is reflected through the focus
   2. A ray through the focus is reflected parallel to the principal axis
   3. A ray through the centre of curvature is reflected back through the centre of curvature.

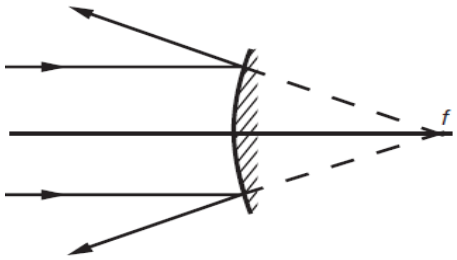


Convex mirror

A mirror with a reflecting surface that bulges outwards, toward the light source.
A convex a mirror cannot form a real images, so you will never need a screen with it. It can act as a looking glass, however, and you will be able to use it to see a virtual images ,which seems to be a short way behind it.

This images has the following properties

- ✓ **It is always the right way up(virtual)**
- ✓ **It always has magnification of less than one(diminished)**
- ✓ **It has a striking clarity**



The three reflected rays and image formations by a curved mirror

1. A ray parallel to the axis is reflected as though it come from the focal point
2. A ray bending to the focal point is reflected to the principal axis
3. A ray heading towards the centre of curvature is reflected back of itself.

The mirror equations

- ✓ The mirror equation is an algebraic relationship between object distance(S_0),image distance(S_i) and focal length(f)of mirror.

The connection between them is:

$$\frac{1}{s_o} + \frac{1}{s_i} = \frac{1}{f}$$

The magnification relation ship for mirrors

- ✓ Magnification is defined to be:

  M=$\frac{the\ height\ of\ the\ image}{the\ height\ of\ the\ object}=\frac{hi}{ho}$
- ✓ It is just anumber,and will have no units

Sign conventions

Quantity	Concave mirror	Convex mirror
Focal length f	+ve sign	–ve sign
Object distance s_o	In front of mirror +ve sign	Behind mirror –ve sign (virtual)
Image distance s_i	In front of mirror +ve sign (real)	Behind mirror (virtual)
Magnification m	Image upright +ve sign	Image inverted –ve sign

Solved examples

1. **A mirror has afocal length of 200mm.if an object is placed 0.6m from the mirror, where will the image be formed?**

   So/n

   $\frac{1}{s^\circ}+\frac{1}{Si}=\frac{1}{f}$

   $\frac{1}{0.6}+\frac{1}{Si}=\frac{1}{0.2}$

   1.67+$\frac{1}{Si}$=5.00=$\frac{1}{Si}$=5-1.67=3.33

   $\frac{1}{Si}$**=3.33**

   $$Si = 0.3(30cm, 300mm)$$

   Therefore, a screen would have to be placed 300mm back from the mirror

2. **A candle of height 10cm is placed in front of aconcave mirror whose focal length is 25cm .where is the image formed and what is its type?**

   Given

   s_o=10cm, f=25cm(f is +ve for a concave mirror)

   So/n

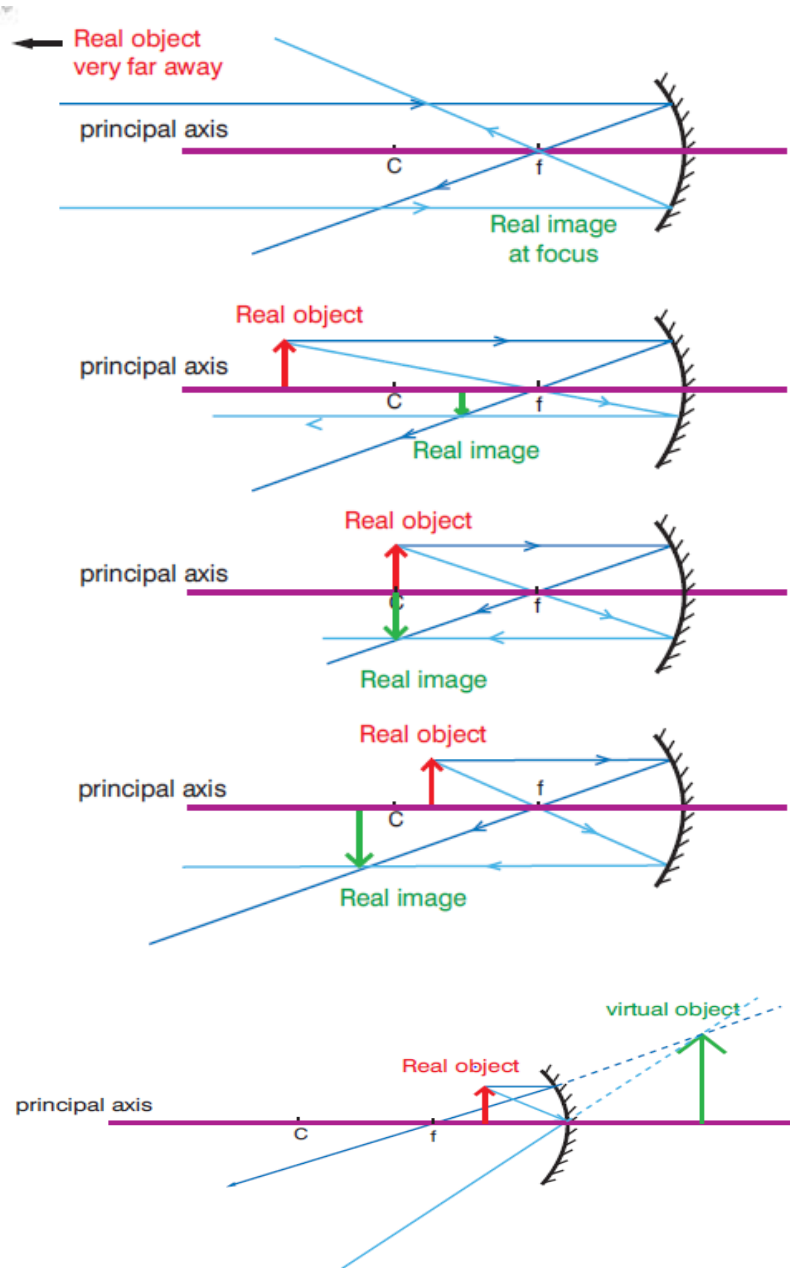
   $\frac{1}{Si}=\frac{1}{f}-\frac{1}{So}=\frac{1}{Si}=\frac{1}{25cm}-\frac{1}{-10cm}=\frac{-50cm}{3}$**=-16.7cm**

   the negative sign indicates that the image is avirtual image.that means, ***it is*** **16**.7 cm behind the vertex of the mirror.

   M=$\frac{hi}{ho}=-\frac{-16.7}{10}$=1.67

Finding the position and nature of the image formed by a concave and a convex mirror using the mirror equation and a ray tracing method

$(\boldsymbol{RTM})$



4TH QUARTER PHYSICS 1ST WORKSHEET FOR GRADE10

NAME_____GRADE _____SECTION_____

i. ANSWER THE FOLLOWIMG QUESTIONS ACCORDINGLY

1. **An object is placed 50cm in front of a convex mirror .the image size is one-tenth of the object size .what is the focal length of the mirror?(**$(ans, f = -5.56cm)$
2. **A candle is placed 10cm away from a concave mirror. A virtual image is formed at 50/3cm away from the mirror .what is the focal length of the mirror?**$\left(ans\ f = \frac{50}{2}cm\right)$
3. An object is placed 25 cm from a convex mirror .the image of the object is found to be half the size of the object .where is the focal point of the mirror?$(ans\ f = -25cm\ or\ 25cm\ behind\ the\ mirror)$
4. If an object is placed between the principal focus and the centre of curvature of a concave mirror ,describe the characteristics of image formed using RTM of a curved mirror
5. Find the position and nature of the image formed by the concave and convex mirrors from the given below figure

i. Using the mirror equations

ii. A ray tracing method