



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:** 100 Multiple Choice Questions (Mathematics).
- (iv) **Compulsory Questions:** All 200 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. The rate of reaction $A \rightarrow P$ is $1.25 \times 10^{-2} \text{ mol dm}^{-3} \text{ s}^{-1}$ when $[A] = 0.5 \text{ M}$. Calculate the rate constant if the reaction is second order in A.

- (A) 0.05
- (B) 0.04
- (C) 0.03
- (D) 0.01

2. Which of the following is a correct set of four quantum numbers for 4d orbital?

- (A) (4, 3, 2, +1/2)
(B) (4, 2, 1, +1/2)
(C) (4, 1, 2, +1/2)
(D) None of these
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3. Identify unit of rate constant for first order reaction from the following.

- (A) $\text{mol dm}^{-3} \text{s}^{-1}$
(B) s^{-1}
(C) $\text{mol}^{-1} \text{dm}^3 \text{s}^{-1}$
(D) mol dm^{-3}
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4. Which of the following mixtures of gases represent water gas?

- (A) $\text{CO} + \text{H}_2$
(B) $\text{CO}_2 + \text{H}_2$
(C) $\text{H}_2\text{O} + \text{CH}_4$
(D) $\text{H}_2 + \text{O}_2$
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5. Which of the following electrolytic solutions of the same electrolyte has Maximum electrolytic conductivity at the same temp?

- (A) 0.2 mole of solute is dissolved in 250 ml
(B) 0.3 mol in 600 ml
(C) 0.6 in 1000 ml
(D) 0.8 mole in 2000 ml
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6. If $\sin x \cos x = \frac{1}{4}$, then the general solution is:

- (A) $x = \frac{n\pi}{2} + (-1)^n \frac{\pi}{12}$
(B) $x = n\pi + (-1)^n \frac{\pi}{12}$
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- (C) $x = \frac{n\pi}{2} + (-1)^n \frac{\pi}{6}$
(D) $x = n\pi + (-1)^n \frac{\pi}{6}$
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7. If $n \in \mathbb{Z}$, then the expression $\frac{2^n}{(1-i)^{2n}} + \frac{(1+i)^{2n}}{2^n}$ is equal to:

- (A) $2i^n$
(B) 0
(C) 2^{n+1}
(D) i^n
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8. The value of $\int \frac{x^2-1}{(x^4+3x^2+1)\tan^{-1}(x+\frac{1}{x})} dx$ is:

- (A) $\ln |\tan^{-1}(x + 1/x)| + C$
(B) $\tan^{-1}(x + 1/x) + C$
(C) $\frac{1}{2}(\tan^{-1}(x + 1/x))^2 + C$
(D) $\ln |x^4 + 3x^2 + 1| + C$
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9. If $A = \begin{bmatrix} \sin \alpha & -\cos \alpha \\ \cos \alpha & \sin \alpha \end{bmatrix}$ and $\alpha \in (\frac{\pi}{2}, \frac{3\pi}{2})$. If $A + A^T = I$, then $\alpha =$

- (A) $\frac{2\pi}{3}$
(B) $\frac{5\pi}{6}$
(C) π
(D) $\frac{4\pi}{3}$
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10. The parametric equations of the circle $x^2 + y^2 - 4x - 6y - 12 = 0$ are:

- (A) $x = 2 + 5 \cos \theta, y = 3 + 5 \sin \theta$
(B) $x = -2 + 5 \cos \theta, y = -3 + 5 \sin \theta$
(C) $x = 2 + 25 \cos \theta, y = 3 + 25 \sin \theta$
(D) $x = 5 + 2 \cos \theta, y = 5 + 3 \sin \theta$
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11. If the absolute temperature of a black body is doubled, the frequency corresponding to maximum emissive power becomes:

- (A) halved
 - (B) doubled
 - (C) four times
 - (D) unchanged
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12. The ratio of specific heats C_p/C_v for a mixture of 1 mole of helium and 1 mole of hydrogen is:

- (A) 1.5
 - (B) 1.67
 - (C) 1.4
 - (D) 1.33
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13. In an isothermal expansion of an ideal gas, the heat supplied to the gas is:

- (A) entirely used to increase internal energy
 - (B) entirely used to do work
 - (C) partly used to do work and partly to increase internal energy
 - (D) none of the above
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14. A refrigerator has a coefficient of performance of 5. If the temperature inside the freezer is -20°C , the temperature of the surroundings to which it rejects heat is:

- (A) 31°C
 - (B) 41°C
 - (C) 21°C
 - (D) 11°C
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15. The displacement of a particle executing SHM is given by $x = 0.01 \sin(100\pi t + 0.05)$. Its

maximum velocity is:

- (A) π m/s
 - (B) 10π m/s
 - (C) 0.1π m/s
 - (D) 100π m/s
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