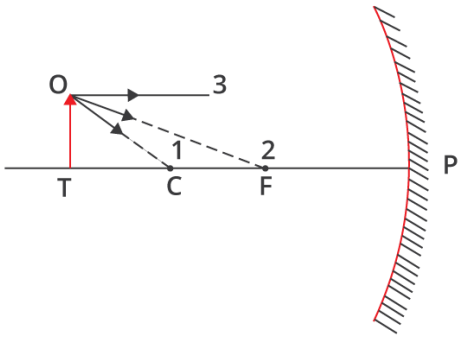
# QUIZ: IMAGE FORMATION BY SPHERICAL MIRROR

**1.** Meena conducts an experiment to study nature of image formed by a concave mirror. She places the object at different distances from the pole of the mirror. In which of the following cases, the image formed is virtual, erect and enlarged?
When the Object is placed
(a) beyond centre of curvature.
(b) between centre of curvature and focus.
(c) at focus
(d) between focus and pole of the mirror.

**2.** An object 4 cm in size, is placed at 20 cm in front of a concave mirror of focal length 15 cm. Which of the following correctly represents the image distance ($v$) and height ($h'$), as per New Cartesian sign convention?
(a) $v$ = 60 cm, $h'$ = 12 cm
(b) $v$ = -60 cm, $h'$ = 12 cm
(c) $v$ = *60 cm,* $h'$ = *-12 cm*
(d) $v$ = -60 cm, $h'$ = -12 cm

**3.** An object OT is placed in front of a concave mirror as shown in figure, P, F and C represent pole, focus and centre of curvature of the mirror. These rays marked 1, 2 and 3 start from point O of the object. After reflection from the mirror, the rays meet at the tip of the image formed.



The ray/rays which is/are incident normal to the mirror is
(a) Only 1
(b) Only 2
(c) Only 3
(d) 1 and 2

**4**. An object and a screen are separated by 25 cm. When a convex lens is placed between them at a distance of 5 cm from the object, a sharp image is formed on the screen. The focal length of the lens is

(a) 20 cm
(b) 6.67 cm
(c) 4.0 cm
(d) 2.0 cm.

**5.** A lens has a power of -2D. Its focal length and type of lens is

(a*)* -50cm, convex
(b) -50cm, concave
(c)+50cm, convex
(d)+50cm, concave

**Answers:**

**1. (d)**
**Options:**
(a) When the object is placed beyond the center of curvature, the image formed is real, inverted and diminished. Hence this option is wrong.
(b) When the object is placed between center of curvature and focus, the image formed is real, inverted and enlarged. Hence this option is wrong.
(c) When the object is placed at focus, the image formed is real, inverted and highly enlarged. Hence this option is wrong.
(d) When the object is placed between focus and pole of the mirror, the image formed is virtual, erect and enlarged. Hence this option is correct.

**Explanation:** When the object is beyond focus, the image formed is real and inverted. When it is at focus, the image remains real and

inverted but is highly enlarged. For position between the focus and pole of the mirror, the image formed is virtual, erect and enlarged.

**2. (d)**

**Options:**

(a) $u$= -20 cm, $f$= -15cm. Using $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$, we get $v$= -60 cm, $m=\frac{h'}{h}=\frac{-v}{u}=-3$, therefore $h'$= -12 cm. Hence this option is wrong.

(b) Since $u$= 20 cm, $f$= -15cm, using mirror formula i.e. $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$, we get $v$ = - 60 cm, $m=\frac{h'}{h}=\frac{-v}{u}=-3$, therefore $h'$= -12 cm. Hence this option is wrong.

(c) $u$ = -20cm, $f$= - 15 cm using mirror equation i.e. $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$ we get $v$ = -60 cm, $m=\frac{h'}{h}=\frac{-v}{u}=-3$, therefore $h'$= -12 cm. Hence this option is wrong.

(d) Since $u$= -20cm, $f$= -15cm, using mirror equation i.e. $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$, we get $v$ = -60 cm, $m=\frac{h'}{h}=\frac{-v}{u}=-3$, therefore $h'$= -12 cm.
Hence this option is correct.

**Explanation:** Using New Cartesian sign convention, $u$=-20 cm, $f$ =-15 cm. Using mirror formula, $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$, we get $v$= -60 cm, Now using $m=\frac{h'}{h}=\frac{-v}{u}$ we get $h^1 = -\ 12cm$. Hence option (d) is correct.

**NOTE FOR TEACHERS**: We can generate many more questions based on this question, emphasizing the use of New Cartesian sign conventions. It helps students to understand and apply the use of sign convention in solving similar problems.

**3. (a)**

**Options:**

(a) Ray 1 passes through C and any ray which passes through the center of curvature of the reflecting surface is always normal. Hence this option is correct.

(b) Ray 2 passes through F. So after reflection from the mirror, it travels parallel to the principal axis of the mirror i.e. TP. Hence this option is wrong.

(c) Ray 3 is parallel to the principal axis of the mirror i.e TP. Thus after reflection, it passes through focus (F). Hence this option is wrong.

(d) Ray 1 passes through C and any ray which passes through the center of curvature of the reflecting surface is always normal. But

ray 2 passes through F, so after reflection from the mirror, it travels parallel to the principal axis of the mirror. Hence this option is wrong.

**Explanation:** Any incident ray passing through center of curvature meets the mirror, along the normal to the mirror at that point. So option (a) is correct. Note that this fact helps in finding the direction of reflected ray corresponding to an incident ray at a point on the mirror, using law of reflection.

**4. (c)**

**Options:**

(a) $u$ = -5 cm, $v$ = +20 cm, using lens formula $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ , we get $f$ = 4 cm. Hence this option is wrong.

(b) $u$ = -5 cm, $v$ = +20 cm, using lens formula $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ , we get $f$ = 4 cm. Hence this option is wrong.

(c) $u$ = -5 cm, $v$ = +20 cm, using lens formula $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ , we get $f$ = 4 cm. Hence this option is correct.

(d) $u$ = -5 cm, $v$ = +20 cm, using lens formula $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ , we get $f$ = 4 cm. Hence this option is wrong.

**Explanation:** Using New Cartesian convention, $u$ = -5 cm, $v$ = +20 cm. Using lens formula $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ , we get $f$ = 4 cm. Hence option (c) is correct.

**5. (b)**

**Options:**

(a) Here power of lens is -2D. Using P = $\frac{1}{f}$, we get $f$ = - 50 cm. Since focal length is negative, therefore it is a concave lens. Hence this option is wrong.

(b) Here power of lens is -2D. Using P = $\frac{1}{f}$, we get $f$ = - 50 cm. Since focal length is negative, therefore it is a concave lens. Hence this option is correct.

(c) Here power of lens is -2D. Using P = $\frac{1}{f}$, we get $f$ = - 50 cm. Since focal length is negative. Hence this option is wrong.

(d) Here power of lens is -2D. Using P = $\frac{1}{f}$, we get $f$ = - 50 cm. Since focal length is negative. Hence this option is wrong.

**Explanation:** Power of a lens of focal length 'f' is given by P = $\frac{1}{f}$ . If $f$ is expressed in metres, then power is expressed in Diopter (D). Here P= -

2D, using P = $\frac{1}{f}$ we get $f$ = - 0.5 m = - 50cm. From New Cartesian convention, concave lens has negative focal length. Therefore the given lens is a concave lens since its focal length is negative. Hence option (b) is correct.