



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.

1. If the vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} + a\hat{j} + 5\hat{k}$ are coplanar, find the value of a .

- (A) 4
 - (B) -4
 - (C) 2
 - (D) -2
-

2. Find the area of the region bounded by the curve $y^2 = 8x$ and the line $x = 2$.

- (A) $\frac{28}{3}$ sq. units
 - (B) $\frac{32}{3}$ sq. units
 - (C) $\frac{16}{3}$ sq. units
 - (D) $\frac{20}{3}$ sq. units
-

3. Solve the differential equation $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$ given $y(0) = 1$.

- (A) $\tan^{-1} y = \tan^{-1} x + \frac{\pi}{6}$
 - (B) $\tan^{-1} y = \tan^{-1} x + \frac{\pi}{4}$
 - (C) $\tan^{-1} y = \tan^{-1} x + \frac{\pi}{3}$
 - (D) $\tan^{-1} y = \tan^{-1} x + \frac{\pi}{2}$
-

4. In a Binomial distribution with $n = 10$ and $p = 0.4$, find the variance.

- (A) 2.0
 - (B) 2.4
 - (C) 4.0
 - (D) 3.2
-

5. Find the direction cosines of a line that makes equal angles with the coordinate axes.

- (A) $\pm \frac{1}{\sqrt{2}}, \pm \frac{1}{\sqrt{2}}, 0$
 - (B) $\pm \frac{1}{\sqrt{3}}, \pm \frac{1}{\sqrt{3}}, \pm \frac{1}{\sqrt{3}}$
 - (C) $\pm \frac{1}{2}, \pm \frac{1}{2}, \pm \frac{1}{2}$
 - (D) $\pm 1, 0, 0$
-

6. Calculate the de Broglie wavelength of an electron accelerated through a potential of 100 V.

- (A) $1.227 \text{ \AA}$
 - (B) $0.612 \text{ \AA}$
 - (C) $2.45 \text{ \AA}$
 - (D) $3.12 \text{ \AA}$
-

7. A Carnot engine works between 600 K and 300 K. Find its efficiency.

- (A) 25%
 - (B) 40%
 - (C) 50%
 - (D) 60%
-

8. Calculate the energy stored in a $10 \mu\text{F}$ capacitor charged to 50 V.

- (A) 0.025 J
 - (B) 0.0125 J
 - (C) 0.05 J
 - (D) 0.1 J
-

9. Find the moment of inertia of a uniform ring of mass M and radius R about a tangent perpendicular to its plane.

- (A) MR^2
 - (B) $2MR^2$
 - (C) $3MR^2$
 - (D) $4MR^2$
-

10. What is the major product when 2-bromopentane reacts with alcoholic KOH?

- (A) Pent-1-ene
 - (B) Pent-2-ene
 - (C) Pentanol
 - (D) Pentanal
-

11. How many atoms are present in a unit cell of a body-centered cubic (BCC) lattice?

- (A) 1
 - (B) 2
 - (C) 3
 - (D) 4
-

12. Which reagent is used in the Lucas test to distinguish alcohols?

- (A) $\text{ZnCl}_2 + \text{HCl}$
 - (B) KMnO_4
 - (C) NaOH
 - (D) H_2SO_4
-

13. Calculate the osmotic pressure of 0.1 M glucose at 27°C .

- (A) 1.23 atm
 - (B) 2.46 atm
 - (C) 4.92 atm
 - (D) 0.82 atm
-

14. What is the hybridization of the central sulfur atom in SF_6 ?

- (A) sp^3
 - (B) sp^3d
 - (C) sp^3d^2
 - (D) sp^2
-