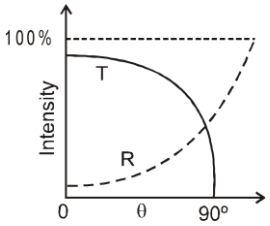
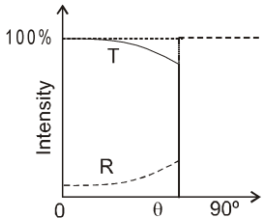
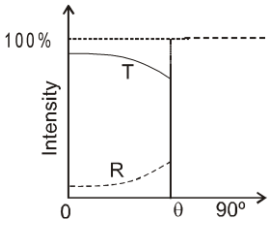
Self Practice Paper (SPP)

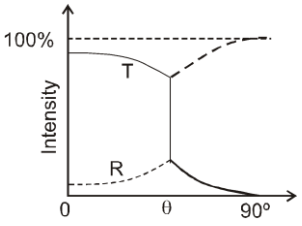
1. Sky appears to be red colour at the time of sun sat. The reason is-
(1) Blue colour out sun rays is scattered away by the atmosphere
(2) As sun emits out only red colour in the morning
(3) White light is made to appear red by atmosphere
(4) None of the above

2. A light ray traveling in glass medium is incident on glass-air interface at an angle of incidence θ. The reflected (R) and transmitted (T) intensities, both as function of θ, are plotted. The correct sketch is

(1) 

(2) 

(3) 

(4) 

3. The image of an object, formed by a plano-convex lens at a distance of 8 m behind the lens, is real and is one-third the size of the object. The wavelength of light inside the lens is $\frac{2}{3}$ times the wavelength in free space. The radius of the curved surface of the lens is :
(1) 1 m (2) 2 m (3) 3 m (4) 6 m

4. I is the image of a point object O formed by spherical mirror, then which of the following statements is **incorrect** :
(1) If O and I are on same side of the principal axis, then they have to be on opposite sides of the mirror.
(2) If O and I are on opposite side of the principal axis, then they have to be on same side of the mirror.
(3) If O and I are on opposite side of the principal axis, then they can be on opposite side of the mirror as well.
(4) If O is on principal axis then I has to lie on principal axis only.

5. The dimond shines because-
(1) It absorbs maximum light form sun (2) Of the nature of diamond
(3) Of total internal reflection (4) Of refraction

6. A transparent cube contains a small air bubble. Its apparent distance is 2 cm when seen through one face and 5 cm when seen through other face. If the refractive index of the material of the cube is 1.5, the real length of the edge of cube must be :
(1) 7 cm (2) 7.5 cm (3) 10.5 cm (4) 3.5 cm

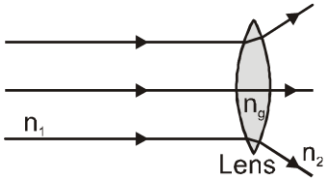
7. The maximum refractive index of a material, of a prism of apex angle 90º, for which light may be transmitted is:
(1) $\sqrt{3}$ (2) 1.5 (3) $\sqrt{2}$ (4) None of these

8. The refractive index of the material of a prism is and its refracting angle is 30°. One of the refraction surfaces of the prism is made a mirror inwards. A beam of monochromatic light entering the prism from the other face will retrace its path after reflection from the mirrored surface if its angle of incidence on the prism is :

(1) 45° (2) 60° (3) 0° (4) 30°

9. Prism of which material is used for study of infrared spectrum :
(1) rock salt (2) flint glass (3) crown glass (4) quartz

10. The ray diagram could be correct



(1) If $n_1 = n_2 = n_g$ (2) If $n_1 = n_2$ and $n_1 < n_g$
(3) If $n_1 = n_2$ and $n_1 > n_g$ (4) Under no circumstances

11. A biconvex lens of focal length 15 cm is in front of a plane mirror. The distance between the lens and the mirror is 10 cm. A small object is kept at a distance of 30 cm from the lens. The final image is
(1) Virtual and at a distance of 16 cm from mirror
(2) Real and at distance of 16 cm from the mirror
(3) Virtual and at a distance of 20 cm form the mirror
(4) Real and at a distance of 20 cm from the mirror

12. A far sighted man who has lost his spectacles, reads a book by the looking through a small hole (3–4 mm) in sheet of paper, The reason will be
(1) Because the hole produces an image of the letters at a longer distance
(2) Because in doing so, the focal length of the eye lens is effectively increased
(3) Because in doing so ,the focal length of the eye lens is effectively decreased
(4) None of these

13. If in compound microscope m_1 and m_2 be the linear magnification of the objective lens and eye lens respectively, then magnifying power of the compound microscope will be

(1) $m_1 - m_2$ (2) $\sqrt{m_1 + m_2}$ (3) $(m_1 + m_2)/2$ (4) $m_1 \times m_2$

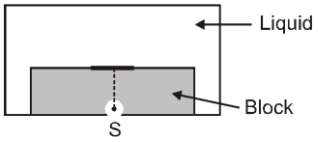
14. A telescope has an objective lens of 10 cm diameter and is situated at a distance of one kilometre from two objects. The minimum distance between these two objects, which can be resolved by the telescope, when the mean wavelength of light is 5000 Å, of the order of :
(1) 0.5 m (2) 5 m (3) 5 mm (4) 5 cm

15. The angular resolution of a 10 cm diameter telescope at a wavelength of 5000 Å is of the order of :
(1) 10^6 rad (2) 10^{-2} rad (3) 10^{-4} rad (4) 10^{-6} rad

16. A ray of light travelling in air is incident on a medium of refractive index μ. If the angle of refraction is twice the incident angle, the incident angle is

(1) $\sin^{-1}\left(\frac{1}{\mu}\right)$ (2) $\sin^{-1}\left(\frac{1}{2\mu}\right)$ (3) $\cos^{-1}\left(\frac{1}{\mu}\right)$ (4) $\cos^{-1}\left(\frac{1}{2\mu}\right)$

17. A point source S is placed at the bottom of a transparent block of height 10 mm and refractive index 2.72. It is immersed in a lower refractive index liquid as shown in the figure. It is found that the light emerging from the block to the liquid forms a circular bright spot of diameter 11.54 mm on the top of the block. The refractive index of the liquid is



(1) 1.21 (2) 1.30 (3) 1.36 (4) 1.42

18. An experiment is performed to find the refractive index of glass using a travelling microscope. In this experiment distances are measured by -
(1) a standard laboratory scale (2) a meter scale provided on the microscope
(3) a screw gauge provided on the microscope (4) a vernier scale provided on the microscope

19. **Assertion :** By increasing the diameter of the objective of telescope, we can increase its range.
Reason : The range of a telescope tells us how far away a star of some standard brightness can be spotted by telescope.
(1) (2) (3) (4)

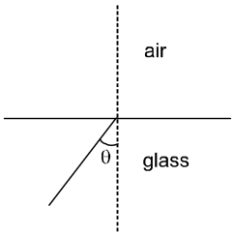
20. **Assertion :** If objective and eye lenses of a microscope are interchanged then it can work as telescope.
Reason : The objective of telescope has small focal length.
(1) (2) (3) (4)

21. **Assertion :** The resolving power of both microscope and telescope depends on the wavelength of light used.
Reason : The resolving power of a lens is the ability to resolve the two image so they are distinctly identified.
(1) (2) (3) (4)

1.	(1)	**2.**	(3)	**3.**	(3)	**4.**	(3)	**5.**	(3)	**6.**	(3)	**7.**	(3)
8.	(1)	**9.**	(1)	**10.**	(3)	**11.**	(2)	**12.**	(3)	**13.**	(4)	**14.**	(3)
15.	(4)	**16.**	(4)	**17.**	(3)	**18.**	(4)	**19.**	(2)	**20.**	(4)	**21.**	(2)

SPP Solutions

2.



Initially most of part will be transmitted. When $\theta > i_c$, all the light rays will be total internal reflected. So transmitted intensity = 0
So correct answer is (C)

3. v = 8 m (magnification = $-\frac{1}{3} = \frac{v}{u}$)
u = –24m

$$\frac{1}{f} = \left(\frac{3}{2} - 1\right)\left(\frac{1}{\infty} + \frac{1}{R}\right)$$

R = 3m

4. $\frac{I}{O} = -\frac{v}{u}$

If O and I are on same sides of PA . $\frac{I}{O}$ will be positive which implies v and u will be of opposite signs.

Similarly if O and I are on opp. sides, $\frac{I}{O}$ will be -ve which implies v and u will have same sign.

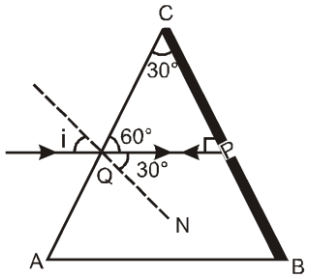
If O is on PA, I = $\left(-\frac{v}{u}\right)$ (O) = 0 ⇒ I will also be on. P.A.

6. Refractive index (μ) = $\frac{\text{Real depth}}{\text{Apparent depth}}$
Refractive index (μ) = 1.5
Apparent depth = 2 + 5 = 7 cm
So, 1.5 = $\frac{\text{Real depth}}{7}$
∴ Real depth = 1.5 × 7 = 10.5 cm

7. For transmission
$r_2 \le \sin^{-1}(1/\mu)$ & $r_1 \le \sin^{-1}(1/\mu)$
$r_1 + r_2 \le 2\sin^{-1}(1/\mu)$ $A \le 2\sin^{-1}(1/\mu)$

$\sin^{-1}(1/\mu) \ge 45^\circ$ ⇒ $\frac{1}{\mu} \ge \frac{1}{\sqrt{2}}$ ⇒ $\mu \le \sqrt{2}$.

8. According to the given condition, the beam of light will retrace its path after reflection from BC. So



$\angle CPQ = 90°$

Thus, angle of refraction at surface AC

$\angle PQN = \angle r = 90° - 60° = 30°$

By Snell's law

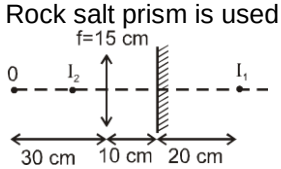
$$\mu = \frac{\sin i}{\sin r} \Rightarrow \sqrt{2} = \frac{\sin i}{\sin 30°}$$

$\therefore \quad \times \sin 30° = \sin i \Rightarrow \quad = \sin i$

$\Rightarrow \quad \sin i = \quad = \sin 45° \quad \therefore \quad i = 45°$

9. Rock salt prism is used for studying of infrared spectrum.

11.



First image,

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

$$\frac{1}{v} - \frac{1}{-30} = \frac{1}{15}$$

v = 30, image in formed 20 cm behind the mirror.

Second image, by plane mirror will be at 20 cm infront of plane mirror.

For third image $\frac{1}{v} - \frac{1}{10} = \frac{1}{15}$

$$\frac{1}{v} = \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{5}{30}$$

v = 6 cm

13. Magnification of a compound microscope is given by

$$m = \frac{v_0}{u_0} \times \frac{D}{u_e} \Rightarrow |m| = m_0 \times m_e$$

14. Resolving limit of telescope is

$$\theta \propto \frac{x}{D} = \frac{\lambda}{d}$$

$$\Rightarrow \quad x = \frac{\lambda D}{d}$$

Given, $\lambda = 5000$ Å $= 5000 \times 10^{-10}$ m,

D = 1 km = 1000 m

d = 10 cm = 0.1 m

Hence, $x = \frac{5000 \times 10^{-10} \times 1000}{0.1}$

$= 5 \times 10^{-3}$ m

= 5 mm

15. Angular resolution = $\frac{1.22\lambda}{d}$

$= \frac{1.22 \times 5000 \times 10^{-10}}{10 \times 10^{-2}}$

$= 6.1 \times 10_{-6}$

$\approx 10_{-6}$ rad

16. Using Snell's law,

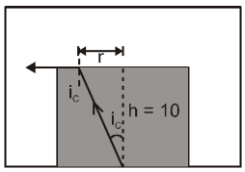
$\sin i = \mu \sin 2i$

$\sin i = 2\mu \sin i \cos i$

$i = \cos_{-1}\left(\frac{1}{2\mu}\right)$

Although the given data are not appropriate since when light ray goes from rarer to denser medium then light move towards the normal.

17. $\sin i_C = \frac{r}{\sqrt{r^2+h^2}} \Rightarrow \frac{n_l}{n_B} = \frac{r}{\sqrt{r^2+h^2}}$



$\Rightarrow = \frac{r}{\sqrt{r^2+h^2}} \times 2.72 = \frac{5.77}{11.54} \times 2.72 = 1.36$

18. A travelling microscope moves horizontally on a main scale provided with a vernier scale, provided with the microscope

19. The light gathering power (or brightness) of a telescope is directly proportional to area of the objective lens i.e., light gathering power, where D is the diameter of the objective.

$\propto \pi r^2 \propto \frac{\pi D^2}{4}$

Thus telescope will have large light gathering power if aperture diameter of the objective lens is large. So by increasing the objective diameter even far off stars may produce images of optimum brightness.

20. We cannot interchange the objective and eye lens of a microscope to make a telescope. The reason is that the focal length of lenses in microscope are very small, of the order of mm or a few cm and the difference ($f_0 - f_e$) is very small, while the telescope objective have a very large focal length as compared to eye lens of microscope.

21. The resolving power of a microscope is determined by the smallest distance between two point objects which can be distinguished by it. The distance d is given by

$$d = \frac{1.22 \quad \lambda}{2n \quad \sin\theta}$$

The resolving power of the microscope is reciprocal of the distance d. An increase in n (refractive index of the transparent medium between the objects and the objective of the microscope) will produce a greater resolving power. It also increases with decrease in wavelength. While the resolving power of telescope is defined as the reciprocal of the smallest angular sepration between two distant objects whose images are distinctly separated by the telescope.

$$\delta\theta = \frac{1.22 \quad \lambda}{D}$$

So for higher resolving power telescope should have the objective lens of large diameter (D) and object is illuminated by light of small wavelength. Thus in both the case resolving power is increased by taking illumination light of small wavelength.