



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. If the statement $(p \wedge q) \rightarrow (r \vee \neg s)$ is False (F), what are the truth values of p, q, r , and s respectively?

- (A) T, T, F, T
- (B) T, F, F, T
- (C) T, T, T, F

(D) F, T, F, T

2. Evaluate the integral: $\int \frac{4x^2 \cot^{-1}(x^3)}{1+x^6} dx$ (where C is a constant of integration).

(A) $\frac{2}{3}(\cot^{-1}(x^3))^2 + C$

(B) $-\frac{2}{3}(\cot^{-1}(x^3))^2 + C$

(C) $\frac{1}{3}(\cot^{-1}(x^3))^2 + C$

(D) $-\frac{1}{3}(\cot^{-1}(x^3))^2 + C$

3. If $y = \sin^{-1}(3x - 4x^3)$, find the derivative $\frac{dy}{dx}$ in its standard form.

(A) $\frac{3 - 12x^2}{\sqrt{1 - (3x - 4x^3)^2}}$

(B) $\frac{3 + 12x^2}{\sqrt{1 - (3x - 4x^3)^2}}$

(C) $\frac{3 - 12x^2}{1 - (3x - 4x^3)^2}$

(D) $\frac{12x^2 - 3}{\sqrt{1 - (3x - 4x^3)^2}}$

4. Find the angle between non-zero vectors $\mathbf{a}$ and $\mathbf{b}$ if their dot product $\mathbf{a} \cdot \mathbf{b} = 0$.

(A) 0°

(B) 45°

(C) 90°

(D) 180°

5. Evaluate the definite integral: $\int_3^5 |x - 4| dx$.

(A) 1

(B) 2

(C) 3

(D) 4

Physics

6. Calculate the potential energy of a 1.5 kg block attached to a spring with $k = 100 \text{ N/m}$ displaced by 0.2 m.

- (A) 1 J
 - (B) 2 J
 - (C) 4 J
 - (D) 6 J
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7. At what temperature will the r.m.s. velocity of a hydrogen molecule be equal to that of an oxygen molecule at 47°C ?

- (A) 40 K
 - (B) 20 K
 - (C) 10 K
 - (D) 5 K
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8. Determine the equivalent capacitance of an infinite circuit formed by repeating identical capacitors of capacitance C .

- (A) C
 - (B) $\frac{C}{2}$
 - (C) $\frac{C}{3}$
 - (D) $2C$
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9. A wire of length L and resistance R is stretched to twice its length; what is the new resistance?

- (A) R
 - (B) $2R$
 - (C) $3R$
 - (D) $4R$
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10. Find the ratio of the de Broglie wavelengths of an alpha particle and a proton accelerated through the same potential.

- (A) 1 : 1
 - (B) 1 : $\sqrt{2}$
 - (C) 1 : 2
 - (D) 1 : 4
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Chemistry

11. Which of the following compounds will undergo a Cannizzaro reaction:

CH_3CHO , $\text{C}_6\text{H}_5\text{CHO}$, CH_3COCH_3 ?

- (A) CH_3CHO
 - (B) $\text{C}_6\text{H}_5\text{CHO}$
 - (C) CH_3COCH_3
 - (D) Both CH_3CHO and $\text{C}_6\text{H}_5\text{CHO}$
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12. Identify the strongest acid among: acetic acid, chloroacetic acid, dichloroacetic acid, and trichloroacetic acid.

- (A) Acetic acid
 - (B) Chloroacetic acid
 - (C) Dichloroacetic acid
 - (D) Trichloroacetic acid
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13. What is the difference in the oxidation number of Manganese (Mn) between KMnO_4 and MnO_2 ?

- (A) 1
 - (B) 2
 - (C) 3
 - (D) 4
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14. What product is formed when a ketone reacts with hydrazine (NH_2NH_2)?

- (A) Hydrazone
- (B) Alcohol

- (C) Ester
 - (D) Carboxylic acid
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15. Predict the major product formed when an alkene reacts with a hydrogen halide (e.g., HCl or HBr).

- (A) Alkane
 - (B) Alkyl halide
 - (C) Alcohol
 - (D) Ether
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