KOTHARI INTERNATIONAL SCHOOL, NOIDA
ANNUAL EXAMINATION, SESSION: 2025-26
MARKING SCHEME
GRADE: 11 SUBJECT: PHYSICS (042)
SET B

DAY & DATE: MONDAY - FEBRUARY 16, 2026
MAXIMUM MARKS: 70

SECTION – A

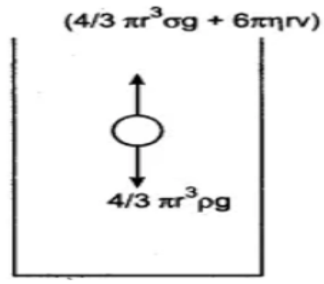
Q1.	**D**	**(1)**
Q2.	**A**	**(1)**
Q3.	**A**	**(1)**
Q4.	**B**	**(1)**
Q5.	**B**	**(1)**
Q6.	**C**	**(1)**
Q7.	**C**	**(1)**
Q8.	**C**	**(1)**
Q9.	**A**	**(1)**
Q10.	**B**	**(1)**
Q11.	**C**	**(1)**
Q12.	**A**	**(1)**
Q13.	**A**	**(1)**
Q14.	**A**	**(1)**
Q15.	**C**	**(1)**
Q16.	**B**	**(1)**
SECTION – B		
Q17.	$\vec{v}(t) = 2t\hat{i} + t^2\hat{j}, \quad m = 2\,\text{kg}$ At $t = 2$: $\vec{v} = 4\hat{i} + 4\hat{j}$ **Momentum:** $\vec{p} = m\vec{v} = 2(4\hat{i} + 4\hat{j})$ (8i+8j) kg m/s Force: $\vec{a} = \frac{d\vec{v}}{dt} = 2\hat{i} + 2t\hat{j} \Rightarrow \vec{a}(2) = 2\hat{i} + 4\hat{j}$ $\vec{F} = m\vec{a} = 2(2\hat{i} + 4\hat{j}) = \boxed{4\hat{i} + 8\hat{j}\ \text{N}}$	**(1)** **(1/2)** **(1/2)**

Q18(I)	Radius $r = 50\,\text{cm} = 0.5\,\text{m}$ $$\omega_1 = 100\,\text{rpm} = \frac{10\pi}{3}\,\text{rad/s}, \quad \omega_2 = 400\,\text{rpm} = \frac{40\pi}{3}\,\text{rad/s}$$ $$t = 5\,\text{min} = 300\,\text{s}$$ Angular acceleration: $$\alpha = \frac{\omega_2 - \omega_1}{t} = \frac{10\pi}{300} = \boxed{\frac{\pi}{30}\,\text{rad/s}^2}$$ Linear (tangential) acceleration: $$a = r\alpha = 0.5 \times \frac{\pi}{30} = \boxed{\frac{\pi}{60}\,\text{m/s}^2}$$	**(1/2)** **(1/2)** **(1)**
Q18(II)	**OR** (A) Longer wrench τ=rF Greater arm r produces larger torque for the same force, so less effort is needed. (B) Diver / skater By conservation of angular momentum: L=Iω= constant Stretching arms increases I, so ω decreases.	**(1)** **(1)**
Q19.	$$\vec{a} = p\hat{i} + \hat{j} - \hat{k}, \quad \vec{b} = \hat{j} - \hat{k}$$ $$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ p & 1 & -1 \\ 0 & 1 & -1 \end{vmatrix} = p\hat{j} + p\hat{k}$$ $$\lvert\vec{a} \times \vec{b}\rvert = \sqrt{p^2 + p^2} = \sqrt{2}\lvert p\rvert$$ Given $\lvert\vec{a} \times \vec{b}\rvert = \sqrt{2} \Rightarrow \lvert p\rvert = 1$ $$\boxed{p = \pm 1}$$	**(1)** **(1/2)** **(1/2)**
Q20(I)	(I)Limitations (Any two) (II)$[T^{-2}]$	**(1/2+ 1/2)** **(1)**
Q20(II)	**OR** $$T^2 = \frac{ML^3}{ML^{-1}T^{-2}} \cdot \frac{1}{[q]} = L^4T^2 \cdot \frac{1}{[q]}$$ $$[q] = L^4$$	**(1.5)** **(1/2)**

Q21.	(I) **Process 1: Isochoric process** **Process 2: Adiabatic process -**Steeper **Process 3: Isothermal process** (II) Cp−Cv=R The **difference represents the extra heat** required at constant pressure **to do external work** during expansion. At constant volume, **no work is done**, so less heat is required.	**(1.5)** **(1)**
	SECTION – C	
Q22.	(a) Wire with larger plastic region is more ductile material A. (b) Young's modulus is $\frac{\text{Stress}}{\text{Strain}}$ $\therefore Y_A > Y_B$ (c) For given strain, larger stress is required for A than that for B. $\therefore$ A is stronger than B.	**(1)** **(1)** **(1)**
Q23.	$T^{-1} = L^a(ML^{-1})^b(MLT^{-2})^c$ $T^{-1} = M^{b+c}L^{a-b+c}T^{-2c}$ For mass M: $b + c = 0$ For length L: $a - b + c = 0$ For time T: $-2c = -1 \Rightarrow c = \frac{1}{2}$ $b = -\frac{1}{2}, \quad a = -1$ $\boxed{\nu = k\frac{1}{l}\sqrt{\frac{T}{m}}}$	**(1)** **(1/2)** **(1)** **(1/2)**
Q24.	Essential conditions for adiabatic process are: (i) The container should be perfectly insulating to the surroundings. (ii) The process must be carried out very fast so that there is no suffiecient time for exchange of heat with the surroundings. Derivation for work done during an adiabatic process	**(1/2 +1/2)** **(2)**

Q25.	**Derivation of relation between angular momentum and moment of inertia** **Factors on which centre of mass of a body depends:** The **centre of mass of a body** depends on the following factors: 1. **Distribution of mass** — how the mass is spread out in the body. 2. **Shape and geometry of the body** — because different shapes with same mass distribution have different COM. 3. **Location of the coordinate origin** — the numerical position of the COM depends on the chosen reference frame.	**(2)** **(1/2) + (1/2) (Any two)**
Q26.	Definition Derivation **Escape velocity does not depend on the mass of the body** because the formula $v_e = \sqrt{2GM/r}$ has no term for the object's mass. **It depends on the height** since escape velocity decreases as the distance r from the centre of the planet increases.	**(1/2)** **(1.5)** **(1/2)** **(1/2)**
Q27(I) Q23(II)	(A) <u>For t > 4 s</u> For t>4 s, the position-time graph segment AC runs parallel to the time axis, indicating that the particle maintains a position 3 metres from the origin, implying it is stationary. Therefore, the force acting on the particle is zero. <u>For 0 < t < 4</u> Between 0 < t < 4 s, the position-time graph labelled OA displays a constant slope, which indicates that the velocity of the particle remains constant during this interval, meaning the particle has zero acceleration. Consequently, the force on the particle must be zero. (B) . At <u>t = 0</u> Impulse = Change in momentum = mv – mu Mass of the particle, m = 4 kg Initial velocity of the particle, u = 0 Final velocity of the particle, $v = \frac{3}{4}$m/s ∴Impulse = $4\left(\frac{3}{4} - 0\right) = 3kg$m/s <u>At t = 4 s</u> Initial velocity of the particle, $u = \frac{3}{4}$m/s Final velocity of the particle, v = 0 ∴ Impulse = $4\left(0 - \frac{3}{4}\right)$ = -3 kg m/s **OR**	**(1/2)** **(1/2)** **(1)** **(1)**

	Diagram **Derivation for maximum permissible speed** **Expression for optimum speed**	**(1)** **(1.5)** **(1/2)**
Q28.	(I)A = 0.005m $$k = 80 \text{ rad/m}$$ Wavelength λ is given by: $$\lambda = \frac{2\pi}{k} = \frac{2\pi}{80} = \frac{\pi}{40} \text{ m} \approx 0.0785 \text{ m}$$ $$\omega = 3 \text{ rad/s}$$ Frequency f is: $$f = \frac{\omega}{2\pi} = \frac{3}{2\pi} \text{ Hz} \approx 0.477 \text{ Hz}$$ $$v = \frac{\omega}{k} = \frac{3}{80} \text{ m/s} = 0.0375 \text{ m/s}$$ (II) In SHM, The velocity leads the displacement by a phase π/2 radians and acceleration leads the velocity by a phase π/2 radians.	**(1/2)** **(1/2)** **(1/2)** **(1/2)** **(1)**
	SECTION – D **Case Study Based Questions**	
Q29.	**(i) C** **(ii) A** **(iii)C** **(iv) A**	**(1)** **(1)** **(1)** **(1)**
Q30.	**(I)** $$m_1v_1 + m_2v_2 = (m_1 + m_2)v$$ $$0.25(3) + 0.25(-1) = (0.25 + 0.25)v$$ $$0.75 - 0.25 = 0.5v$$ $$0.5 = 0.5v \Rightarrow v = 1 \text{ m/s}$$ **(II)** $$p = mv + m(-v) = 0$$ **(III)** Key rule for elastic collision of identical masses (1D):They exchange velocities. $$\boxed{v_A = -0.3 \text{ m/s}, \quad v_B = +0.5 \text{ m/s}}$$	**(1)** **(1)** **(1)** **(1)**
	SECTION – E	
Q31(I)	**(A & B)** **Terminal velocity: Steady speed achieved by an object freely falling through a gas or liquid**.	**(1)**

	$F_G = mg = \frac{4}{3}\pi r^3 \rho g$ (downward force) Up thrust, $U = \frac{4}{3}\pi r^3 \sigma g$ (upward force) Viscous force $F = 6\pi\eta r v_t$ At terminal velocity v_t, Downward force = upward force $F_G - U = F \Rightarrow \frac{4}{3}\pi r^3 \rho g - \frac{4}{3}\sigma r^3 \sigma g = 6\pi\eta r v_t$ $v_t = \frac{2}{9} \times \frac{r^2(\rho - \sigma)}{\eta} g \Rightarrow v_t \propto r^2$  Air bubble formed in liquid obtained acceleration in upward direction and it is rising in liquid, because the density of air bubble (ρ) is less than density of liquid (σ). (ρ<σ) hence terminal velocity of bubble is negative and hence it rises in liquid. (C) $\eta = \frac{2r^2 g(\rho_s - \rho_f)}{9v}$ $\eta = \frac{2(2.0 \times 10^{-3})^2(9.8)(8.9 - 1.5) \times 10^3}{9(6.5 \times 10^{-2})}$ $\eta = \frac{2(4 \times 10^{-6})(9.8)(7.4 \times 10^3)}{0.585}$ $\eta = \frac{0.580}{0.585}$ = 0.99 deca poise Or 0.99 Pa s **OR**	**(1/2)** **(1/2)** **(1/2)** **(1/2)** **(1)** **(1/2)** **(1/2)**
31(II)	(A) To show that there is always an excess pressure on the concave side of the meniscus of a liquid. (B) expression for the excess pressure inside (i) a liquid drop (ii) air bubble inside a liquid. (C) **Effect of pressure:** **(a) Melting point of ice:** • Ice is less dense than water. • ↑ Pressure → melting point ↓ (ice melts at lower temperature). **(b) Boiling point of water:** • ↑ Pressure → boiling point ↑ (water boils at higher temperature).	**(2)** **(2)** **(1/2)** **(1/2)**
Q32(I)	(A)Expression for Maximum Height To show for two complimentary angles R is same. (B)Expression for Time of flight	**(1+1)** **(1)**

	(C) $R = \frac{u^2 \sin 2\theta}{g}$ $= \frac{u^2 \sin(2 \times 45°)}{g} = \frac{u^2}{g}$ ...(1) Maximum height for angle of projection 45° is, $H = \frac{u^2 \sin^2\theta}{2g}$ $= \frac{u^2 \sin^2 45°}{2g} = \frac{u^2}{4g}$ ...(2) Therefore, from equation (1) and (2), R = 4H	**(1/2)** **(1/2)** **(1/2)** **(1/2)**
	OR	
Q32(II)	**(A)** $a^2 = a^2 + a^2 + 2a^2 \cos\theta$ $a^2 = 2a^2(1 + \cos\theta)$ $1 = 2(1 + \cos\theta)$ $1 = 2 + 2\cos\theta$ $2\cos\theta = -1$ $\cos\theta = -\frac{1}{2}$ **So angle is 120°** **(B)** **(i) When the motion started, B is ahead of A by distance OP =100 km** (ii) Speed of B $= \frac{QR}{PR} = \frac{150-100}{2-0} = 25$ km/h. **(iii) As it is clear from graphs, A will catch B at point Q, i.e., after 2 hours and at a distance of 150 km.** (iv) Speed of A $= \frac{QS}{OS} = \frac{150-0}{2-0} = 75$ km/h ∴ Difference in speeds $= 75 - 25 = 50$ km/h.	**(1/2)** **(1/2)** **(1)** **(1)** **(1)** **(1)**

Q33(I)	(A)Derive an expression for resultant displacement of standing waves. **(B)** Show that only odd harmonics are present in a closed organ pipe. Case 1 Diagram Derivation Case 2 Diagram Derivation Case 3 Diagram Derivation	**(2)** **(1/2)** **(1/2)** **(1/2)** **(1/2)** **(1/2)** **(1/2)**
	OR	
Q33(II)	(A)Derivation of Kinetic Energy Derivation of Potential Energy Total Energy Graph (B) As the airplane flies higher, the **effective gravitational acceleration decreases**. Since the time period $T \propto \frac{1}{\sqrt{g}}$, the **time period of oscillation increases.**	**(1)** **(1)** **(1)** **(1)** **(1/2)** **(1/2)**