CHAPTER END TEST

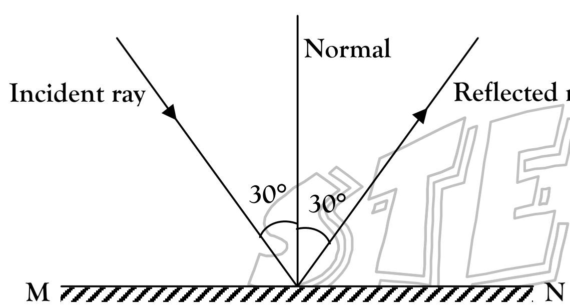
LIGHT

(Covers Part – I & II)

SOLUTIONS

SECTION – A

1. They are applicable to all the reflecting surfaces which may or may not be polished. [1]
2. Both will have equal radius of curvature. [1]
3. For mirrors of small aperture. [1]
4. 20 cm [1]
5. Towards the mirror. [1]
6.



[Diagram: ½ marks]

The reflected ray is shown in the figure.

Angle between incident ray and reflected ray = 30° + 30° = 60°. [½]

7. Zero [1]
8. Object is placed at C or at the centre of curvature. Object distance is 40 cm from the pole. [1]
9. Magnification '1' indicates same size of the image as that of the object while the positive sign indicates virtual and erect image. [1]
10. No change, the focal length of mirror is not medium dependent. [1]
11. Convex [1]

SECTION – B

12. Principal focus is a point on the principal axis where the rays parallel to the principal axis meet after reflection. [½]

    Focus is a point where rays parallel to each other (may or may not be parallel to the principal axis) meet. [½]

Those are infinite foci, all lying in a plane called focal plane whereas principal focus is a point on focal plane as well as on principal axis. **[1]**

13. **Uses of concave mirrors:**

(i) **Shaving mirror:** A concave mirror is used as a shaving or make–up mirror because it forms erect and enlarged image of the face when it is held closer to the mirror.

(ii) **As head mirror:** E.N.T. specialists use concave mirror on their forehead. The light from a lamp after reflection from the mirror is focused into the throat, ear or nose of the patient making the affected part more visible.

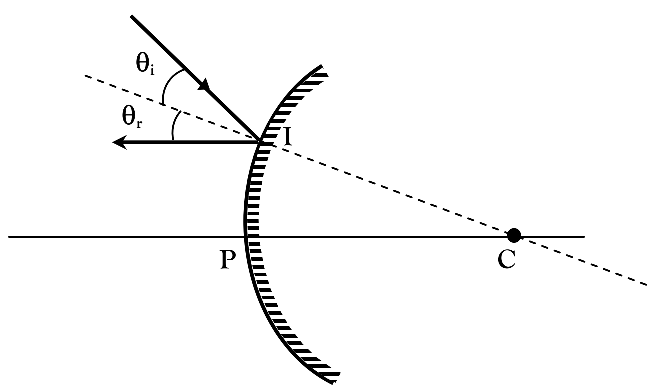
(iii) **In ophthalmoscope:** If consists of a concave mirror with a small hole at its centre. The doctor looks through the hole from behind the mirror while a beam of light from a lamp reflected from it is directed into the pupil of patient's eye which makes the retina visible.

(iv) **In headlights:** Concave mirrors are used as reflectors in headlights of motor vehicles, railway engines, torch lights, etc. The source is placed at the focus of the concave mirror. The light rays after reflection travel over a large distance as a parallel beam of high intensity.

(v) **In astronomical telescopes:** A concave mirror of large diameter (5 m or more) is used as objective in an astronomical telescope. It collects light from the sky and makes visible even those faint stars which cannot be seen with naked eye.

(vi) **In solar furnaces:** Large concave mirrors are used to concentrate sunlight to produce heat in solar furnace. **[Any 2×1=2]**

14.



[Diagram: 1mark]

<u>**Steps to complete a ray diagram**</u>**:**

(i) Draw normal passing through C and measure θ_i.

(ii) Draw a ray from I making an angle θ_r with the normal such that $\theta_i = \theta_r$. **[½×2=1]**

15. It is essential to maintain uniformity in drawing and interpreting ray diagrams and taking appropriate measurements. It enables us to use a single mirror and lens formula for different situations. [½]

According to sign convention:

(i) All measurements should be made from pole.

(ii) All measurements made in the direction of incident ray, will be considered positive.

(iii) All measurements done above the principal axis are to be considered positive. **[½×3=1½]**

16. $f = -15$ cm, $h_1 = 3h_0$

Real image $m = -\frac{v}{u} = -3 \;\therefore\; v = 3u$ [½]

Using mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$,

We get, $\frac{1}{-15} = \frac{1}{3u} + \frac{1}{u} \Rightarrow u = -20$ cm. [½]

Virtual image, $m = -\frac{v}{u} = +3$

$v = -3u$ [½]

Using mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$,

We get, $\frac{1}{-15} = \frac{1}{(-3u)} + \frac{1}{u} \Rightarrow u = -10$ cm. [½]

SECTION – C

17. (i) The upper part of the mirror may be convex, or concave because it forms a diminished image.

(ii) The middle part of the mirror is concave as it forms an enlarged image.

(iii) The lower part of the mirror can be plane or concave as it forms an image of same size. **[3×1=3]**

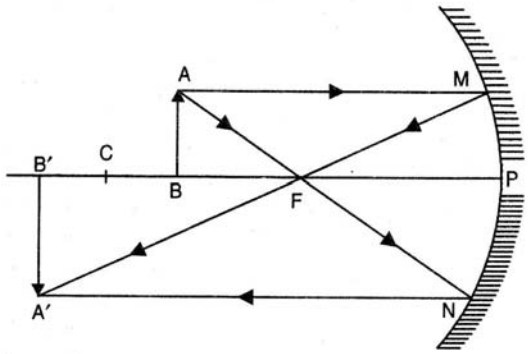
18. We look our face in each mirror, turn by turn. First we keep our face quite close to the mirror and them move it slowly away from the mirror.

(i) If the image formed is of same size as our face but laterally inverted (i.e., left face looks right and vice–versa) for all positions, then it is a plane mirror. **[1]**

(ii) If the image formed is erect and enlarged initially but gets inverted as the face is moved away, then it is a concave mirror. **[1]**

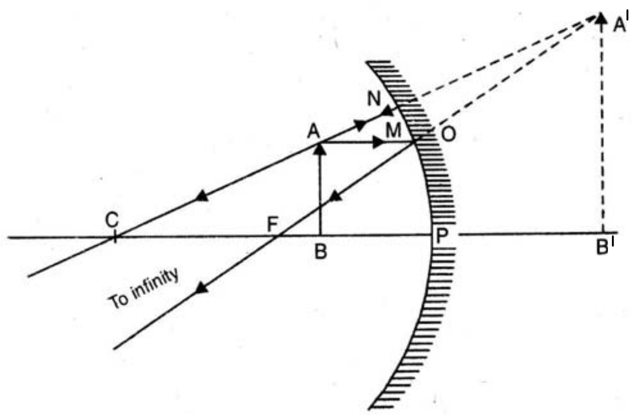
(iii) If the image formed is erect and smaller in size for all positions, then it is a convex mirror. **[1]**

19. (a)



[Diagram: 1½ marks]

(b)



[Diagram: 1½ marks]

SECTION – D

20. There is change in the position of object only, hence the focal length of mirror is same in both the cases. [½]

$u_1 = -6$ cm

$m_1 = +4$

$v_1 = ?$

$-\frac{v_1}{u_1} = m_1$

$v_1 = -m_1u_1 = 24$ cm. [½]

The focal length of the mirror = $\left(\frac{1}{v_1} + \frac{1}{u_1}\right)^{-1}$ [½]

$= \left(\frac{1}{24} + \frac{1}{-6}\right)^{-1}$

$= \left(\frac{1-4}{24}\right)^{-1} = \left(\frac{-3}{24}\right)^{-1} = -8$ cm [1]

$$\frac{1}{v_2} + \frac{1}{u_2} = \frac{-1}{8}$$

$u_2 = -12$ cm [½]

$$\frac{1}{v_2} = \frac{-1}{8} + \frac{1}{12} = \frac{-3+2}{24}$$

$= \frac{-1}{24}$ [½]

$v_2 = -24$ cm

$h_i = h_o \times \frac{-v_2}{u_2} = 2 \text{ cm} \times \frac{24}{-12} = -4$ cm [1]

Hence, size of the image is double the object, when moved away from the mirror. [½]