Test / Exam Name: Light Reflection And Refraction **Standard: 10th** **Subject: Science**

Instructions

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Q1. In order to obtain a magnification of, −1.5 with a concave mirror of focal length 16cm, the object will have to be placed at a distance. **1 Mark**

A Between 6cm and 16cm. **B** Between 32cm and 16cm. **C** Between 48cm and 32cm. **D** Beyond 64cm.

Ans: **B** Between 32cm and 16cm.

Explanation:

To obtain a magnification of -1.5, the object needs to be placed between the focus and the centre of curvature.

Q2. If R is the radius of curvature of a spherical mirror and f is its focal length, then: **1 Mark**

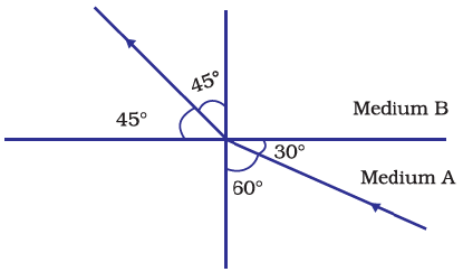
A R = f **B** R = 2f
C $\mathrm{R} = \frac{\mathrm{f}}{2}$ **D** R = 3f

Ans: **B** R = 2f

Explanation:

If R is the radius of curvature of a spherical mirror and f is its focal length, then R = 2f.

Q3. Figure shows a ray of light as it travels from medium A to medium B. Refractive index of the medium B relative to medium A is: **1 Mark**



A $\frac{\sqrt{3}}{\sqrt{2}}$ **B** $\frac{\sqrt{2}}{\sqrt{3}}$
C $\frac{1}{\sqrt{2}}$ **D** $\sqrt{2}$

Ans: **A** $\frac{\sqrt{3}}{\sqrt{2}}$

Explanation: $\mathrm{n_{BA}} = \frac{\sin \mathrm{i}}{\sin \mathrm{r}} = \frac{\sin 60^\circ}{\sin 45^\circ}$
$= \frac{\frac{\sqrt{3}}{2}}{\frac{1}{\sqrt{2}}} = \frac{\sqrt{3}}{\sqrt{2}}$

Q4. The power of a lens is +2.0D. Its focal length should be: **1 Mark**

A 100cm **B** 50cm **C** 25cm **D** 40cm

Ans: **B** 50cm

Explanation:

$\mathrm{Focal\ length} = \frac{1}{\mathrm{Power}}$
$= \frac{1}{2.0} = 0.5\mathrm{m} = 50\mathrm{cm}$

Q5. A concave mirror produces magnification of +4. The object is placed: **1 Mark**

A At the focus. **B** Between focus and centre of curvature.
C Between focus and pole. **D** Between the centre of curvature.

Ans: **C** Between focus and pole.

Explanation:

A concave mirror produces a magnification of +4 when the object is placed between the focus and the pole.

Q6. A convex lens of focal length 15 cm produces a magnification of +4. The object is placed: **1 Mark**

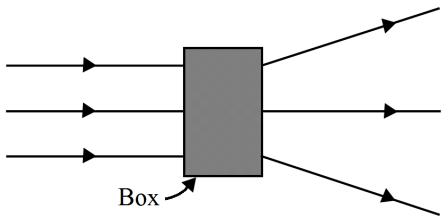
A At a distance of 15cm. **B** Between 15cm and 30cm. **C** At less than 15cm. **D** Beyond 30cm.

Ans: C At less than 15cm.

Explanation:

A convex lens forms a virtual, erect and magnified image when an object is placed within the focus.

Q7. A beam of light is incident through the holes on one side of a box and emerges out through the holes on its opposite side as shown in the following figure: **1 Mark**



The box contains:

A A glass prism. **B** A concave lens.

C A convex lens. **D** A parallel-sided glass slab.

Ans: B A concave lens.

Explanation:

This is because the emergent rays of light are diverging.

Q8. Rays from Sun converge at a point 15cm in front of a concave mirror. Where should an object be placed so that size of its image is equal to the size of the object? **1 Mark**

A 15cm in front of the mirror. **B** 30cm in front of the mirror.

C Between 15cm and 30cm in front of the mirror. **D** More than 30cm in front of the mirror.

Ans: B 30cm in front of the mirror.

Explanation:

In this case, f = -15cm and hence c = -30cm; because radius of curvature is double the focal length. When and object is placed on C, its image is of the same size, inverted and is formed on C.

Q9. Magnification produced by a convex mirror is always: **1 Mark**

A More than 1. **B** Less than 1. **C** Equal to 1. **D** More or less than 1.

Ans: B Less than 1.

Explanation:

Magnification produced by a convex mirror is always less than 1. This is because the size of the image formed by a convex mirror is smaller than the object.

Q10. The image formed by a concave mirror is real, inverted and highly diminished (much smaller than the object). The object must be: **1 Mark**

A Between pole and focus. **B** At focus.

C At the centre of curvature. **D** At infinity.

Ans: D At infinity.

Explanation:

The reason being, the image formed by a concave mirror is real, inverted and highly diminished (much smaller than the object). Therefore, the object must be at infinity.

Q11. Define: **2 Marks**

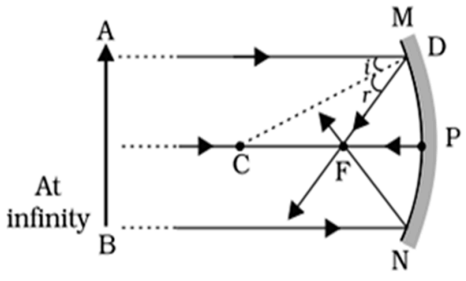
1. Principal focus of a concave mirror.
2. Focal length of a concave mirror.

Ans: 1. Principal focus of a concave mirror: The principal focus of a concave mirror is a point on its principal axis to which all the light rays which are parallel and close to the axis, converge after reflection from the concave mirror.

2. Focal length of a concave mirror: The focal length of a concave mirror is the distance between its pole and the principal focus.

Q12. Draw ray diagrams showing the image formation by a concave mirror when an object is placed: **2 Marks**
At infinity.

Ans: The image formation by a concave mirror when the object is at infinity.



Q13. State three characteristics of the image formed by a convex mirror. **2 Marks**

Ans:

Q14. Describe with the help of a diagram, the nature, size and position of the image formed when an object is placed beyond the centre of curvature of a concave mirror. **2 Marks**

Ans: When an object is placed beyond the centre of curvature (C) of a concave mirror, the image is:

1. Between the focus and centre of curvature.
2. Real and inverted.
3. Smaller than the object (or diminished).

Q15. If an object is placed at a distance of 8cm from a concave mirror of focal length 10cm, discuss the nature of the image formed by drawing the ray diagram. **2 Marks**

Ans: The focal length of the mirror is PF = 10cm.
The object is placed at B such that PB = 8cm. This means that the object lies between the pole and focus of the concave mirror.
The image formed is virtual, erect and magnified.

Q16. A 2.0cm tall object is placed 40 cm from a diverging lens of focal length 15cm. Find the position and size of the image. **3 Marks**

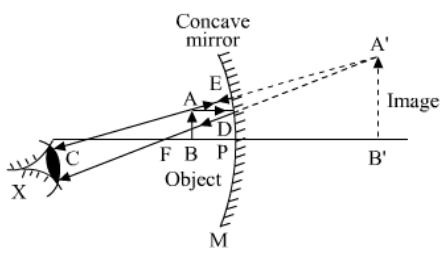
Ans: h_1 = 2cm
u = -40cm
f = -15cm

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$
$$\frac{1}{v} = -\frac{1}{15} - \frac{1}{40}$$
$$\frac{1}{v} = \frac{-11}{120}$$
$$v = -10.90\text{cm}$$
$$m = \frac{v}{u} = \frac{h_2}{h_1}$$
$$\frac{-10.09}{-40} = \frac{h_2}{2}$$
$$h_2 = 0.54\text{cm}$$

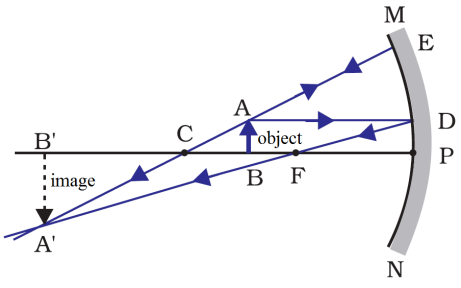
Q17. Draw ray-diagrams to show the formation of images when the object is placed in front of a concave mirror (converging mirror): **3 Marks**

1. Between its pole and focus.
2. Between its centre of curvature and focus Describe the nature, size and position of the image formed in each case.

Ans: 1. When the object is palced between the pole and focus of a concave mirror a mangnified image is formed.

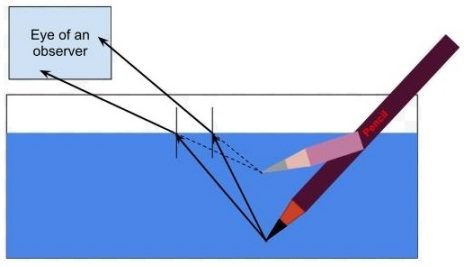


2. When the object is palced between the focus and the centre of the curvature of a concave mirror a mangnified image is formed.



Q18. Explain with the help of a labelled ray diagram, why a pencil partly immersed in water appears to be bent at the water surface. **3 Marks**
State whether the bending of pencil will increase or decrease if water is replaced by another liquid which is optically more dense than water. Give reason for your answer.

Ans: A pencil placed in water appears to be bent because of refraction of light. The refraction causes an apparent shift in the position of the part of the pencil within the water.



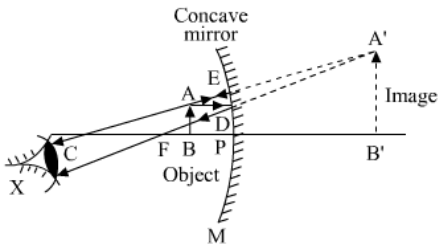
Q19. Describe the New Cartesian Sign Convention used in optics. Draw a labelled diagram to illustrate this sign convention. **3 Marks**

Ans: According to the New Cartesian Sign Convention:

1. All the distances are measured from pole of the mirror as origin.
2. Distances measured in the same direction as that of incident light are taken as positive.
3. Distances measured against the direction of incident light are taken as negative.
4. Distances measured upward and perpendicular to the principal axis are taken as positive.
5. Distance measured downward and perpendicular to the principal axis are taken as negative.

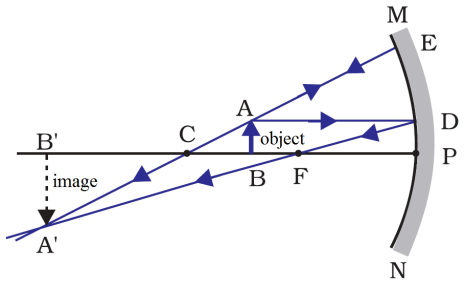
Q20. Give two circumstances in which a concave mirror can form a magnified image of an object placed in front of it. Illustrate your answer by drawing labelled ray diagrams for both. **3 Marks**

Ans: 1. When the object is placed between the pole and focus of a concave mirror a magnified image is formed.



Flg.formation of image by concave mirror whrn the object is palced between its pole and focus.

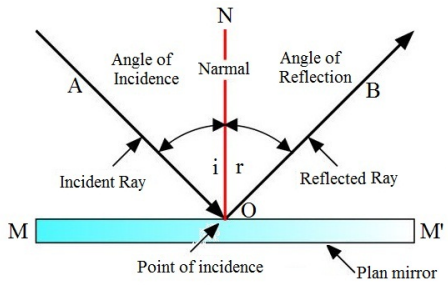
2. When the object is palced between the focus and the centre of curvature of a concave mirror a mangnified image is formed.



Q21. What is meant by 'reflection of light'? Define the following terms used in the study of reflection of light by drawing a labelled ray-diagram : **5 Marks**

1. Incident ray.
2. Point of incidence.
3. Normal.
4. Reflected ray.
5. Angle of incidence.
6. Angle of reflection.

Ans: The process of sending back the light rays which fall on the surface of an object is called reflection of light.



1. **Incident ray:** The ray of light that falls on the mirror surface is called the incident ray.
2. **Point of incidence:** The point at which the incident ray falls on the mirror is called the point of incidence.
3. **Normal:** The normal is a line at right angle to the mirror surface at the point of incidence.
4. **Reflected ray:** The ray of light which is sent back by the mirror is called the reflected rays.
5. **Angle of incidence:** The angle of incidence is the angle made by the incident ray with the normal at the point of incidence.
6. **Angle of reflection:** The angle of reflection is the angle made by the reflected ray with the normal at the point of incidence.

Q22. When a spherical mirror is held towards the sun and its sharp image is formed on a piece of a carbon paper for some time, a hole is burnt in the carbon paper. **5 Marks**

1. What is the nature of spherical mirror?
2. Why is a hole burnt in the carbon paper?
3. At which point of the spherical mirror the carbon paper is placed?
4. What name is given to the distance between spherical mirror and carbon paper?
5. What is the advantage of using a carbon paper rather than a white paper?

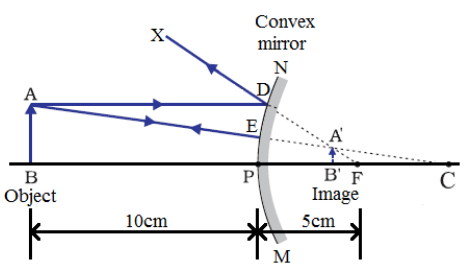
Ans: 1. The spherical mirror is concave.

2. A concave mirror converges light rays, and in this case it will converge the incoming parallel rays of the sun at its focus. Since the carbon paper was kept at the focus of the concave mirror, the hole was burnt into it.
3. The carbon paper was kept at the focus of the spherical mirror.
4. The distance between the mirror and the carbon paper is the focal length.
5. A carbon paper is a good absorber of sunlight; hence, it burnt quickly.

Q23. An object is placed at a distance of 10cm from a convex mirror of focal length 5cm. **5 Marks**

1. Draw a ray-diagram showing the formation of image.
2. State two characteristics of the image formed.
3. Calculate the distance of the image from mirror.

Ans: 1.



2. The image formed is diminished and erect.
3. u = 10cm, f = 5cm

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$\Rightarrow \frac{1}{v} + \frac{1}{-10} = \frac{1}{5}$

$\Rightarrow \frac{1}{v} = \frac{1}{10} + \frac{1}{5} = \frac{3}{10}$

$\therefore \frac{1}{v} = \frac{3}{10}\text{cm} = 3.33\text{cm}$