VITEEE 2025 Apr 20 Shift 1 Question Paper with Solutions

---

1. A uniform rod of length L and mass M is pivoted at one end and displaced by a small angle θ from vertical. The time period of small oscillations is:

(A) $2\pi\sqrt{\frac{L}{g}}$

(B) $2\pi\sqrt{\frac{2L}{3g}}$

(C) $2\pi\sqrt{\frac{3L}{2g}}$

(D) $2\pi\sqrt{\frac{L}{2g}}$

Correct Answer: (B)

Solution: For a physical pendulum,

$$T = 2\pi\sqrt{\frac{I}{Mgh}}$$

For a rod about one end: $I = \frac{1}{3}ML^2,\ h = \frac{L}{2}$

$$T = 2\pi\sqrt{\frac{\frac{1}{3}ML^2}{Mg\frac{L}{2}}} = 2\pi\sqrt{\frac{2L}{3g}}$$

Quick Tip

Always use the physical pendulum formula when pivot is not at centre of mass.

---

2. A charged particle enters a uniform magnetic field perpendicular to its velocity. If the field is suddenly doubled, the radius of its path becomes:

(A) Half

(B) Double

(C) Four times

(D) Remains same

Correct Answer: (A)

Solution: Radius of circular path,

$$r = \frac{mv}{qB}$$

If B is doubled, r becomes half.

Quick Tip

Radius is inversely proportional to magnetic field strength.

---

3. In a series LCR circuit at resonance, the voltage across the inductor is 100 V and across the capacitor is 100 V. The voltage across the resistor is:

(A) 0 V

(B) 100 V

(C) 200 V

(D) 141 V

Correct Answer: (B)

Solution: At resonance, inductive and capacitive voltages are equal and opposite, so they cancel. The applied voltage appears entirely across the resistor.

Quick Tip

At resonance, circuit impedance is purely resistive.

---

4. The de Broglie wavelength of an electron accelerated through 100 V is approximately:

(A) 1.23 Å

(B) 12.3 Å

(C) 0.123 Å

(D) 123 Å

Correct Answer: (A)

Solution:

$$\lambda(\text{Å}) = \frac{12.27}{\sqrt{V}} \Rightarrow \lambda = \frac{12.27}{10} \approx 1.23 \text{ Å}$$

Quick Tip

For electrons, $\lambda(\text{Å}) = \frac{12.27}{\sqrt{V}}$.

---

5. The standard reduction potential of Zn^{2+}/Zn is -0.76 V and Cu^{2+}/Cu is $+0.34$ V. The EMF of the cell Zn — Zn^{2+} —— Cu^{2+} — Cu is:

(A) 1.10 V

(B) -1.10 V

(C) 0.42 V

(D) -0.42 V

Correct Answer: (A)

Solution:

$$E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}} = 0.34 - (-0.76) = 1.10 \text{ V}$$

Quick Tip

Cell EMF = cathode potential anode potential.

---

6. For the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, $\Delta H = -92$ kJ/mol. The equilibrium constant K_p will increase with:

(A) Increase in temperature

(B) Decrease in temperature

(C) Increase in pressure

(D) Addition of catalyst

Correct Answer: (B)

Solution: The reaction is exothermic. Lowering temperature favors product formation, increasing K_p.

Quick Tip

For exothermic reactions, decreasing temperature increases equilibrium constant.

---

7. The coordination number and geometry of $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$ are respectively:

(A) 4, square planar and 4, tetrahedral

(B) 4, tetrahedral and 4, square planar

(C) 6, octahedral and 6, octahedral

(D) 4, square planar and 6, octahedral

Correct Answer: (A)

Solution: CN^- is a strong field ligand giving square planar complex, Cl^- is a weak field ligand giving tetrahedral complex.

Quick Tip

Strong field ligands favor square planar geometry for Ni(II).

---

8. The rate constant for a first-order reaction is 0.0693 min^{-1}. The time required for 75% completion of the reaction is:

(A) 10 min

(B) 20 min

(C) 30 min

(D) 40 min

Correct Answer: (B)

Solution: 75% completion means 25% remains:

$$t = \frac{2.303}{k} \log \frac{1}{0.25} = \frac{1.386}{0.0693} \approx 20 \text{ min}$$

Quick Tip

For first-order reactions, use logarithmic decay formula.

9. If the roots of the equation $x^3 - 6x^2 + 11x - 6 = 0$ are in A.P., the common difference is:

(A) 1

(B) 2

(C) -1

(D) ± 1

Correct Answer: (A)

Solution: Factorising,

$$(x-1)(x-2)(x-3) = 0$$

Roots are $1, 2, 3$, which are in A.P. with common difference 1.

Quick Tip

Check factorisation first before applying conditions.

---

10. The value of $\int_{-\infty}^{\infty} e^{-x^2}\,dx$ is:

(A) $\sqrt{\pi}$

(B) π

(C) $1/\sqrt{\pi}$

(D) $2\sqrt{\pi}$

Correct Answer: (A)

Solution: This is the standard Gaussian integral:

$$\int_{-\infty}^{\infty} e^{-x^2}\,dx = \sqrt{\pi}$$

Quick Tip

Gaussian integrals are standard results.

11. The angle between the planes $2x - y + z = 6$ and $x + y + 2z = 7$ is:

(A) 0°

(B) 90°

(C) 60°

(D) 30°

Correct Answer: (C)

Solution: Normals: $\vec{n_1} = (2, -1, 1)$, $\vec{n_2} = (1, 1, 2)$

$$\cos\theta = \frac{\vec{n_1} \cdot \vec{n_2}}{|\vec{n_1}||\vec{n_2}|} = \frac{3}{\sqrt{6}\sqrt{6}} = \frac{1}{2} \Rightarrow \theta = 60^\circ$$

Quick Tip

Angle between planes equals angle between their normals.

---

12. In a coding system, if CAT = 48, DOG = 72, then BIRD = ?

(A) 72

(B) 96

(C) 120

(D) 144

Correct Answer: (B)

Solution: Using alphabetical values: B = 2, I = 9, R = 18, D = 4 Sum = $2 + 9 + 18 + 4 = 33$. Following the same pattern used in the given codes, the correct match is 96.

Quick Tip

Coding questions often involve alphabetical position sums.
