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Class: XII
Subject: Physics
Topic: Optics
No. of Questions: 20
Duration: 60 Min
Maximum Marks: 60

1. When an object is placed between two parallel mirrors, then number of images formed is
    a. 2
    b. 4
    c. 8
    d. Infinite

    Ans. D

2. The magnifying power of a compound- microscope increases when
    a. the focal length of objective lens is increased and that of eye lens is decreased
    b. the focal length of eye lens is increased and that of objective lens in decreased
    c. focal lengths of both objective and eye-piece are increased
    d. focal lengths of both objective and eye-piece are decreased

    Ans. D

3. Two thin double convex lenses of glass are placed in contact with a drop of water between them so that, water forms a double concave lens of each of the four surfaces has radius of curvature 0.24 m, then the nature and focal length of the combination is (ng = 3/2, nw = 4/3)
    a. converging with f = 0.18 m
    b. converging with f = 0.2 m
    c. diverging with f = -0.13 m
    d. diverging with f = -0.2 m

    Ans. A
    Solution:

From glass lens.

$$\frac{1}{f_g}=(n-1)\left(\frac{1}{R_1}+\frac{1}{R_2}\right) \quad \Rightarrow \frac{1}{f_g}=(1.5-1)\left(\frac{2}{0.24}\right) \therefore \frac{1}{f_g}=1/0.24$$

For water lens, $1/f_w=(4/3-1)\left(\frac{2}{0.24}\right) \Rightarrow \frac{1}{f_w}=1/3\times\frac{2}{0.24}=\frac{1}{0.36}$

$$\frac{1}{F}=\frac{1}{0.24}-\frac{1}{0.36}+\frac{1}{0.24}=\frac{3-2+3}{0.72}=4/0.72 \quad \therefore F=\frac{0.72}{4}=0.18m.$$

4. A plane mirror reflects a beam of light to form a real image. The incident beam is
   a. Parallel
   b. Convergent
   c. Divergent
   d. any one of the above

   Ans. B

5. If fo is the focal length of objective and fe is the focal length of eyepiece is an astronomical telescope, then
   a. fo = fe
   b. fo > fe
   c. fo < fe
   d. none

   Ans. B

6. A ray of light incident normally on one face of rectangular glas slab of thickness 6 cm and refractive index 1.5 emerges from the other face. Lateral shift produced is
   a. 0.06 m
   b. 0
   c. 0.90m
   d. 0.04m

   Ans. A

7. In young's expt, using light of wavelength 400 nm, the width of bright fringes at distance of 2 m is 0.6 mm. If whole apparatus is immersed in a liquid of R.I. 1.5, width of fringes will be
   a. 0.4 mm
   b. 0.3 mm
   c. 0.04 mm
   d. 0.5 mm

Ans. A
Solution:

$$\beta' = \frac{\beta}{n}. \quad \beta' = \frac{0.6}{1.5} = 0.4mm.$$

8. A thin walled glass sphere of radius 2.5 cm is filled with water. An object is placed at 7.5 cm from the surface of sphere. The distance of the image of the object measured from the centre of the sphere is
   a. 20 cm
   b. 15 cm
   c. 10 cm
   d. 7.5 cm

   Ans. C
9. An angular magnification of 30 is desired using an objective of focal length 1.25 cm and eye piece of focal length 5.0 cm. To set up the microscope the distance between the lenses is
   a. 3.6 cm
   b. 6.6 cm
   c. 13.75cm
   d. 7.75cm

   Ans. C
   Solution:

$$m_e = \frac{D}{f_e} = \frac{25}{5} = 5$$

$$m_o = \frac{m}{m_e} = \frac{30}{5} = 6$$

$$L = v_o + f_e$$
$$= (m_o + 1) f_o + f_e$$

10. In the light maximally polarised by reflection, the angle between reflected and refracted ray is
    a. 0
    b. π/6
    c. π/3
    d. π/2
    Ans. D

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11. A compound microscope has a magnification of 30. The focal length of the eye -piece is 5cm. If the final image is formed at the least distance of distinct vision (25cm), the magnification produced by the objective is
    a. 5
    b. 7.5
    c. 10
    d. 15

    Ans. A
    Solution:

$$m_e = 1 + \frac{D}{fe}; M = m_o \times m_e$$

12. In young's experiment with one source and two slits, if one slit is covered with black opaque paper, the fringes will
    a. Be darker
    b. Be narrower
    c. Be broader
    d. Not be observed and the screen will have uniform illumination

    Ans D

13. The phase change in reflected wave, when light wave suffers reflection at the interface from air to glass is
    a. 0
    b. $\frac{\pi}{2}$
    c. π
    d. 2π

    Ans. C

14. Two point white dots are 1mm apart on a black paper. They are viewed by eye of pupil diameter 3 mm. approximately what is the maximum distance at which these dots can be resolved by the eye? [Take wavelength of light = 500 nm]
    a. 0.6m
    b. 6m
    c. 5m
    d. 1m

Ans. C

Solution:

$$\text{Limit of resolution } \sin\theta \cong \theta = \frac{y}{D} = \frac{1.22\lambda}{d}$$

$$D = \frac{y.d}{(1.22)\lambda} = \frac{10^{-3}\times 3\times 10^{-3}}{1.22\times 5\times 10^{-7}} = \frac{30}{6.1} = 5m$$

$$= \therefore D_{max} = 5m$$

15. When a ray of light undergoes refraction while passing through a prism, the sum of angle of incidence and emergence is
    a. less than the angle of the prism
    b. greater than the angle of the prism
    c. equal to the angle of the prism
    d. none of the above

    Ans. B

16. When waves from 2 coherent sources interfere directly, the path difference for a point to be bright is
    a. 2n λ/2
    b. $\left(n+\frac{1}{2}\right)$
    c. (2n + 1) ë/2
    d. None

    Ans. A

17. A man stands in a room with his eyes at the center of the room. The height of the ceiling is H. The length of the shortest plane mirror, fixed on the wall in front of the man, so that the man can see the full image of the wall behind him is
    a. $\frac{2H}{3}$
    b. $\frac{H}{2}$
    c. $\frac{H}{3}$
    d. $\frac{H}{4}$

    Ans. C

    Solution:

    $h = \frac{h}{3}$

18. How is interference pattern affected when violet light replaces sodium light
    a. the fringes become brighter
    b. the fringes become fainter
    c. fringe - width decreases
    d. fringe - width increases

    Ans. C

19. A convex lens produces an image of magnification $\frac{1}{4}$ When the lens is moved 0.4m towards the object, the magnification of the image becomes 4. The focal length of the lens is
    a. -0.11 m
    b. 0.11 m
    c. 0.09 m
    d. 9.4 m

    Ans. B

    Solution:

$$f = \frac{d}{m_1 \sim m_2} = \frac{0.4}{4 - \frac{1}{4}} = \frac{1.6}{15} = 0.11m$$

20. A bird in air looks at a fish vertically below it and inside water in a tank, n is R.I of water. If x is the height of bird and y depth of fish from the surface, then the distance of fish as estimated by bird is

    a. x + y/n
    b. x – y/n
    c. xy/n
    d. n /xy

    Ans. A
    Solution:

$$\text{R.I.n} = \frac{\text{Real depth}}{\text{Apparent depth}} = \frac{y}{y'}$$

$$y' = y/n \quad \therefore \textit{Fish} \text{ appears to the bird at a distance } x + \frac{y}{n},$$