



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 390 marks.
- (iii) **Structure:** The paper has 4 Sections:
 - **Part 1:** 30 Multiple Choice Questions (Physics).
 - **Part 2:** 30 Multiple Choice Questions (Chemistry).
 - **Part 3:** 10 Multiple Choice Questions (English Proficiency),
20 Multiple Choice Questions (Logical Reasoning)
 - **Part 4:** 40 Multiple Choice Questions (Mathematics/Biology)
- (iv) **Compulsory Questions:** All 130 questions are compulsory, and +12 Questions (Optional Extra Questions)
- (v) Each question has four options. Only **one** option is correct.
- (vi) **Correct Answer:** +3 marks.
- (vii) **Incorrect Answer:** -1 (Negative marking).
- (viii) **Unanswered/Marked for Review:** 0 marks.

PHYSICS

1. According to Bohr's model of the hydrogen atom, the ratio of the kinetic energy to the total energy of an electron in 3rd excited state is?

- (A) 1 : 1
 - (B) 1 : -1
 - (C) -1 : 1
 - (D) 1 : 2
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2. A radioactive sample has a half-life of 10 days. The fraction of the initial nuclei decayed after 40 days is:

- (A) 1/4
 - (B) 3/4
 - (C) 1/16
 - (D) 15/16
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3. A block of mass M attached to a horizontal spring of spring constant k executes SHM with amplitude A . When the block passes through its mean position, a small piece of mass m is dropped vertically onto it and sticks to it. The new amplitude of oscillation is:

- (A) $A\sqrt{\left(\frac{M}{M+m}\right)}$
 - (B) $A\left(\frac{M}{M+m}\right)$
 - (C) $A\sqrt{\left(\frac{M+m}{M}\right)}$
 - (D) A
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4. The dimensions of magnetic flux are identical to the dimensions of:

- (A) EMF $\times$ Time
 - (B) Electric field $\times$ Velocity
 - (C) Force/Current
 - (D) Magnetic field $\times$ Current
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CHEMISTRY

5. If the ionic product of Ni(OH)_2 is 1.9×10^{-15} , then the molar solubility of Ni(OH)_2 in 1.0 M NaOH is

- (A) 2.9×10^{-18} M
 - (B) 1.9×10^{-13} M
 - (C) 1.9×10^{-15} M
 - (D) 2.9×10^{-14} M
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6. The solubility of Pb(OH)_2 in water is 6.7×10^{-6} M. Its solubility in a buffer solution of $\text{pH} = 8$ would be:

- (A) 1.2×10^{-2}
 - (B) 1.6×10^{-3}
 - (C) 1.6×10^{-2}
 - (D) 1.2×10^{-3}
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7. 0.1 m of urea and 0.05 m of CaCl_2 are dissolved separately in equal volumes of water. Which solution will have higher elevation in boiling point?

- (A) Urea solution
 - (B) CaCl_2 solution
 - (C) Both will show equal elevation
 - (D) None will show elevation
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8. A decimolar solution of potassium ferrocyanide is 50% dissociated at 300K. The osmotic pressure of the solution is ($R = 8.314 \text{ JK}^{-1}\text{mol}^{-1}$)

- (A) 7.48 atm

- (B) 4.99 atm
(C) 3.74 atm
(D) 6.23 atm
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MATHEMATICS

9. Given a real valued function f such that $f(x) = \begin{cases} \frac{\tan^2\{x\}}{x^2 - [x]^2} & \text{for } x > 0 \\ 1 & \text{for } x = 0 \\ \sqrt{\{x\} \cot\{x\}} & \text{for } x < 0 \end{cases}$ then

- (A) $\text{LHL} = 1$
(B) $\text{RHL} = \sqrt{\cot 1}$
(C) $\lim_{x \rightarrow 0} f(x)$ exist
(D) $\lim_{x \rightarrow 0} f(x)$ does not exists
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10. If the eccentricity and length of latus rectum of a hyperbola are $\frac{\sqrt{13}}{3}$ and $\frac{10}{3}$ units respectively, then what is the length of the transverse axis?

- (A) $7/2$ unit
(B) 12 unit
(C) $15/2$ unit
(D) $15/4$ unit
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11. The eccentricity of the ellipse whose major axis is three times the minor axis is:

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

12. Let L_1 be the length of the common chord of the curves $x^2 + y^2 = 9$ and $y^2 = 8x$, and L_2 be the length of the latus rectum of $y^2 = 8x$, then:

- (A) $L_1 > L_2$
 - (B) $L_1 = L_2$
 - (C) $L_1 < L_2$
 - (D) $L_1/L_2 = \sqrt{2}$
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