



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. Which of the following pairs contains only intensive properties?

- (A) Mass, Volume
- (B) Density, Temperature
- (C) Volume, Pressure
- (D) Mass, Density

2. Which compound undergoes Cannizzaro reaction?

- (A) CH_3CHO
 - (B) $\text{C}_6\text{H}_5\text{CHO}$
 - (C) CH_3COCH_3
 - (D) $\text{CH}_3\text{CH}_2\text{OH}$
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3. The relation between molar conductivity Λ_m , conductivity κ , and concentration C of an electrolyte solution is:

- (A) $\Lambda_m = \frac{\kappa}{1000C}$
 - (B) $\Lambda_m = \frac{C}{\kappa \times 1000}$
 - (C) $\Lambda_m = \frac{\kappa \times 1000}{C}$
 - (D) $\Lambda_m = \kappa C$
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4. If the concentration of an electrolyte solution decreases, the molar conductivity Λ_m will:

- (A) Decrease
 - (B) Increase
 - (C) Remain same
 - (D) Become zero
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5. A metal has BCC structure. Atomic radius = 173 pm and molar mass $M = 56 \text{ g mol}^{-1}$. The density of the metal is:

- (A) 7.2 g cm^{-3}
 - (B) 5.6 g cm^{-3}
 - (C) 8.5 g cm^{-3}
 - (D) 3.2 g cm^{-3}
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6. Evaluate the integral:

$$\int_1^4 \left(\frac{1}{\sqrt{x}} + \frac{1}{\sqrt{e^x}} \right) dx$$

- (A) $3 + \frac{2}{\sqrt{e}} - \frac{2}{e^2}$
(B) $2 + \frac{2}{\sqrt{e}} - \frac{2}{e^2}$
(C) $2 + \frac{2}{e} - \frac{2}{e^2}$
(D) $3 + \frac{2}{e} - \frac{2}{e^2}$
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7. Evaluate the integral:

$$\int \frac{x+1}{x(1+xe^x)^2} dx$$

- (A) $\frac{1}{1+xe^x} + C$
(B) $-\frac{1}{1+xe^x} + C$
(C) $\ln(1+xe^x) + C$
(D) $\frac{xe^x}{1+xe^x} + C$
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8. If $h(x) = \sqrt{4f(x) + 3g(x)}$, $f(1) = 4$, $g(1) = 3$, $f'(1) = 3$, $g'(1) = 4$, then $h'(1)$ is equal to:

- (A) $-\frac{5}{12}$
(B) $-\frac{12}{7}$
(C) $\frac{5}{12}$
(D) $\frac{12}{5}$
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9. If $y = \sin^{-1}\left(\frac{5x + 12\sqrt{1-x^2}}{13}\right)$, then $\frac{dy}{dx}$ is equal to:

- (A) $\frac{x}{\sqrt{1-x^2}}$
(B) $\frac{2}{\sqrt{1-x^2}}$
(C) $-\frac{1}{\sqrt{1-x^2}}$
(D) $-\frac{x}{\sqrt{1-x^2}}$
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10. Evaluate the integral:

$$\int \frac{4x^2 \cot^{-1}(x^3)}{1+x^6} dx$$

(where C is a constant of integration)

- (A) $-\frac{2}{3}(\cot^{-1} x^3) + C$
 - (B) $\frac{2}{3}(\cot^{-1} x^3) + C$
 - (C) $-\frac{2}{3}(\cot^{-1} x^3)^2 + C$
 - (D) $\frac{2}{3}(\cot^{-1} x^3)^2 + C$
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11. Evaluate the integral:

$$\int_0^{\frac{\pi}{2}} \frac{dx}{1 + (\cot x)^{101}}$$

- (A) $\frac{\pi}{2}$
 - (B) $\frac{\pi}{4}$
 - (C) $\frac{\pi}{8}$
 - (D) π
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