

# JEE MAIN Sample Paper Physics

Duration: 1 Hour

Maximum Marks: 100

## Instructions

1. This paper contains TWO sections: Section A and Section B.
2. Section A contains 20 Multiple Choice Questions (MCQs).
3. Section B contains 5 Numerical Value Questions.
4. All questions are compulsory.
5. Each correct answer carries **+4 marks**.
6. Each incorrect answer carries **-1 mark**.
7. No negative marking for unattempted questions.
8. Use  $g = 9.8 \text{ m/s}^2$  unless otherwise stated.

## Section A — Multiple Choice Questions

- Q1.** A small block of mass  $m$  is placed on a rotating horizontal turntable at a distance  $r$  from the center. The coefficient of static friction is  $\mu$ . The maximum angular velocity  $\omega$  for which the block does not slip is: [2024]
- (A)  $\sqrt{\mu g/r}$   
(B)  $\mu g/r$   
(C)  $\sqrt{r/\mu g}$   
(D)  $g/\mu r$
- Q2.** The ratio of the molar specific heats  $C_p/C_v$  for a mixture of 2 moles of Helium and 4 moles of Nitrogen is: [2023]
- (A) 1.5  
(B) 1.54  
(C) 1.59  
(D) 1.4
- Q3.** In a series LCR circuit,  $L = 10 \text{ mH}$ ,  $C = 1 \mu\text{F}$  and  $R = 10 \Omega$ . The quality factor  $Q$  of the circuit is: [2025]
- (A) 10  
(B) 100  
(C) 1000  
(D) 1
- Q4.** A light ray is incident at an angle of  $60^\circ$  on one face of a prism of refractive index  $\sqrt{3}$ . If the ray emerges normally from the other face, the angle of the prism is: [2021]
- (A)  $30^\circ$   
(B)  $45^\circ$   
(C)  $60^\circ$   
(D)  $90^\circ$

- Q5.** The stopping potential  $V_0$  versus frequency  $\nu$  graph for a photosensitive surface is a straight line. The slope of this line is: [2022]
- (A)  $h$   
(B)  $h/e$   
(C)  $e/h$   
(D)  $w/e$
- Q6.** Two satellites  $A$  and  $B$  go round a planet in circular orbits of radii  $4R$  and  $R$  respectively. If the speed of satellite  $A$  is  $3v$ , the speed of satellite  $B$  is: [2024]
- (A)  $12v$   
(B)  $6v$   
(C)  $1.5v$   
(D)  $3v/2$
- Q7.** A galvanometer of resistance  $50\ \Omega$  gives full scale deflection for a current of  $0.05$  A. To convert it into a voltmeter of range  $0$ – $200$  V, the resistance to be connected in series is: [2023]
- (A)  $3950\ \Omega$   
(B)  $4000\ \Omega$   
(C)  $4050\ \Omega$   
(D)  $3900\ \Omega$
- Q8.** The displacement of a particle is given by  $x = 3\sin(5\pi t) + 4\cos(5\pi t)$ . The amplitude of the particle's motion is: [2021]
- (A) 3  
(B) 4  
(C) 5  
(D) 7
- Q9.** An electromagnetic wave is propagating along the x-axis. At a certain point, the electric field vector is along the y-axis. The magnetic field vector at that point is along: [2025]
- (A) x-axis  
(B) y-axis  
(C) z-axis  
(D) -z-axis
- Q10.** The work function of a metal is  $2.5$  eV. The threshold wavelength for the metal is approximately: [2022]
- (A)  $4960\ \text{\AA}$   
(B)  $3100\ \text{\AA}$   
(C)  $6200\ \text{\AA}$   
(D)  $2500\ \text{\AA}$
- Q11.** A wire of length  $L$  and area  $A$  has resistance  $R$ . It is stretched such that its radius becomes half. The new resistance is: [2024]
- (A)  $4R$   
(B)  $8R$   
(C)  $16R$   
(D)  $2R$
- Q12.** The efficiency of a Carnot engine is  $1/6$ . When the temperature of the sink is reduced by  $62^\circ\text{C}$ , its efficiency is doubled. The temperatures of the source and sink are: [2023]
- (A)  $99^\circ\text{C}$ ,  $37^\circ\text{C}$   
(B)  $372\ \text{K}$ ,  $310\ \text{K}$   
(C)  $124^\circ\text{C}$ ,  $62^\circ\text{C}$   
(D)  $400\ \text{K}$ ,  $300\ \text{K}$
- Q13.** If the pressure of an ideal gas is increased by  $0.4$
- (A) 0.4  
(B) 0.8  
(C) 0.2  
(D) 0.1

**Q14.** A magnetic needle suspended in a vertical plane at  $30^\circ$  from the magnetic meridian makes an angle of  $45^\circ$  with the horizontal. The real dip at that place is: [2022]

- (A)  $\tan^{-1}(\sqrt{3}/2)$   
 (B)  $\tan^{-1}(1/2)$   
 (C)  $\tan^{-1}(\sqrt{3})$   
 (D)  $30^\circ$

**Q15.** The binding energy per nucleon of  $Li^7$  and  $He^4$  are 5.60 MeV and 7.06 MeV respectively. In the reaction  $Li^7 + p \rightarrow 2He^4$ , the energy  $Q$  released is: [2024]

- (A) 19.6 MeV  
 (B) 17.3 MeV  
 (C) 8.4 MeV  
 (D) 2.4 MeV

**Q16.** A capacitor of  $10 \mu\text{F}$  is charged to 100 V and then connected to an uncharged capacitor of  $20 \mu\text{F}$ . The final potential difference across the combination is: [2025]

- (A) 33.3 V  
 (B) 50 V  
 (C) 66.6 V  
 (D) 100 V

**Q17.** The de-Broglie wavelength of an electron accelerated through a potential of 100 V is approximately: [2023]

- (A)  $1.23 \text{ \AA}$

- (B)  $12.3 \text{ \AA}$   
 (C)  $0.123 \text{ \AA}$   
 (D)  $123 \text{ \AA}$

**Q18.** A soap bubble of radius  $r$  is blown to a radius  $2r$ . If  $S$  is the surface tension, the work done is: [2021]

- (A)  $12\pi r^2 S$   
 (B)  $24\pi r^2 S$   
 (C)  $16\pi r^2 S$   
 (D)  $8\pi r^2 S$

**Q19.** In a common emitter amplifier, the audio signal voltage across the collector resistance  $2 \text{ k}\Omega$  is 2 V. If the current amplification factor is 100 and the base resistance is  $1 \text{ k}\Omega$ , the input signal voltage is: [2024]

- (A) 0.1 V  
 (B) 0.01 V  
 (C) 0.001 V  
 (D) 1 V

**Q20.** A body of mass  $M$  hits a wall at an angle  $\theta$  and rebounds at the same angle with the same speed  $v$ . The change in momentum is: [2022]

- (A)  $2Mv \cos \theta$   
 (B)  $2Mv \sin \theta$   
 (C)  $Mv \cos \theta$   
 (D)  $Mv \sin \theta$

### Section B — Numerical Value Questions

**Q21.** A point mass is moving in a harmonic motion  $x = A \sin(\omega t)$ . When the displacement is  $x = A/2$ , the ratio of its kinetic energy to potential energy is  $X : 1$ . Find  $X$ . [2024]

**Q22.** A physical quantity  $P$  is given by  $P = A^3 B^2 / (C \sqrt{D})$ . The percentage errors in  $A, B, C, D$  are 1

**Q23.** A uniform rod of length 1 m and mass 2 kg is rotating about an axis passing through its

center and perpendicular to its length. If its angular velocity changes from 0 to 10 rad/s in 2 seconds, the torque applied is: [2025]

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**Q24.** A gas is compressed at a constant pressure of  $50 \text{ N/m}^2$  from a volume of  $10 \text{ m}^3$  to  $4 \text{ m}^3$ . Energy of 100 J is then added to the gas by heating. Its internal energy increases by: [2021]

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**Q25.** Two resistors of  $10 \Omega$  and  $20 \Omega$  are connected in parallel. This combination is connected in series with a  $5 \Omega$  resistor and a 10 V battery. The current through the  $10 \Omega$  resistor is  $I$  Amperes. Find  $10 \times I$  (to the nearest integer). [2022]

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**Answer Key****Section A**

1.(A)	2.(B)	3.(B)	4.(A)	5.(B)
6.(B)	7.(A)	8.(C)	9.(C)	10.(A)
11.(B)	12.(A)	13.(A)	14.(B)	15.(A)
16.(A)	17.(B)	18.(B)	19.(A)	20.(A)

**Section B**

21. 3	22. 12	23. 0.83	24. 400	25. 6
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