



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 C:** 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) **Right Answer:** +1 marks for Physics and Chemistry Questions. +2 marks for Mathematics Questions.
- (vii) **Incorrect Answer:** No Negative marking.

1. If $I = \int \frac{\sin x + \sin^3 x}{\cos 2x} dx = P \cos x + Q \log \left| \frac{\sqrt{2} \cos x - 1}{\sqrt{2} \cos x + 1} \right| + C$, then the values of P and Q are respectively:

- (A) $\frac{1}{2}, \frac{3}{4\sqrt{2}}$
- (B) $\frac{1}{2}, \frac{-3}{4\sqrt{2}}$
- (C) $\frac{1}{2}, \frac{3}{2\sqrt{2}}$
- (D) $\frac{1}{2}, \frac{-3}{2\sqrt{2}}$

2. In a triangle $\triangle ABC$, if a , b , and c are in arithmetic progression, then $\cos A + 2 \cos B + \cos C =$

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

3. If the area of triangle ABC is $b^2 - (c - a)^2$, then $\tan B =$

- (A) 1
 - (B) $\frac{13}{15}$
 - (C) $\frac{1}{4}$
 - (D) $\frac{8}{15}$
-

4. In a $\triangle ABC$, $a = 1$, $b = \sqrt{3}$ and $\angle C = \frac{\pi}{6}$. Then the measure of the third side $c =$

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

5. The integral $\int \frac{1}{\sqrt[4]{(x-1)^3(x+2)^5}} dx$ is equal to: (where C is a constant of integration)

- (A) $\frac{3}{4} \left(\frac{x+2}{x-1} \right)^{1/4} + C$
 - (B) $\frac{3}{4} \left(\frac{x+2}{x-1} \right)^{5/4} + C$
 - (C) $\frac{4}{3} \left(\frac{x-1}{x+2} \right)^{1/4} + C$
 - (D) $\frac{4}{3} \left(\frac{x-1}{x+2} \right)^{5/4} + C$
-

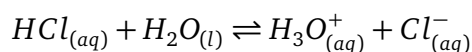
6. Calculate the pH of 0.02 M monobasic acid having 2% dissociation.

- (A) 3.4
- (B) 4.5
- (C) 5.1
- (D) 5.8

7. What is the pH of 2×10^{-3} M solution of monoacidic weak base if it ionises to the extent of 5%?

- (A) 14
- (B) 6
- (C) 4
- (D) 2

8. Identify base₂ for the following equation according to Brønsted–Lowry theory:



- (A) $H_3O^+_{(aq)}$
- (B) $H_2O_{(l)}$
- (C) $Cl^-_{(aq)}$
- (D) $HCl_{(aq)}$

9. Calculate the pH of 0.01 M sulphuric acid.

- (A) 1.699
- (B) 2.00

- (C) 0.699
 - (D) 3.398
-

10. What is the pH of a weak dibasic acid that is 2% dissociated in its M/100 solution at 298 K?

- (A) 1.6990
 - (B) 2.3979
 - (C) 3.3970
 - (D) 4.6990
-

11. An open pipe resonates with a tuning fork of frequency 500 Hz. It is observed that two successive nodes are separated by 34 cm. The velocity of sound in air is:

- (A) 330 m/s
 - (B) 340 m/s
 - (C) 350 m/s
 - (D) 360 m/s
-

12. A train moving at 20 m/s approaches a stationary observer. The frequency of the whistle emitted by the train is 640 Hz. If the velocity of sound is 340 m/s, the apparent frequency heard by the observer is:

- (A) 680 Hz
 - (B) 600 Hz
 - (C) 720 Hz
 - (D) 640 Hz
-

13. Unpolarized light of intensity I_0 is incident on two polaroids placed coaxially. The transmission axis of the second polaroid is at an angle of 60° to the first. The intensity of emerging light is:

- (A) $I_0/2$
 - (B) $I_0/4$
 - (C) $I_0/8$
 - (D) $3I_0/8$
-

14. A parallel plate capacitor has capacitance C . If a dielectric slab of dielectric constant K and thickness equal to half the plate separation is introduced parallel to the plates, the new capacitance is:

- (A) $\frac{2K}{K+1} C$
 - (B) $\frac{K+1}{2K} C$
 - (C) $\frac{K}{K+1} C$
 - (D) KC
-

15. An infinite line charge of uniform linear charge density λ is placed along the z -axis. The work done in moving a charge q from $(a, 0, 0)$ to $(2a, 0, 0)$ is:

- (A) $\frac{q\lambda}{2\pi\epsilon_0} \ln 2$
 - (B) $\frac{q\lambda}{4\pi\epsilon_0} \ln 2$
 - (C) $\frac{q\lambda}{2\pi\epsilon_0} \ln\left(\frac{1}{2}\right)$
 - (D) zero
-