

JEE Main Physics Sample Paper-8

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.** A proton and an α -particle are accelerated from rest through the same potential difference. The ratio of their de-Broglie wavelengths is approximately: [JEE Main 2023]
- (A) 1:2
(B) 4:1
(C) 2:1
(D) 1:1
- Q2.** The energy band gap required to produce a violet LED ($\lambda = 400 \text{ nm}$) is closest to: [JEE Main 2022]
- (A) 2 eV
(B) 1 eV
(C) 3 eV
(D) 4 eV
- Q3.** In the hydrogen atom Bohr model, the wavelength of the first line of the Lyman series is around: [JEE Main 2021]
- (A) 122 nm



- (B) 102 nm
- (C) 97 nm
- (D) 150 nm

Q4. A radioactive sample has activity decaying exponentially. If after a certain time its activity drops to $1/4$ th, the number of half-lives elapsed is:

[JEE Main 2020]

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Q5. Two point charges $+Q$ and $-Q$ are placed 2 m apart. The electric potential at a point 1 m from each charge (midpoint) is:

[JEE Main 2025]

- (A) Zero
- (B) $\frac{Q}{2\pi\epsilon}$
- (C) $\frac{2Q}{\pi\epsilon}$
- (D) $\frac{Q}{4\pi\epsilon}$

Q6. A parallel-plate capacitor with air between the plates has capacitance C . If a dielectric slab of constant K fills the space, the new capacitance becomes:

[JEE Main 2024]

- (A) $\frac{C}{K}$
- (B) KC
- (C) $C\sqrt{K}$
- (D) $\frac{C}{\sqrt{K}}$

Q7. In which of the following positions between two equal $+$ charges does the net electric field become zero?:

[JEE Main 2023]

- (A) Exactly in the middle
- (B) Closer to the first charge
- (C) At infinity
- (D) Closer to the second charge



- Q8.** In a circuit with two resistors of $6\ \Omega$ and $3\ \Omega$ in parallel, and a total voltage of $9\ \text{V}$ applied, the current through the $3\ \Omega$ resistor is: [JEE Main 2025]
- (A) $1\ \text{A}$
(B) $2\ \text{A}$
(C) $3\ \text{A}$
(D) $0.5\ \text{A}$
- Q9.** A wire of length $1\ \text{m}$ and resistance $4\ \Omega$ is stretched to double its length. The new resistance becomes: [JEE Main 2022]
- (A) $8\ \Omega$
(B) $16\ \Omega$
(C) $4\ \Omega$
(D) $2\ \Omega$
- Q10.** The equivalent resistance between points a and b is X when three resistors of $2\ \Omega$, $3\ \Omega$, and $6\ \Omega$ are connected as follows: $2\ \Omega$ in series with the parallel combination of $3\ \Omega$ and $6\ \Omega$. : [JEE Main 2021]
- (A) $5\ \Omega$
(B) $4\ \Omega$
(C) $3\ \Omega$
(D) $6\ \Omega$
- Q11.** A circular loop of radius $0.1\ \text{m}$ carries $2\ \text{A}$ current. The magnetic field at the center is: [JEE Main 2023]
- (A) $1.26 \times 10^{-5}\ \text{T}$
(B) $2.52 \times 10^{-5}\ \text{T}$
(C) $5.04 \times 10^{-5}\ \text{T}$
(D) $1 \times 10^{-5}\ \text{T}$
- Q12.** In an LCR series circuit, resonance occurs when: [JEE Main 2024]
- (A) $X_L = X_C$
(B) $R = X_L$
(C) $R = X_C$



(D) $XL + XC = R$

Q13. A circular loop is moved out of a uniform magnetic field. The induced emf depends on: [JEE Main 2021]

(A) Rate of change of area inside the field

(B) Flux change

(C) Number of turns

(D) All of the above

Q14. In Young's double-slit experiment, intensity is maximum at a point where the path difference is: [JEE Main 2022]

(A) $\frac{\lambda}{2}$

(B) λ

(C) $\frac{3\lambda}{2}$

(D) $\frac{\lambda}{4}$

Q15. A concave mirror forms an image at the center of curvature when the object is placed at: [JEE Main 2025]

(A) Infinity

(B) Focus

(C) Twice the focal length

(D) Between focus and center

Q16. Lateral magnification for a lens system is -2 . If the object is at 15 cm and $f = 10$ cm, find the image distance: [JEE Main 2023]

(A) -20 cm

(B) -30 cm

(C) 20 cm

(D) 30 cm

Q17. A gas undergoes an adiabatic compression. If its initial temperature is 300 K and $\gamma = 1.4$, the final temperature is increased. The relation connecting T and V for an adiabatic process is: $TV^{(\gamma-1)} = \text{constant}$ [JEE Main 2024]

(A) $TV = \text{constant}$



- (B) $TV^{(\gamma-1)} = \text{constant}$
- (C) $PTV = \text{constant}$
- (D) $TP = \text{constant}$

Q18. According to kinetic theory, the RMS speed of a gas molecule is proportional to $\sqrt{\frac{T}{m}}$. If T is doubled, the RMS speed becomes: [JEE Main 2020]

- (A) $\sqrt{2}$ times
- (B) Twice
- (C) Half
- (D) Same

Q19. A mass m on a spring executes SHM with period T . If amplitude doubles, the period: [JEE Main 2022]

- (A) Doubles
- (B) Halves
- (C) Remains same
- (D) Quadruples

Q20. The frequency of a wave is 500 Hz and speed in medium is 340 m/s. The wavelength is: [JEE Main 2021]

- (A) 0.68 m
- (B) 1.36 m
- (C) 2 m
- (D) 0.34 m



Section B — Numerical Questions

- Q21.** A capacitor of $6 \mu\text{F}$ is charged to 12 V . Find the energy stored in the capacitor: [JEE Main 2025]
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- Q22.** A 2 kg block slides down a frictionless incline of height 5 m . Find its speed at the bottom: [JEE Main 2024]
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- Q23.** Current of 3 A flows through a 5Ω resistor. Calculate the power dissipated: [JEE Main 2023]
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- Q24.** A string of length 1 m and tension 100 N has linear density 0.01 kg/m . Find wave speed on the string: [JEE Main 2021]
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- Q25.** A ball of mass 0.5 kg tied to a string rotates in a horizontal circle of radius 1 m with speed 10 m/s . Find the tension in the string: [JEE Main 2022]
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Detailed Solutions for Section A

Q1.

Solution

Concept: De-Broglie wavelength is inversely proportional to momentum. Since the proton and alpha particle are accelerated through the same potential difference, their momentum and mass ratio will determine the de-Broglie wavelengths.

Formula:

$$\lambda = \frac{h}{p}, \quad p = mv$$

Solution: The ratio of their wavelengths is approximately given by the ratio of the square root of their masses, leading to a ratio of 2:1.

Answer: (C)

Q2.

Solution

Concept: Energy band gap is related to the wavelength of emitted light for LED.

Formula:

$$E_g = \frac{hc}{\lambda}$$

Solution: For $\lambda = 400$ nm, the energy band gap is closest to 3 eV.

Answer: (C)

Q3.

Solution

Concept: The wavelength of the first line in the Lyman series for hydrogen can be found using the Rydberg formula.

Formula:

$$\lambda = \frac{1}{R} \left(\frac{1}{1^2} - \frac{1}{2^2} \right)$$

Solution: The wavelength is 121.6 nm, which rounds to 122 nm.

Answer: (A)



Q4.

Solution

Concept: The activity of a radioactive sample decays exponentially. If the activity drops to 1/4th, the number of half-lives elapsed is 2.

Solution: After 2 half-lives, the activity reduces to 1/4th of the original.

Answer: (B)

Q5.

Solution

Concept: The electric potential due to point charges follows the principle of superposition.

Formula:

$$V = k \left(\frac{Q_1}{r_1} + \frac{Q_2}{r_2} \right)$$

Solution: At the midpoint, the potential from +Q and -Q cancels out, so the electric potential is zero.

Answer: (A)

Q6.

Solution

Concept: The capacitance increases by a factor of the dielectric constant K when a dielectric is inserted.

Formula:

$$C_{\text{new}} = K \cdot C$$

Solution: The new capacitance is K times the original capacitance.

Answer: (B)

Q7.

Solution

Concept: Between two equal charges, the net electric field is zero at a point where the magnitudes of the electric fields due to both charges cancel out.

Solution: The field becomes zero exactly in the middle.

Answer: (A)

Q8.

Solution**Concept:** In a parallel circuit, current divides inversely with resistance.**Formula:**

$$I_2 = \frac{R_1}{R_1 + R_2} \cdot I_{\text{total}}$$

Solution: The current through the $3\ \Omega$ resistor is 2 A.**Answer:** (B)

Q9.

Solution**Concept:** When a wire is stretched to double its length, its resistance increases by a factor of 4 due to the proportionality between resistance, length, and cross-sectional area.**Solution:** The new resistance becomes $16\ \Omega$ **Answer:** (B)

Q10.

Solution**Concept:** The equivalent resistance of resistors in series and parallel can be calculated using the appropriate formulas.**Formula:**

$$R_{\text{eq}} = R_1 + \left(\frac{1}{R_2} + \frac{1}{R_3} \right)^{-1}$$

Solution: The equivalent resistance is $5\ \Omega$ **Answer:** (A)

Q11.

Solution**Concept:** The magnetic field at the center of a circular loop is given by the formula:**Formula:**

$$B = \frac{\mu_0 I}{2R}$$

Solution: Using the given values, the magnetic field is $1.26 \times 10^{-5}\ \text{T}$.**Answer:** (A)

Q12.

Solution

Concept: Resonance occurs in an LCR circuit when the inductive reactance equals the capacitive reactance.

Solution: At resonance, $X_L = X_C$.

Answer: (A)

Q13.

Solution

Concept: The induced emf depends on the rate of change of magnetic flux, the area inside the field, and the number of turns.

Solution: The induced emf depends on all of the above factors.

Answer: (D)

Q14.

Solution

Concept: Intensity maxima occur at integer multiples of the wavelength.

Solution: At a path difference of λ , the intensity is maximum.

Answer: (B)

Q15.

Solution

Concept: The concave mirror forms an image at the center of curvature when the object is placed at twice the focal length.

Solution: The object should be placed at twice the focal length to form an image at the center of curvature.

Answer: (C)

Q16.

Solution

Concept: Lateral magnification is related to the object and image distances through the magnification formula.

Formula:

$$M = \frac{v}{u}$$

Solution: The image distance is -30 cm.

Answer: (B)



Q17.

Solution**Concept:** For adiabatic processes, $TV^{\gamma-1} = \text{constant}$.**Solution:** The relation connecting temperature and volume for adiabatic processes is $TV^{\gamma-1} = \text{constant}$.**Answer: (B)**

Q18.

Solution**Concept:** The RMS speed of gas molecules is proportional to the square root of temperature.**Solution:** When T is doubled, the RMS speed increases by a factor of $\sqrt{2}$.**Answer: (A)**

Q19.

Solution**Concept:** The period of oscillation in SHM does not depend on the amplitude.**Solution:** The period remains the same when the amplitude doubles.**Answer: (C)**

Q20.

Solution**Concept:** The wavelength of a wave is given by the formula $\lambda = \frac{v}{f}$.**Solution:** The wavelength is 0.68 m.**Answer: (A)**

Q21.

Solution**Concept:** The energy stored in a capacitor is given by:**Formula:**

$$E = \frac{1}{2}CV^2$$

Solution:

$$E = \frac{1}{2} \times 6\mu F \times (12V)^2 = 0.432 \text{ J}$$

Answer: (0.432)

Q22.

Solution**Concept:** Use conservation of energy to find the final speed.**Formula:**

$$v = \sqrt{2gh}$$

Solution:

$$v = \sqrt{2 \times 9.8 \text{ m/s}^2 \times 5 \text{ m}} = 9.9 \text{ m/s}$$

Answer: (9.9)

Q23.

Solution**Concept:** Power dissipated in a resistor is given by:**Formula:**

$$P = I^2 R$$

Solution:

$$P = (3 \text{ A})^2 \times 5 \Omega = 45 \text{ W}$$

Answer: (45)

Q24.

Solution**Concept:** Wave speed on a string is given by:**Formula:**

$$v = \sqrt{\frac{T}{\mu}}$$

Solution:

$$v = \sqrt{\frac{100 \text{ N}}{0.01 \text{ kg/m}}} = 100 \text{ m/s}$$

Answer: (100)

Q25.

Solution**Concept:** The tension in the string is given by:**Formula:**

$$T = \frac{mv^2}{r}$$

Solution:

$$T = \frac{0.5 \times (10)^2}{1} = 50 \text{ N}$$

Answer: (50)

Answer Key — Section A

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

Answer Key — Section B

Q	Ans	Q	Ans
21	0.432	22	9.9
23	45	24	100
25	50		

