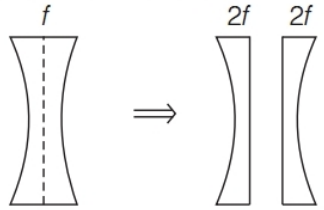
Explanations

1. (b) If a symmetrical biconcave lens of focal length f (say) is vertically splitted into two identical plano concave parts (as shown below), then focal length of each part will be $2f$.



As we know, power of a lens $= \dfrac{1}{\text{focal length}}$

So, power of the biconcave lens, $P = \dfrac{1}{f}$ ... (i)

Similarly, power of each part of plano-concave lens, $P' = \dfrac{1}{2f} = \dfrac{1}{2}P$ [using Eq. (i)]

2. (d) Let man stand in front of the concave mirror at a distance p (where p is greater than focal length f of mirror), it will form a real image. The image is a magnified one.

3. (c) In a plane mirror, the image formed is erect and of same size as of object. Thus, magnification of plane mirror is 1.

4. (a) When light passes from one medium to another its frequency does not change.

5. (d) Maximum lateral displacement is t.

6. (a) We know that, $\mu = \dfrac{\text{Real depth}}{\text{Apparent depth}}$

Red colour has minimum value of refractive index and thus, maximum value of apparent depth. Hence, it should be raised least.

7. (a) In optical fibres, the refractive index of the core is greater than that of the cladding.

8. (a) For convex lens as object comes closer to lens image runs away from it and also object distance is always negative, so correct graph is (a).

9. (a) When a biconvex lens of glass is dipped into a liquid whose refractive index is equal to refractive index of lens, then lens behave as a plane sheet of glass.

10. (a) The intermediate image formed by the objective of a compound microscope is real, inverted and magnified.

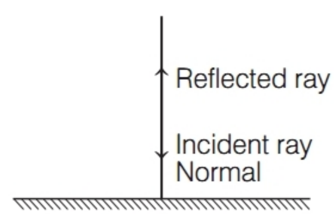
11. (c) We know that, magnifying power m is given by

$$m = -\frac{f_o}{f_e}.$$

Now, if the focal length of the eye piece (f_e) is doubled, then the new magnification would be equal to

$$m' = -\frac{f_o}{2f_e} = \frac{m}{2}.$$

12. (c) When a ray of light is incident along normal to the plane mirror as shown below, then angle of incidence = angle between



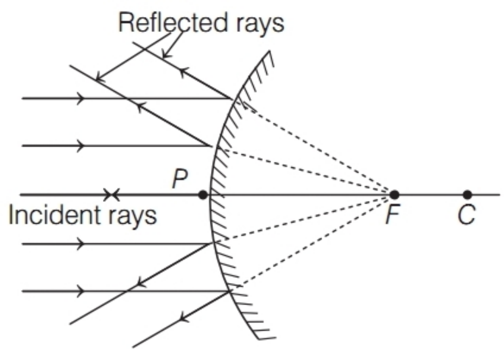
incident ray and normal to the mirror = 0°

⇒ Angle of reflection = 0° (from laws of reflection)

Hence, the reflected ray retraces its path along the normal at an angle 0° with normal.

13. (*a*) Convex mirror always form virtual image of an object because rays always diverge after reflection from this mirror.

This can be shown in the ray diagram given below



14. (*a*) In total internal reflection, 100% of incident light is reflected back into the same medium and there is no loss of intensity, while in reflection from mirrors and refraction from lenses, there is always same loss of intensity. Therefore, images formed by total internal reflection are much brighter than those formed by mirrors or lenses.

15. (*a*) When a diverging lens is immersed in a liquid, then its diverging power will either decrease or it will become converging.

16. (*a*) As, $\frac{1}{f_1} = (\mu - 1)\left(\frac{1}{R} - \frac{1}{R}\right) = 0$

$\therefore \quad P_1 = 0$

$\frac{1}{f_2} = (\mu - 1)\left(\frac{1}{-R} - \frac{1}{(-R)}\right) = 0$

$\therefore \quad P_2 = 0$

17. (i) (d) Refraction does not change the frequency of light.

(ii) (a) From Snell's law of refraction,

$$^{a}\mu_{g} = \frac{\sin i}{\sin r} = \text{constant} \quad \ldots\text{(i)}$$

Since, angle of incidence decrease, the angle of refraction has to decrease. So, that the ratio $\left(\frac{\sin i}{\sin r}\right)$ remain constant according to Eq. (i).

(iii) (a) When an object lying in a denser medium is observed from rarer medium, then real depth of object is more than that observed depth.

(iv) (c) As, $\mu = \frac{\sin i}{\sin r}$ ...(i)

or $\quad \mu \propto \frac{1}{\sin r}$

Also, $\mu = \frac{c}{v}$ ...(ii)

$\Rightarrow \quad \mu \propto \frac{1}{v}$

$\therefore \quad v \propto \sin r$

Therefore, velocity of light is minimum in medium R and order of velocity will be $v_P > v_Q > v_R$.

(v) (a) We see that, ray of light bends towards the normal as we go from medium A to medium B. And we know that, when ray goes from rarer to denser medium, it bends towards normal.

So, that means refractive index of B is greater than A, i.e. $\mu_B > \mu_A$.

18. (i) (a) The images formed by the objective and the eyepiece of a compound microscope are respectively virtual and real.

(ii) (a) The magnification of a compound microscope does not depend upon the aperture of the objective and the eyepiece.

(iii) (a) Option (A) is incorrect as both the lenses are not of short focal lengths. The objective is of short focal length white the eye piece is of large focal length.

(iv) (d) Hence, $m_o = 10X$ and $m_e = 20X$

So, the magnification due to microscope will be

$m = m_o \times m_e = 10 \times 20 = 200$ times

(v) (c) Given, $f_o = 1.2\,\text{cm}$, $f_e = 3\,\text{cm}$

$u_o = 1.25\,\text{cm}$

Using lens formula,

$$\frac{1}{f_o} = \frac{1}{v_o} - \frac{1}{u_o}$$

$$\Rightarrow \quad v_o = \frac{f_o \times u_o}{u_o + f_o} = \frac{1.2 \times (-1.25)}{-1.25 + 1.2}$$

$$= 30\,\text{cm}$$

When final image is formed at infinity, then magnification power $= \frac{v_o}{u_o} \times \frac{D}{f_e}$

$$= \frac{30}{(-1.25)} \times \frac{25}{3} = -200$$

or $\quad |m| = 200$