



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.

PHYSICS

1. A capillary tube of radius r is dipped vertically in water. If the radius of the tube is doubled, then the height of capillary rise becomes:

- (A) Half
- (B) Double
- (C) Four times

(D) Unchanged

2. The dimensional formula of coefficient of viscosity is:

(A) $[ML^{-1}T^{-1}]$

(B) $[MLT^{-1}]$

(C) $[ML^{-2}T^{-1}]$

(D) $[M^0LT^{-1}]$

3. The radius of gyration of a thin circular ring about its central axis perpendicular to its plane is:

(A) $R/\sqrt{2}$

(B) R

(C) $\sqrt{2}R$

(D) $2R$

4. Two soap bubbles of radii 2 cm and 4 cm combine to form a bigger bubble. The radius of the new bubble will be:

(A) 6 cm

(B) 4.8 cm

(C) 8 cm

(D) 5 cm

5. A body floats in water with 80% of its volume submerged. The density of the body is:

(A) $0.8\rho_w$

(B) $1.25\rho_w$

(C) $0.2\rho_w$

(D) $0.5\rho_w$

6. Which intermolecular force is strongest among the following?

- (A) London dispersion force
 - (B) Dipole-dipole force
 - (C) Hydrogen bonding
 - (D) Dipole-induced dipole force
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7. A gas mixture contains 2 moles of oxygen and 3 moles of nitrogen. If the total pressure of the mixture is 5 atm, then the partial pressure of oxygen is:

- (A) 1 atm
 - (B) 2 atm
 - (C) 3 atm
 - (D) 4 atm
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8. Which of the following molecules possesses distorted tetrahedral geometry due to the presence of one lone pair on the central atom?

- (A) BF_3
 - (B) NH_3
 - (C) CO_2
 - (D) $BeCl_2$
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9. The conjugate base of $H_2PO_4^-$ is:

- (A) H_3PO_4
 - (B) HPO_4^{2-}
 - (C) PO_4^{3-}
 - (D) $H_2PO_3^-$
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10. A particle executes simple harmonic motion such that its displacement is given by $x = A\cos(\omega t + \phi)$. If its kinetic energy is equal to three times its potential energy, then

the displacement of the particle from the mean position is:

- (A) $\pm \frac{A}{2}$
 - (B) $\pm \frac{A}{\sqrt{2}}$
 - (C) $\pm \frac{A}{2\sqrt{2}}$
 - (D) $\pm \frac{\sqrt{3}A}{2}$
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11. If the lines $\frac{x-1}{2} = \frac{y+2}{3} = \frac{z}{\lambda}$ and $\frac{x}{1} = \frac{y-1}{2} = \frac{z+1}{3}$ are perpendicular to each other, then the value of λ is:

- (A) -8
 - (B) -7
 - (C) -6
 - (D) -5
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12. A solution contains 0.1 mole of weak acid HA and 0.1 mole of sodium salt NaA in one litre solution. If the dissociation constant of the acid is $K_a = 1 \times 10^{-5}$, then the pH of the solution is:

- (A) 3
 - (B) 4
 - (C) 5
 - (D) 6
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13. The shortest distance between the lines $\frac{x-1}{1} = \frac{y}{2} = \frac{z+1}{-1}$ and $\frac{x}{2} = \frac{y-1}{-1} = \frac{z}{1}$ is:

- (A) $1/\sqrt{2}$
 - (B) $2/\sqrt{3}$
 - (C) $\sqrt{2}$
 - (D) $\sqrt{6}/3$
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14. A Carnot engine operates between temperatures 500 K and 300 K. If it absorbs 600 J heat from the source, then the work done by the engine is:

- (A) 120 J
 - (B) 180 J
 - (C) 240 J
 - (D) 300 J
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15. If $y = x^x$, then $\frac{dy}{dx}$ is equal to:

- (A) x^x
 - (B) $x^x(1 + \log x)$
 - (C) x^{x-1}
 - (D) $(1 + x)^x$
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