



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 $f(x) = \frac{k \sin x + 2 \cos x}{\sin x + \cos x}$ is increasing for all x .

- (A) $k < 2$
- (B) $k = 2$
- (C) $k \geq 2$

(D) $k \leq 2$

2. Calculate the area of the region bounded by the curve $y^2 = 4x$ and the line $x = 3$.

(A) $6\sqrt{3}$

(B) $8\sqrt{3}$

(C) $12\sqrt{3}$

(D) $4\sqrt{3}$

3. Find the general solution of the differential equation $\frac{dy}{dx} + \frac{y}{x} = x^2$.

(A) $y = \frac{x^3}{4} + \frac{C}{x}$

(B) $y = \frac{x^3}{3} + \frac{C}{x}$

(C) $y = \frac{x^3}{2} + \frac{C}{x}$

(D) $y = x^3 + \frac{C}{x}$

4. Determine the shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$.

(A) $\frac{2}{\sqrt{3}}$

(B) $\frac{2}{\sqrt{5}}$

(C) $\frac{2}{\sqrt{2}}$

(D) $\frac{2}{\sqrt{29}}$

5. If $\vec{a}$ and $\vec{b}$ are unit vectors and the angle between them is 60° , find $|\vec{a} - \vec{b}|$.

- (A) 1
 - (B) $\sqrt{2}$
 - (C) $\sqrt{3}$
 - (D) 2
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Physics

6. A particle performs SHM with an amplitude of 5 cm. Find its acceleration when it is 3 cm from the mean position (assume $\omega = 2 \text{ rad/s}$).

- (A) 3 cm/s^2
 - (B) 6 cm/s^2
 - (C) 12 cm/s^2
 - (D) 24 cm/s^2
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7. Calculate the de-Broglie wavelength of an electron accelerated through a potential difference of 100 V.

- (A) $1.227 \text{ \AA}$
 - (B) 0.1227 nm
 - (C) 12.27 nm
 - (D) 0.01227 nm
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8. Find the equivalent resistance between two opposite corners of a cube made of wires, each having resistance R .

- (A) $\frac{R}{6}$
- (B) $\frac{5R}{6}$

- (C) $\frac{R}{3}$
(D) $\frac{2R}{3}$
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9. Determine the ratio of the speed of sound in Oxygen to that in Hydrogen at the same temperature.

- (A) 1 : 4
(B) 1 : 2
(C) 2 : 1
(D) 4 : 1
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Chemistry

10. What is the oxidation state of Phosphorus in H_3PO_4 ?

- (A) +3
(B) +5
(C) +1
(D) +7
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11. Which of the following polymers is a copolymer: Buna-S, Polythene, or PVC?

- (A) Polythene
(B) PVC
(C) Buna-S
(D) All of these
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12. Calculate the pH of a 0.001 M NaOH solution at 25°C.

- (A) 3
 - (B) 7
 - (C) 11
 - (D) 13
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13. Name the reagent used in the conversion of benzene to nitrobenzene.

- (A) Concentrated HNO_3 only
 - (B) Concentrated H_2SO_4 only
 - (C) Mixture of concentrated HNO_3 and H_2SO_4
 - (D) Dilute HNO_3
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