



General Instructions

- (i) **Duration:** The total duration of the examination is 3 hours (180 minutes).
- (ii) **Total Marks:** The complete paper carries a maximum of 200 marks.
- (iii) **Structure:** The paper has 3 Sections:
 - **Section A:** 50 Multiple Choice Questions (Physics).
 - **Section B:** 50 Multiple Choice Questions (Chemistry).
 - **Section B:** 50 Multiple Choice Questions (Mathematics).
- (iv) **Compulsory Questions:** All 150 questions are compulsory.
- (v) Each question has four options. Only **one** option is correct.
- (vi) **Correct Answer:** +1 marks.
- (vii) **Incorrect Answer:** (No Negative marking).
- (viii) **Unanswered/Marked for Review:** 0 marks.

Mathematics

1. Find the value of k if the function $f(x) = \frac{k \cos x}{\pi - 2x}$ is continuous at $x = \frac{\pi}{2}$.

- (A) 1
- (B) 2
- (C) $\frac{\pi}{2}$
- (D) π

2. If $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$, find the unit vector perpendicular to both $\vec{a}$ and $\vec{b}$.

- (A) $\frac{1}{3}(\hat{i} + \hat{j} + \hat{k})$
(B) $\frac{1}{3}(\hat{i} - \hat{j} + \hat{k})$
(C) $\frac{1}{3}(\hat{i} + \hat{j} - \hat{k})$
(D) $\frac{1}{3}(-\hat{i} - \hat{j} - \hat{k})$
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3. Evaluate the integral $\int_0^{\pi/2} \frac{\sin^n x}{\sin^n x + \cos^n x} dx$.

- (A) 0
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{2}$
(D) π
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4. Find the area of the region bounded by the parabola $y^2 = 4ax$ and its latus rectum.

- (A) $\frac{4a^2}{3}$
(B) $\frac{8a^2}{3}$
(C) $\frac{16a^2}{3}$
(D) $\frac{32a^2}{3}$
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5. Identify the truth value of the statement pattern $(p \wedge \sim q) \rightarrow r$.

- (A) Tautology
(B) Contradiction
(C) Contingency
(D) None of these
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Physics

6. Calculate the moment of inertia of a uniform ring of mass M and radius R about a tangent in its own plane.

- (A) MR^2
 - (B) $2MR^2$
 - (C) $\frac{3}{2}MR^2$
 - (D) $\frac{5}{2}MR^2$
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7. A capillary tube of radius r is dipped in water; find the height h to which water rises if the surface tension is T .

- (A) $\frac{T}{\rho g r}$
 - (B) $\frac{2T}{\rho g r}$
 - (C) $\frac{4T}{\rho g r}$
 - (D) $\frac{T}{2\rho g r}$
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8. Find the ratio of the de Broglie wavelengths of a proton and an alpha particle accelerated through the same potential difference.

- (A) 1 : 2
 - (B) 2 : 1
 - (C) 1 : 1
 - (D) 1 : $\sqrt{2}$
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9. Determine the energy of a photon in eV if its wavelength is $4000 \text{ \AA}$.

- (A) 3.1 eV
 - (B) 2.5 eV
 - (C) 1.55 eV
 - (D) 4.2 eV
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10. In a Young's Double Slit Experiment, find the fringe width if the distance between slits is doubled and the screen distance is halved.

- (A) Fringe width becomes half

- (B) Fringe width becomes one-fourth
(C) Fringe width remains unchanged
(D) Fringe width becomes double
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Chemistry

11. What is the IUPAC name for the compound $\text{CH}_3 - \text{CH}(\text{OH}) - \text{CH}_2 - \text{CHO}$?

- (A) 3-hydroxybutanal
(B) 2-hydroxybutanal
(C) 4-hydroxybutanal
(D) 1-hydroxybutanal
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12. Calculate the spin-only magnetic moment of a Mn^{2+} ion (Atomic number = 25).

- (A) 3.87 BM
(B) 4.90 BM
(C) 5.92 BM
(D) 6.93 BM
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13. Which of the following polymers is prepared by condensation polymerization: Nylon-6,6 or Polythene?

- (A) Polythene
(B) Nylon-6,6
(C) Both
(D) None of these
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14. Find the oxidation state of Phosphorus in H_3PO_4 and H_3PO_3 .

- (A) +5 and +3
(B) +3 and +5
(C) +4 and +3
(D) +5 and +4
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15. Identify the major product formed when phenol reacts with bromine water.

- (A) Bromobenzene
 - (B) 2,4,6-tribromophenol
 - (C) o-bromophenol
 - (D) p-bromophenol
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