



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, find the truth values of p, q, r , and s .

- (A) $p = T, q = T, r = F, s = T$
- (B) $p = F, q = T, r = F, s = T$
- (C) $p = T, q = F, r = T, s = F$
- (D) $p = F, q = F, r = T, s = T$

2. 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) -1
(D) 0
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3. Find the unit vector perpendicular to both $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$.

- (A) $\frac{-\hat{i} + 7\hat{j} + 5\hat{k}}{5\sqrt{3}}$
(B) $\frac{\hat{i} - 7\hat{j} - 5\hat{k}}{5\sqrt{3}}$
(C) $\frac{-\hat{i} + 7\hat{j} + 5\hat{k}}{\sqrt{75}}$
(D) $\frac{\hat{i} + 7\hat{j} + 5\hat{k}}{5\sqrt{3}}$
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4. Evaluate the definite 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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5. If $y = \sin^{-1}(3x - 4x^3)$, find $\frac{dy}{dx}$.

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

6. A particle moves with a constant velocity of 5 m/s in a circular path of radius 2 m; calculate its centripetal acceleration.

- (A) 5 m/s^2
 - (B) 10 m/s^2
 - (C) 12.5 m/s^2
 - (D) 25 m/s^2
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7. A block of mass 5 kg is on a frictionless surface; find its acceleration when a force of 10 N is applied.

- (A) 1 m/s^2
 - (B) 2 m/s^2
 - (C) 5 m/s^2
 - (D) 10 m/s^2
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8. What is the time period of a simple pendulum of length 1 m if $g = 9.8 \text{ m/s}^2$?

- (A) 1 s
 - (B) 2 s
 - (C) 2.01 s
 - (D) 3 s
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9. Determine the minimum speed at the topmost point of a vertical circle of radius L for the string to remain taut.

- (A) $\sqrt{gL}$
 - (B) $\sqrt{2gL}$
 - (C) $\sqrt{3gL}$
 - (D) gL
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10. Calculate the equivalent capacitance of an infinite circuit formed by repeating identical capacitors of capacitance C .

- (A) 0
(B) C
(C) $2C$
(D) $\frac{C}{2}$
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Chemistry

11. Identify the product formed when phenol reacts with bromine water.

- (A) Bromobenzene
(B) 2,4,6-Tribromophenol
(C) Phenyl bromide
(D) Benzoic acid
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12. 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) Butanol
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13. Which reagent is used in the Lucas test to distinguish between primary, secondary, and tertiary alcohols?

- (A) Dilute HCl
(B) Concentrated HCl and ZnCl_2
(C) NaOH
(D) KMnO_4
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14. Define the coordination number and oxidation state of the central metal ion in $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$.

- (A) Coordination number = 4, Oxidation state = +2
(B) Coordination number = 6, Oxidation state = +3
(C) Coordination number = 6, Oxidation state = +2
(D) Coordination number = 3, Oxidation state = +3

15. Calculate the osmotic pressure of a 0.1 M solution at 27°C.

- (A) 2.46 atm
 - (B) 1.23 atm
 - (C) 0.82 atm
 - (D) 4.10 atm
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