

## JEE Main Session 2 Physics Exam: Model 4

1. If two rings of equal radius  $R$  are arranged perpendicular to each other with a common centre at  $C$  and the rings carry an equal current  $I$ , then find the magnetic field at  $C$ .
2. Find the acceleration of a  $2\text{ kg}$  block on a fixed inclined surface at  $37^\circ$  with the horizontal. The block is tied with a rope that passes over two pulleys (represented through a diagram) such that pulley 1 rests at the top of the inclined surface and pulley 2 carries a weight of  $4\text{ kg}$ . Neglect friction.
3. A particle of mass  $m$  is projected from the ground with a speed  $u$  at an angle of  $30^\circ$  with the horizontal. Find its angular momentum about the point of projection when it reaches its maximum height.
4. Find the ratio of the kinetic energy and the potential energy in the 5th excited state of a hydrogen atom.
5. Find the potential difference  $V_0$  across the  $700\ \Omega$  resistance.  
A diagram was given in which three resistances  $3.5\text{ k}\Omega$ ,  $200\ \Omega$ , and  $700\ \Omega$  are connected in series across a  $7\text{ V}$  battery.
6. A ball is released from a height of  $1\text{ m}$  on a fixed smooth hemispherical surface. Find its velocity when it is at a height of  $0.5\text{ m}$  from the ground. Take  $g = 10\text{ m/s}^2$ .
7. Find the current through the Zener diode if its breakdown voltage is  $5\text{ V}$ . (Diagram was given.)
8. A ball released from a height of  $10\text{ m}$  strikes the ground and rebounds to a height of  $5\text{ m}$ . Find the impulse imparted by the ground during collision. It is given that the mass of the ball is  $100\text{ g}$  and  $g = 10\text{ m/s}^2$ .
9. The electric potential due to the short electric dipole on the axial position at distance  $r$  from the dipole is proportional to ...? (Assume:  $r \gg$  length of the dipole)
10. A block of mass  $2\text{ kg}$  is placed on a disc that is rotating at a constant angular velocity of  $4\text{ rad/sec}$ . Find the friction force in (N) between the block and disc if the block is not sliding.
11. If the distance between the virtual image, which is twice the size of the object placed in front of the mirror, and the object is  $45\text{ cm}$ , what is the magnitude of the focal length of the mirror?
12. A particle is undergoing uniform acceleration. If its displacement from the  $t^{\text{th}}$  to  $(t + 1)^{\text{th}}$  second is  $120\text{ m}$  and the change in velocity is  $50\text{ m/s}$ . Find its displacement in metre in the  $(t + 2)^{\text{th}}$  second.
13. A uniform disc of mass  $5\text{ kg}$  and radius  $2\text{ m}$  is rotating with an angular velocity of  $10\text{ rad/s}$ . Now another identical disc is gently placed on the first disc. Because of the friction, both discs acquire a common angular velocity. What is the loss of kinetic energy in the process?
14. What is the maximum wavelength of the light source such that photoelectrons can be ejected from the material of work-function  $3\text{ eV}$ ?
15. A long wire carrying current  $\sqrt{2}\text{ A}$  is placed in the uniform magnetic field of  $3 \times 10^{-5}\text{ T}$ . If the magnetic field is perpendicular to the wire, find the magnetic force on a unit length of wire.