KOTHARI INTERNATIONAL SCHOOL, NOIDA

ANNUAL EXAMINATION, SESSION: 2025-26

MARKING SCHEME

GRADE: 11 SUBJECT: PHYSICS (042)

SET A

DAY & DATE: MONDAY - FEBRUARY 16, 2026

MAXIMUM MARKS: 70

SECTION – A

Q1.	**A**	**(1)**
Q2.	**A**	**(1)**
Q3.	**D**	**(1)**
Q4.	**C**	**(1)**
Q5.	**C**	**(1)**
Q6.	**B**	**(1)**
Q7.	**C**	**(1)**
Q8.	**D**	**(1)**
Q9.	**B**	**(1)**
Q10.	**C**	**(1)**
Q11.	**D**	**(1)**
Q12.	**D**	**(1)**
Q13.	**B**	**(1)**
Q14.	**C**	**(1)**
Q15.	**A**	**(1)**
Q16.	**A**	**(1)**
	SECTION – B	
Q17.	(I)Limitations (Any two) (II)[T^{-2}] **OR** $T^2 = \frac{ML^3}{ML^{-1}T^{-2}} \cdot \frac{1}{[q]} = L^4T^2 \cdot \frac{1}{[q]}$ $[q] = L^4$	**(1/2+ 1/2)** **(1)** **(1.5)** **(1/2)**

Q18.	$$\vec{a} = p\hat{i} + \hat{j} - \hat{k}, \quad \vec{b} = \hat{j} - \hat{k}$$ $$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ p & 1 & -1 \\ 0 & 1 & -1 \end{vmatrix} = p\hat{j} + p\hat{k}$$ $$\lvert \vec{a} \times \vec{b} \rvert = \sqrt{p^2 + p^2} = \sqrt{2}\lvert p \rvert$$ Given $\lvert \vec{a} \times \vec{b} \rvert = \sqrt{2} \Rightarrow \lvert p \rvert = 1$ $$\boxed{p = \pm 1}$$	**(1)** **(1/2)** **(1/2)**
Q19.	$$\vec{v}(t) = 2t\hat{i} + t^2\hat{j}, \quad m = 2\,\text{kg}$$ 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)**
Q20.	$$Q = \Delta U + W$$ **(I) Isochoric process (V = constant)** $$W = 0 \Rightarrow Q = \Delta U$$ Heat absorbed increases internal energy. **(II) Cyclic process** $$\Delta U = 0 \Rightarrow Q = W$$ Net heat absorbed equals net work done. **(III) Isobaric process (P = constant)** $$Q = \Delta U + W$$ Heat absorbed is used partly to increase internal energy and partly to do work.	**(1/2)** **(1/2)** **(1/2)** **(1/2)**

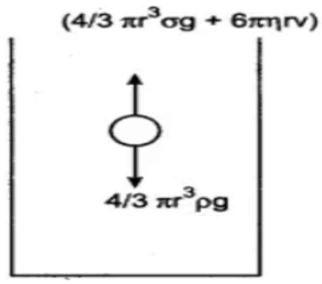
Q21(I)	Radius $r = 50\,\text{cm} = 0.5\,\text{m}$ $$\omega_1 = 100\,\text{rpm} = \frac{10\pi}{3}\,\text{rad/s}, \quad \omega_2 = 400\,\text{rpm} = \frac{40\pi}{3}\,\text{rad/s}$$ $$t = 5\,\text{min} = 300\,\text{s}$$ Angular acceleration: $$\alpha = \frac{\omega_2 - \omega_1}{t} = \frac{10\pi}{300} = \boxed{\frac{\pi}{30}\,\text{rad/s}^2}$$ 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)**
21(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)**
	SECTION – C	
Q22.	$T^{-1} = L^a(ML^{-1})^b(MLT^{-2})^c$ $T^{-1} = M^{b+c}L^{a-b+c}T^{-2c}$ 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)**

Q23(I)	(A) For t > 4 s 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. For 0 < t < 4 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 t = 0 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 $\therefore$Impulse = $4\left(\frac{3}{4} - 0\right) = 3kg$m/s At t = 4 s Initial velocity of the particle, $u = \frac{3}{4}$m/s Final velocity of the particle, v = 0 $\therefore$ Impulse = $4\left(0 - \frac{3}{4}\right)$ = -3 kg m/s	**(1/2)** **(1/2)** **(1)** **(1)**
	OR	
Q23(II)	**Diagram** **Derivation for maximum permissible speed** **Expression for optimum speed**	**(1)** **(1.5)** **(1/2)**
Q24.	Essential conditions for isothermal process are: (i) The container should be perfectly conducting to the surroundings. (ii) The process must be carried out very slowly so that there is sufficient time for exchange of heat with the surroundings so that temperature remains constant. Derivation for work done during an isothermal process	**(1/2 +1/2)** **(2)**
Q25.	**(A)Derivation of formula for kinetic energy of rotation** $K = \frac{1}{2} I\omega^2$ **(B)** The moment of inertia III of a body depends on: **Mass of the body** — more mass → larger value of I. **Distribution of mass relative to the axis** — mass located farther from the axis contributes more to **Axis of rotation** — the same body has different I for different axes.	**(2)** **(1/2+ 1/2) Any two**

Q26.	(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)**
Q27.	Definition Derivation • **Gravitational potential is minimum at the Earth's surface** (or closest position) — more negative. • **Gravitational potential is maximum at infinity** (zero, which is greater than any negative value).	**(1/2)** **(1.5)** **(1/2)** **(1/2)**
Q28.	(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)**
	SECTION – D **Case Study Based Questions**	
Q29.	**(i) A** **(ii) A** **(iii) C** **(iv) C**	**(1)** **(1)** **(1)** **(1)**

Q30.	**(I)** $m_1v_1 + m_2v_2 = (m_1 + m_2)v$ $0.25(3) + 0.25(-1) = (0.25 + 0.25)v$ $0.75 - 0.25 = 0.5v$ $0.5 = 0.5v \Rightarrow v = 1\,\mathrm{m/s}$ **(II)** Key rule for elastic collision of identical masses (1D):They exchange velocities. $\boxed{v_A = -0.3\,\mathrm{m/s}, \quad v_B = +0.5\,\mathrm{m/s}}$ **(III)** $p = mv + m(-v) = 0$	**(1)** **(1)** **(1)** **(1)**
SECTION – E		
Q31(I) Q31(II)	(A)Expression for Maximum Height To show for two complimentary angles R is same. (B)Expression for Time of flight (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 **OR** **(A)** $a^2 = a^2 + a^2 + 2a^2 \cos\theta$ $a^2 = 2a^2(1 + \cos\theta)$ $1 = 2(1 + \cos\theta)$ $1 = 2 + 2\cos\theta$ $2\cos\theta = -1$ $\cos\theta = -\frac{1}{2}$	**(1+1)** **(1)** **(1/2)** **(1/2)** **(1/2)** **(1/2)** **(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 $\therefore$ Difference in speeds $= 75 - 25 = 50$ km/h.	**(1/2)** **(1)** **(1)** **(1)** **(1)**
Q32(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 **OR**	**(2)** **(1/2)** **(1/2)** **(1/2)** **(1/2)** **(1/2)** **(1/2)**
Q32(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)**

Q33(I)	**(A & B)** **Terminal velocity: Steady speed achieved by an object freely falling through a gas or liquid**. $F_G = mg = \frac{4}{3}\pi r^3 \rho g$ **(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	**(1)** **(1/2)** **(1/2)** **(1/2)** **(1/2)** **(1)** **(1/2)** **(1/2)**
	OR	
Q33(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)**