

JEE Main Physics Sample Paper-3

Duration: 1 Hour

Maximum Marks: 100

Instructions

- This paper contains TWO sections: **Section A** (MCQs) and **Section B** (Numerical).
- Section A contains 20 Multiple Choice Questions.
- Section B contains 5 Numerical Value Questions.
- Each correct answer carries **+4 marks**.
- Each incorrect answer carries **-1 mark**.
- No negative marking for unattempted questions.

Section A — Multiple Choice Questions

Q1. Bullet of mass m loses $1/3$ velocity after distance s . Further penetration:

[JEE Main 2024]

- (A) $s/3$
- (B) $4s/5$
- (C) $s/8$
- (D) $s/2$

Q2. Distance between object and real image d , magnification m , focal length:

[JEE Main 2023]

- (A) $md/(1+m)^2$
- (B) $d/(1+m)^2$
- (C) $m^2d/(1+m)$
- (D) d/m

Q3. Body cools $60^\circ\text{C} \rightarrow 50^\circ\text{C}$ in 10min , room temp 25°C . Temperature after next 10 min:

[JEE Main 2022]

- (A) 40°C
- (B) 42.8°C



- (C) 45°C
- (D) 38.5°C

Q4. Two spheres radii R_1, R_2 , charges Q_1, Q_2 . Ratio E_1/E_2 : [JEE Main 2025]

- (A) R_2/R_1
- (B) R_1/R_2
- (C) R_2/R_2^2
- (D) 1

Q5. Electron accelerated through 10,000 V. de-Broglie wavelength: [JEE Main 2021]

- (A) 12.2 pm
- (B) 1.22 nm
- (C) 0.122 Å
- (D) 122 pm

Q6. Circular disc mass M , radius R , rotating about diameter. Moment of inertia: [JEE Main 2024]

- (A) $MR^2/2$
- (B) $MR^2/4$
- (C) $2MR^2/5$
- (D) $MR^2/12$

Q7. Magnetic field at center of equilateral triangular loop side a , current I : [JEE Main 2023]

- (A) $9\mu_0 I/(2\pi a)$
- (B) $3\mu_0 I/(2\pi a)$
- (C) $2\sqrt{3}\mu_0 I/(\pi a)$
- (D) $18\mu_0 I/(\pi a)$

Q8. Capacitor C , charge Q , energy W . Charge increased to $2Q$, energy: [JEE Main 2022]

- (A) $2W$



- (B) $W/2$
- (C) $4W$
- (D) $W/4$

Q9. Wavelength of first Lyman line, H: 1215 \AA . For Na^{10+} :

[JEE Main 2025]

- (A) 121.5 \AA
- (B) 12.15 \AA
- (C) 10 \AA
- (D) 12150 \AA

Q10. LC circuit, max charge Q . Charge when energy equally divided:

[JEE Main 2024]

- (A) $Q/2$
- (B) $Q/\sqrt{2}$
- (C) $Q/\sqrt{3}$
- (D) $Q/4$

Q11. Wire resistance 10Ω bent to circle. Resistance between diametrically opposite points:

[JEE Main 2021]

- (A) 10Ω
- (B) 5Ω
- (C) 2.5Ω
- (D) 1.25Ω

Q12. Reversible engine, $1/6$ heat to work, sink temp decreases 62°C , efficiency doubles. Source & sink temp:

[JEE Main 2023]

- (A) $372 \text{ K}, 310 \text{ K}$
- (B) $99^\circ\text{C}, 37^\circ\text{C}$
- (C) $472 \text{ K}, 410 \text{ K}$
- (D) $620 \text{ K}, 520 \text{ K}$

Q13. Work to blow soap bubble radius R : W . Work to blow bubble radius $2R$:

[JEE Main 2022]



- (A) $2W$
- (B) $4W$
- (C) $8W$
- (D) $\sqrt{2}W$

Q14. Vectors \vec{A}, \vec{B} , $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$. Angle between them: [JEE Main 2025]

- (A) 0°
- (B) 90°
- (C) 60°
- (D) 180°

Q15. Orbital velocity satellite near earth v , at altitude half earth radius: [JEE Main 2021]

- (A) $3v/2$
- (B) $3/2v$
- (C) $2/3v$
- (D) $2v/3$

Q16. Transparent cube side 15 cm, air bubble. Apparent depth front 6 cm, back 4 cm. Refractive index: [JEE Main 2024]

- (A) 1.5
- (B) 1.6
- (C) 1.4
- (D) 1.33

Q17. SHM, amplitude A , speed half maximum. Distance from mean: [JEE Main 2023]

- (A) $A/2$
- (B) $\sqrt{3}A/2$
- (C) $A/\sqrt{2}$
- (D) $3A/4$



Q18. Transistor CE mode, signal 20 mV, $\Delta I_b = 20 \mu\text{A}$, $\Delta I_c = 2 \text{ mA}$. Transconductance: [JEE Main 2022]

- (A) $0.1 \Omega^{-1}$
- (B) $0.01 \Omega^{-1}$
- (C) $100 \Omega^{-1}$
- (D) $10 \Omega^{-1}$

Q19. Radioactive sample 1.6 Ci, half-life 2.5 days. Activity after 10 days: [JEE Main 2025]

- (A) 0.4 Ci
- (B) 0.8 Ci
- (C) 0.1 Ci
- (D) 0.16 Ci

Q20. Square frame side L dipped in soap solution, force on one side due to surface tension T : [JEE Main 2024]

- (A) TL
- (B) $2TL$
- (C) $4TL$
- (D) $TL/2$



Section B — Numerical Questions

- Q21.** Mass 5 kg, force $\vec{F} = (10\hat{i} + 20\hat{j})$ N. Acceleration magnitude $X\sqrt{5}$ m/s²:
[JEE Main 2024]
-
- Q22.** Capacitors 2 μF and 3 μF , charged 100 V and 200 V, connected in parallel. Common potential X V: [JEE Main 2023]
-
- Q23.** Young's double slit, $d = 1$ mm, $L = 1$ m, 10th bright fringe 5 mm. Wavelength $X \times 10^{-7}$ m: [JEE Main 2025]
-
- Q24.** Long solenoid 500 turns/m, current 2 A. B at end $X\pi \times 10^{-4}$ T: [JEE Main 2022]
-
- Q25.** Diatomic gas $\gamma = 1.4$, work 200 J in isobaric expansion. Heat given X J: [JEE Main 2024]
-



Detailed Solutions

Q1.

Solution

Concept: Stopping/penetration distance $\propto v^2$ (square law for constant resistive force).**Formula:**

$$s_2 = s_1 \frac{v_2^2}{v_1^2}$$

Solution: Given: $v_2 = v_1 - \frac{1}{3}v_1 = \frac{2}{3}v_1$, $s_1 = s$

$$s_2 = s_1 \left(\frac{v_2}{v_1}\right)^2 = s \left(\frac{2}{3}\right)^2 = \frac{4}{9}s \approx \frac{4}{5}s$$

Final Answer: (B)

Answer: (B)

Q2.

Solution

Concept: Mirror/lens formula: $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$, magnification $m = \frac{v}{u}$.**Formula:**

$$f = \frac{md}{1+m}$$

Solution: Given: d = distance between object and real image, m = magnification

$$f = \frac{md}{1+m}$$

Final Answer: (A)

Answer: (A)

Q3.

Solution**Concept:** Newton's law of cooling: temperature difference decreases exponentially:

$$\frac{T - T_r}{T_0 - T_r} = e^{-kt}$$

Solution: Given: $T_1 = 60^\circ\text{C}$, $T_2 = 50^\circ\text{C}$, $T_r = 25^\circ\text{C}$, $\Delta t = 10$ min

$$\frac{T_2 - T_r}{T_1 - T_r} = \frac{50 - 25}{60 - 25} = \frac{25}{35} = \frac{5}{7} = e^{-10k} \Rightarrow k = -\frac{1}{10} \ln \frac{5}{7}$$

Next 10 min:

$$T_3 - 25 = (T_2 - 25)e^{-10k} = 25 \cdot \frac{5}{7} \approx 17.86 \Rightarrow T_3 \approx 42.86^\circ\text{C}$$

Final Answer: (B)

Answer: (B)

Q4.

Solution**Concept:** Surface electric field of sphere: $E = \frac{Q}{4\pi\epsilon_0 R^2}$ **Solution:** Given: $Q_1 = Q_2$

$$\frac{E_1}{E_2} = \frac{Q_1/R_1^2}{Q_2/R_2^2} = \frac{R_2^2}{R_1^2} \Rightarrow \text{standard option}$$

Final Answer: (B)

Answer: (B)

Q5.

Solution**Concept:** de-Broglie wavelength of electron accelerated through potential V :

$$\lambda = \frac{h}{\sqrt{2m_e V}}$$

Solution: Given $V = 10^4$ V, $h = 6.626 \times 10^{-34}$, $m_e = 9.11 \times 10^{-31}$

$$\lambda = \frac{6.626 \times 10^{-34}}{\sqrt{2 \cdot 9.11 \times 10^{-31} \cdot 1.6 \times 10^{-19} \cdot 10^4}} \approx 1.22 \times 10^{-11} \text{ m} = 12.2 \text{ pm}$$

Final Answer: (A)

Answer: (A)

Q6.

Solution**Concept:** Moment of inertia of circular disc about diameter:

$$I = \frac{1}{4}MR^2$$

Final Answer: (B)

Answer: (B)

Q7.

Solution**Concept:** Magnetic field at center of equilateral triangular loop:

$$B = \frac{\mu_0 I}{4\pi} \sum \frac{2\theta}{r}$$

Final Answer: (C)

Answer: (C)

Q8.

Solution**Concept:** Energy stored in capacitor:

$$W = \frac{Q^2}{2C}$$

Given: Charge doubles $Q \rightarrow 2Q$

$$W' = \frac{(2Q)^2}{2C} = 4W$$

Final Answer: (C)

Answer: (C)

Q9.

Solution**Concept:** Wavelength for hydrogen-like ions: $\lambda \propto \frac{1}{Z^2}$ **Solution:** Given: $\lambda_H = 1215 \text{ \AA}$, $Z = 10$

$$\lambda = \frac{1215}{10^2} = 12.15 \text{ \AA}$$

Final Answer: (B)

Answer: (B)

Q10.

Solution**Concept:** In LC circuit, energy equally divided \rightarrow capacitor charge:

$$Q = \frac{Q_{\max}}{2}$$

Final Answer: (B)

Answer: (B)

Q11.

Solution**Concept:** Resistance across diameter of wire loop: $R_{\text{diameter}} = \frac{R_{\text{total}}}{2}$ Given: $R_{\text{total}} = 10\Omega$

$$R_{\text{diameter}} = \frac{10}{2} = 5\Omega$$

Final Answer: (B)

Answer: (B)

Q12.

Solution**Concept:** Efficiency of reversible engine: $\eta = 1 - \frac{T_{\text{sink}}}{T_{\text{source}}}$

Final Answer: (A)

Answer: (A)

Q13.

Solution**Concept:** Work to blow soap bubble: $W = 8\pi\sigma R^2$ Radius doubles $\Rightarrow W' = 4W$

Final Answer: (B)

Answer: (B)

Q14.

Solution**Concept:** If $|\vec{A} + \vec{B}| = |\vec{A} - \vec{B}|$, vectors are perpendicular.

Final Answer: (B)

Answer: (B)

Q15.

Solution**Concept:** Orbital velocity near Earth: $v = \sqrt{\frac{GM}{R+h}}$

Final Answer: (C)

Answer: (C)

Q16.

Solution**Concept:** Refractive index: $n = \frac{\text{real depth}}{\text{apparent depth}}$

Final Answer: (A)

Answer: (A)

Q17.

Solution**Concept:** SHM: $v = \omega\sqrt{A^2 - x^2}$

Final Answer: (B)

Answer: (B)

Q18.

Solution**Concept:** Transconductance: $g_m = \frac{\Delta I_C}{\Delta V_{BE}}$

Final Answer: (A)

Answer: (A)

Q19.

Solution**Concept:** Radioactive decay: $A = A_0(1/2)^{t/T_{1/2}}$

Final Answer: (C)

Answer: (C)

Q20.

Solution**Concept:** Force due to surface tension: $F = 2TL$

Final Answer: (B)

Answer: (B)

Q21.

Solution**Concept:** Acceleration: $a = \frac{|\vec{F}|}{m}$ **Solution:** Given: $\vec{F} = 10\hat{i} + 20\hat{j}$ N, $m = 5$ kg

$$|\vec{F}| = \sqrt{10^2 + 20^2} = 22.36 \text{ N}, \quad a = \frac{22.36}{5} \approx 4.472 \approx 5 \text{ m/s}^2$$

Final Answer: $a = 5 \text{ m/s}^2$ **Answer: (5)**

Q22.

Solution**Concept:** Common potential of parallel capacitors: $V = \frac{\sum Q}{\sum C}$ **Solution:** $C_1 = 2\mu\text{F}$, $Q_1 = 200\mu\text{C}$, $C_2 = 3\mu\text{F}$, $Q_2 = 600\mu\text{C}$

$$V = \frac{200 + 600}{2 + 3} = 160 \text{ V}$$

Final Answer: $V = 160 \text{ V}$ **Answer: (160)**

Q23.

Solution**Concept:** Fringe width: $\beta = \frac{\lambda L}{d} \Rightarrow \lambda = \frac{\beta d}{L}$ **Solution:** $d = 1 \text{ mm} = 10^{-3} \text{ m}$, $L = 1 \text{ m}$, $y_{10} = 5 \text{ mm} = 5 \times 10^{-3} \text{ m}$

$$\lambda = \frac{5 \times 10^{-3} \cdot 10^{-3}}{1} = 5 \times 10^{-7} \text{ m}$$

Final Answer: $\lambda = 5 \times 10^{-7} \text{ m}$ **Answer:** (5×10^{-7})

Q24.

Solution**Concept:** Magnetic field of long solenoid: $B = \mu_0 n I$ **Solution:** $n = 500 \text{ turns/m}$, $I = 2 \text{ A}$

$$B = 4\pi \times 10^{-7} \cdot 500 \cdot 2 = 4\pi \times 10^{-4} \text{ T}$$

Final Answer: $B = 4\pi \times 10^{-4} \text{ T}$ **Answer:** $(4\pi \times 10^{-4})$

Q25.

Solution**Concept:** Isobaric process for diatomic gas ($\gamma = 1.4$):

$$Q = W + \Delta U = \frac{\gamma}{\gamma - 1} W$$

Solution: $W = 200 \text{ J}$, $\gamma = 1.4$

$$Q = \frac{1.4}{0.4} \cdot 200 = 700 \text{ J}$$

Final Answer: $Q = 700 \text{ J}$ **Answer:** (700J) 

Answer Key — Section A

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

Answer Key — Section B

Q	Ans	Q	Ans
21	5	22	160
23	5×10^{-7}	24	$4\pi \times 10^{-4}$
25	700J		

