V PLUS U
IIT/PMT INSTITUTE

CHAPTER TEST

Subject : Physics **Topic : Optics** **M.M. : 180**

Have patience all things are difficult before they become easy.

Marking Scheme:
(i) Each question is allotted 4 (four) marks for each correct response.
(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 An object is at a distance of 0.5 m in front of a plane mirror. Distance between the object and image is
(A) 0.5 m (B) 1 m
(C) 0.25 m (D) 1.5 m

Q.2 A light beam is being reflected by using two mirrors, as in a periscope used in submarines. If one of the mirrors rotates by an angle θ, the reflected light will deviate from its original path by the angle
(A) 2θ (B) 0°
(C) θ (D) 4θ

Q.3 An object 5cm tall is placed 1m from a concave spherical mirror which has a radius of curvature of 20cm. The size of the image is
(A) 0.11cm (B) 0.50cm
(C) 0.55cm (D) 0.60cm

Q.4 Which one of the following statements is true
(A) An object situated at the principle focus of a concave lens will have its image formed at infinity.
(B) Concave mirror can give diminished virtual image.
(C) Given a point source of light, a convex mirror can produce a parallel beam of light.
(D) The virtual image formed in a plane mirror can be photographed.

Q.5 If an object is placed 10cm infront of a concave mirror of focal length 20cm, the image will be
(A) Diminished, upright, virtual
(B) Enlarged, upright, virtual
(C) Diminished, inverted, real
(D) Enlarged, upright, real

Q.6 An object is placed at 20cm from a convex mirror of focal length 10cm. The image formed by the mirror is
(A) Real and at 20cm from the mirror
(B) Virtual and at 20cm from the mirror
(C) Virtual and at 20/3 cm from the mirror
(D) Real and at 20/3 cm from the mirror

Q.7 The refractive index of a certain glass is 1.5 for light whose wavelength in vacuum is 6000 Å. The wavelength of this light when it passes through glass is
(A) 4000 Å (B) 6000 Å
(C) 9000 Å (D) 15000 Å

Q.8 A ray of light is incident on the surface of separation of a medium at an angle 45° and is refracted in the medium at an angle 30°. What will be the velocity of light in the medium–
(A) 1.96×10^8 m/s (B) 2.12×10^8 m/s
(C) 3.18×10^8 m/s (D) 3.33×10^8 m/s

Q.9 The frequency of a light ray is 1.5×10^{14} Hz. Its frequency when it propagates in a medium of refractive index 1.5, will
(A) 1.67×10^{14} Hz (B) 9.10×10^{14} Hz
(C) 1.5×10^{14} Hz (D) 4×10^{14} Hz

Q.10 A presbyopic patient has near point as 30 cm and far point as 40 cm. The dioptric power for the corrective lens for seeing distant objects is
(A) 40 D (B) 4 D
(C) –2.5 D (D) 0.25 D

Q.11 A person can see clearly only upto a distance of 25 cm. He wants to read a book placed at a distance of 50 cm. What kind of lens does he require for his spectacles and what must be its power
(A) Concave, – 1.0 D (B) Convex, + 1.5 D
(C) Concave, – 2.0 D (D) Convex, + 2.0 D

Q.12 The focal length of objective and eye lens of a microscope are 4 cm and 8 cm respectively. If the least distance of distinct vision is 24 cm and object distance is 4.5 cm from the objective lens, then the magnifying power of the microscope will be
(A) 18 (B) 32 (C) 64 (D) 20

Q.13 The focal lengths of the objective and the eye-piece of a compound microscope are 2.0 cm and 3.0 cm respectively. The distance between the objective and the eye-piece is 15.0 cm. The final image formed by the eye-piece is at infinity. The two lenses are thin. The distances in cm of the object and the image produced by the objective measured from the objective lens are respectively

(A) 2.4 and 12.0 (B) 2.4 and 15.0

(C) 2.3 and 12.0 (D) 2.3 and 3.0

Q.14 Light of wavelength 4000 Å is incident at small angle on a prism of apex angle 4°. The prism has $n_v = 1.5$ and $n_r = 1.48$. The angle of dispersion produced by the prism in this light is

(A) 0.2° (B) 0.08°

(C) 0.192° (D) None of these

Q.15 Two objects whose images are closer to each other, then the corresponding minimum separation d_{min} in the object plane of microscope is given by

(A) $\frac{1.44\lambda}{2\sin\beta}$ (B) $\frac{2.32\lambda}{\sin\beta}$

(C) $\frac{4.24\lambda}{\sin\beta}$ (D) $\frac{1.22\lambda}{2\sin\beta}$

Q.16 Two thin prisms of flint glass, with refracting angle of 6° and 8° respectively having dispersive powers in the ratio –

(A) 4 : 3 (B) 3 : 4

(C) 1 : 1 (D) 9 : 16

Q.17 Find the angles between two plane mirrors producing five images of a given object.

(A) $30° \le \theta \le 72°$ (B) $45° \le \theta \le 72°$

(C) $60° \le \theta \le 72°$ (D) $15° \le \theta \le 72°$

Q.18 A girl stands at a distance 30 cm from the mirror. She is able to see her erect image but of 1/5 height of actual height. The mirror will be :

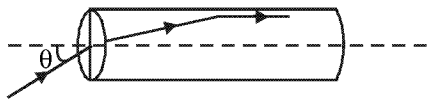
(A) plane mirror

(B) concave mirror

(C) convex mirror

(D) plane convex mirror

Q.19 A transparent solid cylindrical rod has a refractive index of $2/\sqrt{3}$. It is surrounded by air. A light ray is incident at the midpoint of one end of the rod as shown in the figure.



The incident angle θ for which the light ray grazes along the wall of the rod is -

(A) $\sin^{-1}\left(\frac{1}{2}\right)$ (B) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

(C) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (D) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

Q.20 A fish looking up through the water sees the outside world contained in a circular horizon. If the refractive index of water is 4/3 and the fish is 12 cm below the surface, the radius of this circle in cm is

(A) $36\sqrt{7}$ (B) $36/\sqrt{7}$

(C) $36\sqrt{5}$ (D) $4\sqrt{5}$

Q.21 Two point white dots are 1 mm 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) 5 m (B) 1 m

(C) 6 m (D) 3 m

Q.22 An experiment is performed to find the refractive index of glass using a travelling microscope. In this experiment distances are measured by -

(A) a standard laboratory scale

(B) a meter scale provided on the microscope

(C) a screw gauge provided on the microscope

(D) a vernier scale provided on the microscope

Q.23 A thin convex lens made from crown glass ($\mu = 3/2$) has focal length f. When it is measured in two different liquids having refractive indices 4/3 and 5/3, it has the focal lengths f_1 and f_2 respectively. The correct relation between the focal lengths is –

(A) $f_2 > f$ and f_1 becomes negative

(B) f_1 and f_2 both become negative

(C) $f_1 = f_2 < f$

(D) $f_1 > f$ and f_2 becomes negative

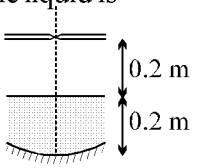
Q.24 A green light is incident from the water to the air-water interface at the critical angle (θ).
Select the correct statement
(A) The spectrum of visible light whose frequency is more than that of green light will come out to the air medium.
(B) The entire spectrum of visible light will come out of the water at various angles to the normal.
(C) The entire spectrum of visible light will come out of the water at an angle of 90° to the normal.
(D) The spectrum of visible light whose frequency is less than that of green light will come out to the air medium.

Q.25 A vessel of depth d is half filled with a liquid of refractive index μ_1 and the other half is filled with a liquid of refractive index μ_2. The apparent depth of the vessel, when looked at normally from air is

(A) $\frac{d}{2}\left[\frac{1}{\mu_1}+\frac{1}{\mu_2}\right]$ (B) $d(\mu_1+\mu_2)$

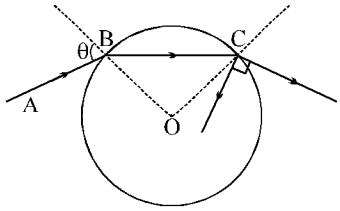
(C) $\frac{d}{2}(\mu_1+\mu_2)$ (D) $d\left[\frac{1}{\mu_1}+\frac{1}{\mu_2}\right]$

Q.26 When a pin is moved along the principal axis of a small concave mirror, the image position coincides with the object at a point 0.5 m from the mirror, refer figure. If the mirror is placed at a depth of 0.2 m in a transparent liquid, the same phenomenon occurs when the pin is placed 0.4m from the mirror. The refractive index of the liquid is
(A) 6/5
(B) 5/4
(C) 4/3
(D) 3/2



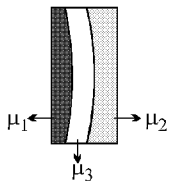
Q.27 A secondary rainbow is formed when light rays coming from the sun undergo the following through spherical water droplets: (IR = internal reflection)
(A) a refraction, IR and then refraction
(B) two refractions only
(C) a refraction, IR, again IR and then refraction
(D) a refraction, IR and again IR

Q.28 A ray incident at a point B at an angle of incidence θ enters into a glass sphere and is reflected and refracted at the farther surface of the sphere, as shown. The angle between the reflected and refracted rays at this surface is 90°. If refractive index of material of sphere is $\sqrt{3}$, the value of θ is–



(A) $\pi/3$ (B) $\pi/4$
(C) $\pi/6$ (D) $\pi/12$

Q.29 The given figure shows a thin plano-convex lens of refractive index μ_1 and a thin plano-concave lens of refractive index μ_2, both having same radius of curvature R of their curved surfaces. The thin lens of refractive index μ_3 has radius of curvature R of both its surfaces. This lens is so placed in between the plano-convex and plano-concave lenses that the plane surfaces are parallel to each other. The focal length of the combination is



(A) $\frac{R}{(\mu_1+\mu_2-\mu_3-1)}$ (B) $\frac{R}{(\mu_1+\mu_2+\mu_3)}$

(C) $\frac{R}{(\mu_1-\mu_2)}$ (D) $\frac{R}{(\mu_1-\mu_2-\mu_3-3)}$

Q.30 A camera lens with a focal length of 5.5 cm is used to take the picture of a person 1.68 m tall. What is the person's distance from the lens, if the image just fills the 24 mm vertical dimension of the film ?
(A) 2.4 m (B) 5.6 m
(C) 3.9 m (D) 1.6 m

Q.31 Wave nature of light follows because
(A) Light rays travel in a straight line.
(B) Light exhibits the phenomena of reflection & refraction.
(C) Light exhibits the phenomenon of interference.
(D) Light causes the phenomenon of photoelectric effect.

Q.32 Interference was observed in interference chamber when air was present, now the chamber is evacuated and if the same light is used, a careful observer will see
(A) No interference.
(B) Interference with bright bands.
(C) Interference with dark bands.
(D) Interference in which width of the fringe will be slightly increased.

Q.33 In Young's double slit experiment, the fringe width is 1×10^{-4} m if the distance between the slit and screen is doubled and the distance between the two slit is reduced to half and wavelength is changed from 6.4×10^{-7}m to 4.0×10^{-7}m, the value of new fringe width will be
(A) 0.15×10^{-4} m (B) 2.0×10^{-4} m
(C) 1.25×10^{-4} m (D) 2.5×10^{-4} m

Q.34 In Young's double slit experiment the wavelength of light was changed from 7000 Å to 3500 Å. While doubling the separation between the slits which of the following is not true for this experiment –
(A) The width of the fringes changes.
(B) The colour of bright fringes changes.
(C) The separation between successive bright fringes changes.
(D) The separation between successive dark fringes remains unchanged.

Q.35 In a Young's slit experiment, the separation between the slits is 0.10 mm, the wavelength of light used is 600 nm and the interference pattern is observed on a screen 1.0 m away. Find the separation between the successive bright fringes.
(A) 6.6 mm (B) 6.0 mm
(C) 6 m (D) 6 cm.

Q.36 When the angle of incidence on a material is 60°, the reflected light is completely polarized. The velocity of the refracted ray inside the material is (in ms^{-1})
(A) 3×10^8 (B) $\left(\frac{3}{\sqrt{2}}\right) \times 10^8$
(C) $\sqrt{3} \times 10^8$ (D) 0.5×10^8

Q.37 If the ratio of amplitude of two waves is 4 : 3, then the ratio of maximum and minimum intensity is
(A) 16 : 18 (B) 18 : 16
(C) 49 : 1 (D) 94 : 1

Q.38 If two waves represented by $y_1 = 4 \sin \omega t$ and $y_2 = 3\sin\left(\omega t + \frac{\pi}{3}\right)$ interfere at a point, the amplitude of the resulting wave will be about
(A) 7 (B) 6
(C) 5 (D) 3.5

Q.39 The Young's experiment is performed with the lights of blue (λ = 4360 Å) and green colour (λ = 5460 Å), If the distance of the 4th fringe from the centre is x, then
(A) x (Blue) = x (Green)
(B) x (Blue) > x (Green)
(C) x (Blue) < x (Green)
(D) $\frac{x(\text{Blue})}{x(\text{Green})} = \frac{5460}{4360}$

Q.40 In Young's double slit experiment using sodium light (λ = 5898 Å), 92 fringes are seen. If given colour (λ = 5461Å) is used, how many fringes will be seen –
(A) 62 (B) 67
(C) 85 (D) 99

Q.41 A single slit of width 0.20 mm is illuminated with light of wavelength 500 nm. The observing screen is placed 80 cm from the slit. The width of the central bright fringe will be
(A) 1 mm (B) 2 mm
(C) 4 mm (D) 5 mm

Q.42 In the visible region of the spectrum the rotation of the plane of polarization is given by $\theta = a + \frac{b}{\lambda^2}$.
The optical rotation produced by a particular material is found to be 30° per mm at λ = 5000Å and 50° per mm at λ = 4000Å. The value of constant a will be
(A) $+\frac{50°}{9}$ per mm (B) $-\frac{50°}{9}$ per mm
(C) $+\frac{9°}{50}$ per mm (D) $-\frac{9°}{50}$ per mm

Q.43 In an experiment similar to young's experiment, interference is observed using waves associated with electrons. The electrons are being produced in an electron gun. In order to increase the fringe width.

(A) electron gun voltage be increased.
(B) electron gun voltage be decreased.
(C) the slit be moved away.
(D) the screen be moved closer to interfering slits.

Q.44 Two polaroids as oriented with their planes perpendicular to incident light and transmission axis making an angle of 30° with each other. What fraction of incident unpolarised light is transmitted?

(A) 57.5 % (B) 17.5 %
(C) 27.5 % (D) 37.5 %

Q.45 Width of slit is 0.3mm. Fraunhoffer diffraction is observed at 1 m focal length in focus planed lens. If third minima is at 5 mm distance from central maxima, then wavelength of light is-

(A) 7000Å (B) 6500Å
(C) 6000Å (D) 5000Å