JEE 2023

Ray Optics and Optical Instruments

DPP-11

1. A concave spherical surface of radius of curvature 10cm separates two media *X* and *Y* of refractive indices $\frac{3}{2}$ and $\frac{4}{3}$ respectively. An object is placed in medium *X*. For image to be real, the object distance must be

(1) Greater than 90cm
(2) Less than 90 cm
(3) Greater than 80cm
(4) Less than 80 cm.

2. A spherical surface of curvature *R* separates air (refractive index 1.0) from glass (refractive index 1.5). The centre of curvature is in the glass. A point object *P* placed in air is found to have a real image *Q* in the glass. The line *PQ* cuts the surface at the point *O*, and *PO* = *OQ*. The distance *PO* is equal to:

(1) 5*R* (2) 3*R*
(3) 2*R* (4) 1.5*R*

3. A concave spherical surface of radius of curvature 10cm separates two medium *x* & *y* of refractive index 4/3 & 3/2 respectively. If the object is placed along principal axis in medium *x* then

(1) Image is always real
(2) Image is real if the object distance is greater than 90cm
(3) Image is always virtual
(4) Image is virtual if the object distance is less than 90cm

4. There is a small black dot at the centre *C* of a solid glass sphere of refractive index μ. When seen from outside, the dot will appear to be located:

(1) Away from *C* for all values of μ
(2) At *C* for all values of μ
(3) At *C* for μ = 1.5, but away from *C* for μ ≠ 1.5
(4) At *C* only for $\sqrt{2} \le \mu \le 1.5$.

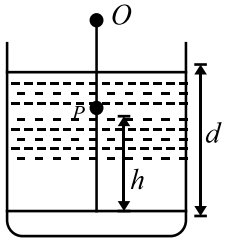
5. A tiny air bubble in a glass slab (μ = 1.5) appears from one side to be 6 cm from the glass surface and from other side, 4 cm. The thickness of the glass slab is

(1) 10 cm (2) 6.67 cm
(3) 15 cm (4) None of these

6. A coin is placed below a rectangular block of glass (μ = 1.5) of thickness 6 cm. A 4 cm thick layer of water (μ = 1.33) is on the top of the glass. The apparent position of the coin from its actual position is:

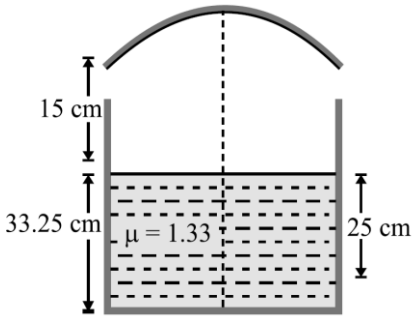
(1) 2 cm (2) 3 cm
(3) 5 cm (4) 7 cm

7. A plane mirror is placed at the bottom of the tank containing a liquid of refractive index *n*. *P* is a small object at a height *h* above the mirror. An observer *O* vertically above *P* outside the liquid sees *P* and its image in the mirror. The apparent distance between these two will be



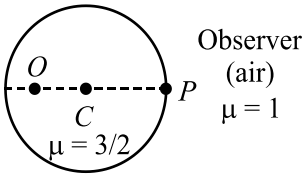
(1) $2nh$ (2) $\frac{2h}{n}$
(3) $\frac{2h}{n-1}$ (4) $h\left(1+\frac{1}{n}\right)$

8. A container is filled with water (μ = 1.33) upto a height of 33.25 cm. A concave mirror is placed 15 cm above the water level and the image of an object placed at the bottom is formed 25 cm below the water level. The focal length of the mirror is



(1) 10
(2) 15
(3) 18
(4) 25

9. In a spherical paper weight (R = 10 cm) made of glass of refractive index $\mu = \frac{3}{2}$, an object is embedded at a distance 5 cm from its centre. What is the apparent position of the object when seen from the opposite side (see figure)?



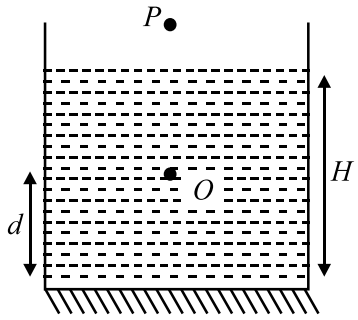
(1) 10 cm behind centre

(2) 10 cm behind P

(3) 15 cm behind centre

(4) 5 cm behind P

10. A tank contains a transparent liquid of refractive index μ. The bottom of the tank is a plane mirror as shown. A person at P looks at an object O and its image in the mirror. The distance between the object and its image in the mirror as perceived by the person is



(1) $2\mu d$ (2) $\frac{2d}{\mu}$

(3) $\frac{2(H-d)}{\mu}$ (4) $\frac{(H+D)}{\mu}$

Answer Key

1. (1)
2. (1)
3. (3)
4. (2)
5. (3)
6. (2)
7. (2)
8. (3)
9. (1)
10. (2)