

## JEE MAIN 27 JANUARY 2024 SHIFT 1 QUESTION PAPER

### PHYSICS

1. A body of mass 1000 kg has a velocity of 6 m/s. If an extra 2000 kg mass is embedded in it, then what will be the velocity of the combined mass?
2. A charge  $Q=10^{-6}\text{C}$  is placed at the origin. Find the potential difference between two points A and B whose position vectors are  $(\sqrt{3}\hat{i} + \sqrt{3}\hat{j})$  m and  $\sqrt{6}\hat{j}$  respectively.
3. A metallic frame of a given dimension has an area vector at  $60^\circ$  with an external magnetic field  $B = 4\text{T}$ . The frame is taken out from the field in 10 seconds. Find the average EMF induced in the frame.
4. A particle has initial ( $t = 0$ ) velocity  $2 = 5\hat{i}$  and is at origin at this instant. Its acceleration is given by  $(3\hat{i} + 4\hat{j})$ . When the particle's x-coordinate is 16 units, then its speed is?
5. A particle performing simple harmonic motion according to  $x = A \sin \omega t$ . Then its kinetic energy (KE), potential energy (PE) and speed ( $v$ ) at position  $x = A/2$  are?
6. A particle performing simple harmonic motion is such that its amplitude is 4 m and the speed of the particle at the mean position is 10 m/s. Find the distance of the particle from the mean position where velocity becomes 5 m/s.
7. A prism has a refractive index  $\cot(A/2)$ , where A is the refractive angle of the prism. The minimum deviation due to this prism is?
8. A ring has a uniformly distributed charge of  $2\pi\text{C}$  and a radius of 3 cm. A charge of  $10^{-6}\text{C}$  is placed at the centre of the ring. Tension developed in the ring is  $10^x\text{N}$ . Find x.
9. A wire of length L and resistance R is cut into 5 equal parts and those parts are connected in parallel, then  $R_{\text{eq}}$  across it will be equivalent to?
10. Find the charge on the capacitor in the given circuit at a steady state.
11. If 4 objects of mass 1 kg are kept on vertices of a square of side 2 metres and an axis is passing perpendicular to the plane through one of the vertices, then calculate the Moment of Inertia about this axis.
12. If the diameter of the earth becomes half while keeping mass constant, then the acceleration due to gravity at the surface of the earth becomes?
13. If the electron revolves in the 3rd Bohr's orbit of the Hydrogen sphere and has a radius R, then what will be its radius in the 4th orbit in terms of R?

14. In which of the following circuits, the diode is reverse biased?
- +2V - PN Diode -  $5\ \Omega$  - +4V
  - 0V - PN Diode -  $3\ \Omega$
  - +2V - PN Diode -  $10\ \Omega$
  - +2V - PN Diode -  $2\ \Omega$
15. Out of air and liquid, which substance is more viscous?
16. Statement 1: Linear momentum and moment of force have the same dimensions.  
Statement 2: Planck's constant and angular momentum have the same dimension.
- Statement 1 is correct while statement 2 is false
  - Statement 1 is false while Statement 2 is correct
  - Both statements are correct
  - Both statements are false
17. Two infinite current-carrying wires having current  $I$  in opposite directions are present 20 cm away from each other. Find the magnetic field in S.I units at the midpoint P.
18. Two masses  $m_1 = 4\text{ gm}$  and  $m_2 = 25\text{ gm}$  have the same kinetic energy, then find the ratio of linear momentum.
19. Two slabs of the same thickness of 6 cm each are placed on a table, over one another with Slab A having  $\mu = 7/3$  and Slab B having  $\mu = 5/3$ . The apparent depth of the table surface is N cm. Find N. (Round off to nearest integer)
20. What should be the elevation of the outer track of the train to move in a circular path of radius R? The Width of the track is  $w$  ( $\ll R$ ) and the speed of the train is  $v$ . Neglect friction.