

## Competitive Questions

### Advanced Geometry by H.C. Rajpoot

Q.1. An electric bulb of 200 W is mounted onto the centre of one of the walls of a room of  $2.6m \times 2.6m \times 2.6m$ . Find out the total radiation energy striking the floor area if the bulb emits radiation uniformly in all the directions.

(Neglect height of bulb from the centre of wall)

Ans. 21.788 J/sec

Q.2. A uniform point-source of light is located at the centre of a torus having inner & outer radii 10cm & 18cm respectively. What will be the fraction of total radiation intercepted by the torus?

Ans.  $\frac{2}{7}$

Q.3. A torus intercepts 60% of the total radiation emitted by a uniform point-source located at the centre of torus. Find out ratio of outer to inner radii of torus.

Ans.  $\frac{8}{3}$

Q.4. A solar-panel of  $30 \times 30 \text{ unit}^2$  is illuminated by a uniform point-source of light located at a normal height  $15\sqrt{\sqrt{2} - 1} \text{ unit}$  from the centre of panel. Find out percentage of total radiation incident on panel.

Ans. 25%

Q.5. Find out the solid angle subtended by an infinitely long vertical cylindrical pole with a diameter D at a point lying in the plane of base at a normal distance 2D from the longitudinal axis.

Ans.  $\frac{\pi}{3} \text{ sr}$

Q.6. A torus having diameter 8cm intercepts 40% of the total radiation emitted by a uniform point-source located at the centre of torus. Find out inner & outer radii of torus.

Ans. 14cm & 6cm

Q.7. A uniform point-source of light is located at a normal height 8cm from the centre of an infinitely long rectangular plane having width 16cm. What will be the percentage of total radiation intercepted by the plane?

Ans. 25%

Q.8. Some identical spheres are arranged, touching one another, in a complete circular fashion such that each of them intercepts 25% of total radiation emitted by a uniform point-source located at the centre of polygonal plane obtained by joining the centres of spheres. Find out number of spheres.

Ans. 3

Q.9. A uniform point-source of 100 cd is located at the centre of a simple cubic cell. What will be total flux directly escaping the cell? Ans. 334.24 lm

Q.10. Solid angle ( $\omega$ ) subtended by an ellipsoid having major and minor axes  $2a$  &  $2b$  respectively at any point lying on the major axis at a distance  $d$  [ $\forall (d \geq a \geq b)$ ] from the centre is given by

a)  $2\pi \left( 1 - \sqrt{\frac{(d^2 - a^2)}{(d^2 - a^2) + b^2}} \right)$       b)  $\pi \left( 1 + \sqrt{\frac{(d^2 - a^2)}{(d^2 - a^2) + b^2}} \right)$

c)  $2\pi \left( 1 - \sqrt{\frac{(d^2 - a^2)}{(d^2 + a^2) - b^2}} \right)$       d) None

Q.11. An ellipsoid with major axis  $2a$  unit & eccentricity  $1/\sqrt{2}$  subtends a solid angle  $\pi$  sr at a point lying on the major axis at a distance  $d$  unit from the centre. The value of  $h/a$

a)  $\sqrt{\frac{8}{7}}$       b)  $\sqrt{\frac{7}{6}}$       c)  $\sqrt{\frac{6}{5}}$       d) none.

Q.12. A sphere with radius  $R$  intercepts 30% of total radiation emitted by a uniform point-source located at a distance  $d$  from the centre. Then the value of  $d/R$  is equal to

a)  $\frac{7}{\sqrt{21}}$       b)  $\frac{5}{\sqrt{21}}$       c)  $\frac{6}{\sqrt{21}}$       d) none.

Q.13. Solid angle, subtended by an infinitely long circular cylinder with a radius 14cm at a point lying in the plane of one of the circular-ends at a normal distance 84cm from the longitudinal axis, is equal to

a)  $\sin^{-1} \left( \frac{1}{6} \right)$  sr      b)  $\sin^{-1} \left( \frac{1}{8} \right)$  sr      c)  $2 \sin^{-1} \left( \frac{1}{6} \right)$  sr      d)  $2 \sin^{-1} \left( \frac{1}{8} \right)$  sr

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