

Shiksha Classes Bhandara

CHAPTER TEST

Subject : Physics

Topic : Ray Optics

M.M. : 100

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 When diffuse reflection from a surface occurs –
 (A) an individual ray of light does not obey the law of reflection.
 (B) the reflected rays are parallel to each other.
 (C) the reflected rays are not parallel to each other.
 (D) there are no reflected rays.

Q.2 A vessel of depth 2d cm. is half filled with a liquid of refractive index μ_1 and the upper half with a liquid of refractive index μ_2 . The apparent depth of the vessel seen perpendicularly is –

- (A) $d \left(\frac{\mu_1 \mu_2}{\mu_1 + \mu_2} \right)$
- (B) $d \left(\frac{1}{\mu_1} + \frac{1}{\mu_2} \right)$
- (C) $2d \left(\frac{1}{\mu_1} + \frac{1}{\mu_2} \right)$
- (D) $2d \left(\frac{1}{\mu_1 \mu_2} \right)$

Q.3 Immiscible transparent liquids A, B, C, D and E are placed in a rectangular container of glass with the liquids making layers according to their densities. The refractive index of the liquids are shown in the adjoining diagram. The container is illuminated from the side and a small piece of glass having refractive index 1.61 is gently dropped into the liquid layer. The glass piece as it descends downwards will not be visible in –

A	1.51
B	1.53
C	1.61
D	1.52
E	1.65

- (A) Liquid A and B only
- (B) Liquid C only
- (C) Liquid D and E only
- (D) Liquid A, B, D & E

Q.4 A lens has a power of +5 diopter in air. What will be its power if completely immersed in water ?

[Given $\mu_g = \frac{3}{2}$; $\mu_w = \frac{4}{3}$]

- (A) $\frac{+5}{3}$ D
- (B) $\frac{+5}{2}$ D
- (C) $\frac{+1}{3}$ D
- (D) $\frac{+1}{2}$ D

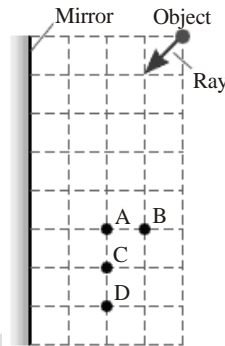
Q.5 A concave spherical surface of radius of curvature 10cm. separates two mediums X and Y of refractive indices $\frac{4}{3}$ and $\frac{3}{2}$ respectively. Centre of curvature of the surface lies in the medium X. An object is placed in medium X –

- (A) Image is always real.
- (B) Image is real if the object distance is greater than 90cm.

(C) Image is virtual only if the object distance is less than 90 cm.

(D) Image is always virtual

Q.6 The figure shows a top view of an object located to the right of a mirror. A single ray of light is shown leaving the object. After reflection from the mirror, through which location, A, B, C, or D, does the ray pass?



- (A) A
- (B) B
- (C) C
- (D) D

Q.7 Which statement regarding real and virtual images is correct?

- (A) A virtual image is always inverted relative to the object, whereas a real image is never inverted.
- (B) A virtual image is always smaller than the object, whereas a real image is always larger.
- (C) A virtual image is always larger than the object, whereas a real image is always smaller.
- (D) Rays of light emanate from a real image, but only appear to do so from a virtual image.

Q.8 A ray of light is passing from air into glass. If the angle of incidence, with respect to the normal to the interface, is increased –

- (A) Total internal reflection will occur when the angle of incidence equals the critical angle
- (B) Total internal reflection will occur when the angle of incidence is less than the critical angle
- (C) Total internal reflection will occur when the angle of incidence is greater than the critical angle
- (D) Angle of refraction angle will increase but there will be no total internal reflection

Q.9 The critical angle of light going from medium A to medium B is θ . The speed of light in medium A is v. The speed of light in medium B is –

- (A) $v \sin \theta$
- (B) $\frac{v}{\sin \theta}$
- (C) $v \cot \theta$
- (D) $v \tan \theta$

Q.10 You hold the words : **TOP DOG** mirror. What does the image of these words look like?

- (A) **ƆOƆ ƆOƆ**
- (B) **ƆOƆ ƆOƆ**
- (C) **ƆOƆ ƆOƆ**
- (D) **ƆOƆ ƆOƆ**

Q.11 A doctor advises a patient to use spectacles with a convex lens of focal length 40 cm. in contact with a concave lens of focal length 25 cm. What is the power of the resultant combination –

- (A) -6.5 D (B) -1.5 D
(C) 6.5 D (D) 1.5 D

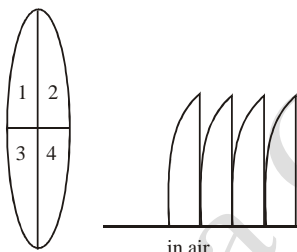
Q.12 Which one of the following statements concerning spherical mirrors is correct?

- (A) Only a convex mirror can produce an enlarged image.
(B) Both concave and convex mirrors can produce an enlarged image.
(C) Only a concave mirror can produce an enlarged image, provided the object distance is less than the radius of curvature.
(D) Only a concave mirror can produce an enlarged image, provided the object distance is greater than the radius of curvature.

Q.13 A mango tree is at the bank of river and one of the branch of tree extends over the river. A tortoise lives in river. A mango falls just above the tortoise. The acceleration of the mango falling from tree appearing to the tortoise is (Refractive index of water is $4/3$ and the tortoise is stationary)

- (A) g (B) $3g/4$
(C) $4g/3$ (D) None of these

Q.14 The given lens is broken into four parts and rearranged as shown. If the initial focal length is f then after rearrangement the equivalent focal length is –



- (A) f (B) $f/2$
(C) $f/4$ (D) $4f$

Q.15 When light is passed through a prism, the colour which deviates least is –

- (A) Red (B) Violet
(C) Blue (D) Green

Q.16 The following data are given for a crown glass prism, refractive index for violet light $n_v = 1.521$, refractive index for red light $n_r = 1.510$ and refractive index for yellow light $n_y = 1.550$. Dispersive power of a prism is –

- (A) 0.01 (B) 0.03
(C) 0.02 (D) 0

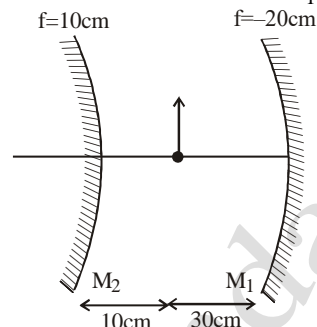
Q.17 An air bubble is inside water. The refractive index of water is $4/3$. At what distance from the air bubble should a point be placed so as form a real image at the same distance from the bubble –

- (A) $2R$
(B) $3R$

(C) $4R$

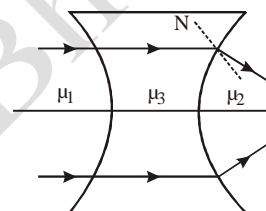
(D) the air bubble cannot form a real image of real object

Q.18 In the figure shown find the total magnification after two successive reflections first on M_1 and then on M_2



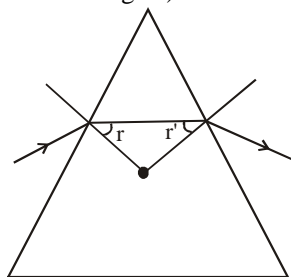
- (A) $+1$ (B) -2
(C) $+2$ (D) -1

Q.19 From the figure shown establish a relation between μ_1, μ_2, μ_3 .



- (A) $\mu_3 > \mu_2 > \mu_1$ (B) $\mu_1 < \mu_2 < \mu_1$
(C) $\mu_2 > \mu_3 ; \mu_3 = \mu_1$ (D) $\mu_2 > \mu_1 ; \mu_3 = \mu_2$

Q.20 r and r' denote the angles inside an equilateral prism, as usual, in degrees. Consider that during some time interval from $t = 0$ to $t = t$, r' varies with time as $r' = 10 + t^2$. During this time r will vary as (assume that r and r' are in degree)



- (A) $50 - t^2$ (B) $50 + t^2$
(C) $60 - t^2$ (D) $60 + t^2$

For Q.21-Q.25 :

The answer to each question is a NUMERICAL VALUE.

Q.21 A convex mirror has a radius of curvature of 20 cm. An object is placed at such a distance from the mirror that the size of the image is exactly half that of the object. The object distance (in cm) must be –

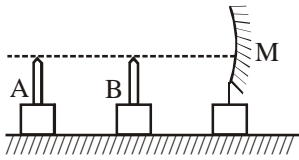
Q.22 Radii of curvature of a concavo-convex lens (refractive index = 1.5) are 40 cm. (concave side) and 20 cm (convex side). The convex side is silvered. The distance x (in cm) on the principal axis where an

object is placed so that its image is created on the object itself, is equal to –

For Q.23-Q.25

A concave mirror M is mounted on an optical bench. Two pins A and B are placed on bench such that their tips also lie on the principal axis of the mirror as shown. The image of tip of one pin is formed on the tip of the other pin. Now if pin B is moved 80cm. towards left and pin A is moved 80cm. towards right, image of tip of one pin is again on the tip of the other pin. The magnitude of transverse magnification of the larger image is three. [All the images are formed by paraxial rays].

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- Q.23** The focal length (in cm) of the mirror is –
- Q.24** The distance (in cm) of the nearest pin from pole initially is
- Q.25** The magnification of the image of the pin B in second case is $(1/X)$. Find the value of X.

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