DIRECTORATE OF GOVERNMENT EXAMINATIONS, CHENNAI- 6

HIGHER SECONDARY (FIRST YEAR) EXAMINATION – MARCH- 2024

PHYSICS KEY ANSWER

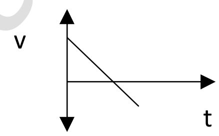
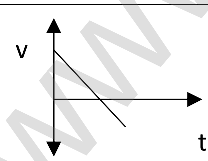
NOTE:

1. Answers written with Blue or Black ink only to be evaluated.
2. Choose the most suitable answer in Part A from the given alternatives and write the option code and their corresponding answer.
3. For answers in Part – II, Part – III, Part – IV like reasoning , explanation, narration, description and listing of points, students may write in their own words but without changing the concepts and without skipping any point.
4. In numerical problems if formula is not written, marks should be given for the remaining correct steps.
5. In graphical representation, physical variables for X-axis and Y-axis should be marked.

TOTAL MARKS:70

PART - I

Answer all the questions : **15×1=15**

Q. NO	OPTION	TYPE - A	Q. NO	OPTION	TYPE - B
1	b	$(250 \pm 5)\Omega$	1	b	increase
2	b	increase	2	c	6 %
3	d	zero	3	a	
4	a	1.0 m	4	d	2 ms^{-2}
5	c	100 Hz and 6m	5	b	Pure rotation
6	d	2 ms^{-2}	6	a	1.0 m
7	b	Pure rotation	7	d	$\sqrt{\frac{k_B}{8k_A}}$
8	c	Carbon - di- oxide	8	a	Increase 4 times
9	a	Decrease and increase	9	d	zero
10	a		10	a	Decrease and increase
11	c	6 %	11	c	Carbon - di- oxide
12	a	$J\,kg^{-1}K^{-1}$	12	c	100 Hz and 6m
13	d	$\sqrt{\frac{k_B}{8k_A}}$	13	d	adiabatic
14	d	adiabatic	14	b	$(250 \pm 5)\Omega$
15	a	Increase 4 times	15	a	$J\,kg^{-1}K^{-1}$

PART - II

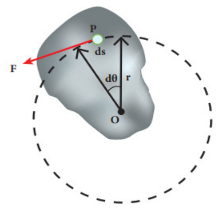
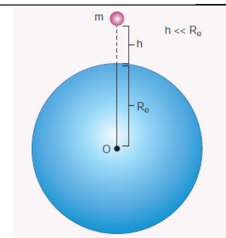
Answer any Six questions: **6×2=12**

Question NO. 24 is Compulsory.

Q. NO	Answer	Marks	
16	Steel is more elastic than rubber. Steel has less strain (or) higher Young's modulus	1 1	2
17	Quantities with magnitude and direction Any two examples.	1 ½+ ½	2
18	$F = \frac{mv^2}{r}$ $F = \frac{60 \times 50 \times 50}{10}$ $F = 15{,}000N$	½ ½ 1	2
19	1. Brownian motion increases with increasing temperature. 2. Brownian motion decreases with bigger particle size, high viscosity and density of the liquid (or) gas.	1 1	2
20	$\mathbf{v_{ROT} = R\omega}$ $\mathbf{v_{ROT} = 1.5 \times 3 = 4.5ms^{-1}}$ $\mathbf{v_{CM}} > R\omega$ **(or)** $\mathbf{v_{TRANS}} > R\omega$ **(or)** It is not in pure rolling, but sliding.	½ 1 ½	2
21	When the oscillator is allowed to oscillate by displacing its position from equilibrium position, it oscillates with a frequency which is equal to the natural frequency of the oscillator. Such an oscillation is known as free oscillation.		2
22	It is defined as the ratio of velocity of separation (relative velocity) after collision to the velocity of approach (relative velocity) before collision, **(or)** Coefficient of restitution $\mathbf{e} = \frac{\text{velocity of separation (after collision)}}{\text{velocity of approach (before collision)}}$ (or) $e = \frac{(v_2 - v_1)}{(u_1 - u_2)}$ (Equation only) 1 Mark	2	2
23	Limitations of Dimensional analysis (Any two)	2	2
24	$\mathbf{\Delta U = Q - W}$ **(or)** $\mathbf{Q = \Delta U + W}$ $\mathbf{\Delta U = -20920J - (-30,000J)}$ $\mathbf{\Delta U = 9080J}$	½ ½ 1	2

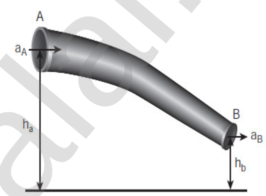
PART - III

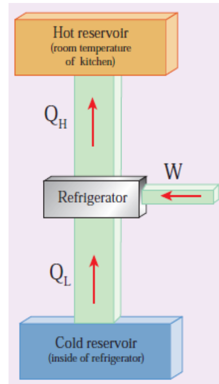
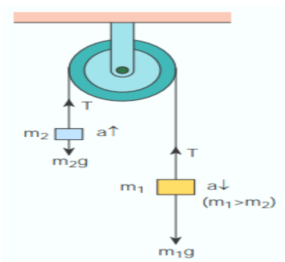
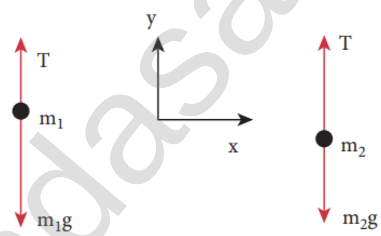
Answer Any Six questions: Question NO.33 is Compulsory. 6×3=18

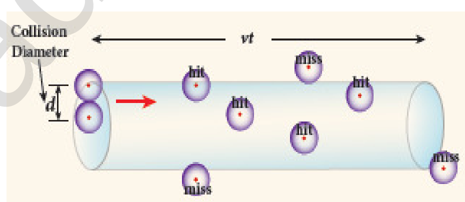
Q.No	Answer	Marks	
25	**Diagram (or) Explanation:** $dW = Fds$ } $ds = rd\theta$ } $dW = Frd\theta$ $dW = \tau d\theta$ (or) $W = \tau\theta$  	½ 1 ½ 1	3
26	**Diagram (or) Explanation** $g' = \frac{GM}{(R_e + h)^2}$ $g' = g\left(1 - 2\frac{h}{R_e}\right)$ $g' < g$ (or) Altitude (h) increases the acceleration due to gravity g decreases.  	½ 1 1 ½	3
27	**Factors affecting the surface tension of a liquid (Any 3)** 1. The presence of any contamination or impurities 2. The presence of dissolved substances 3. Electrification 4.Temperature	3×1	3
28	$P = \frac{1}{3}nm\overline{v^2} = \frac{1}{3}\rho\overline{v^2}$ $P = \frac{2}{3}\left(\frac{\rho}{2}\right)\overline{v^2}$ } $\rho = nm$ – Mass Density } $P = \frac{2}{3}(\overline{KE})$ (or) Pressure is equal to 2/3 of mean kinetic energy per unit volume	1 1 1	3
29	Forced oscillation - Correct Definition		*3*
30	$y = A\sin(2\pi ft)$ $f_1 = 120Hz$ } $f_2 = 122Hz$ } $\lvert f_1 - f_2 \rvert$ = 2beats per sec	1 1 1	3
31	Fundamental quantities – Correct Definition Any one example Derived quantities – Correct Definition Any one example	1 ½ 1 ½	3
32	Law of conservation of energy–correct statement		3
33	$h_{max} = \frac{u^2 \sin^2\theta}{2g}$ } Subsitution } $h_{max} = 0.318\ m$ } $R = \frac{u^2 \sin 2\theta}{g}$ } Subsitution } $R = 2.21\ m$ }	1½ 1½	3

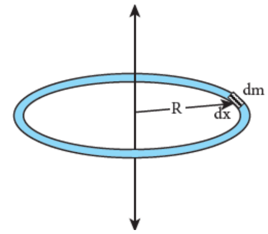
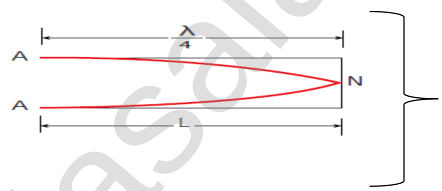
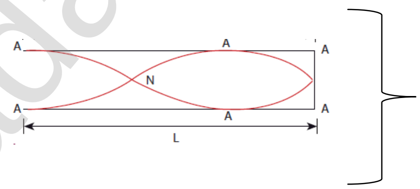
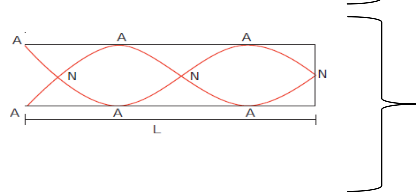
PART - IV

Answer all the questions : **5×5 =25**

34 (a)	$\gamma \propto F^a l^b m^c$ (or) $\gamma = kF^a l^b \left(\frac{M}{l}\right)^c$	1	5
	$[T^{-1}] = [MLT^{-2}]^a [L^b]\, [ML^{-1}]^C$ (or) $[M^0 L^0 T^{-1}] = [M^{a+c} L^{a+b-c} T^{-2a}]$	1	
	$a = \frac{1}{2}, \quad b = -1, \quad c = -{}^1/_2$	1	
	$\gamma \propto F^{1/2} l^{-1} m^{-1/2}$	1	
	$\gamma \propto \frac{1}{l}\sqrt{\frac{F}{m}}$	1	
(OR)			
(b)	**Bernoulli's Theorem - definition**	1	5
	Diagram and Explanation 	1	
	$E_{PA} = m\frac{P_A}{\rho}$ $PE_A = mgh_A$ $KE_A = \frac{1}{2}mv_A{}^2$	½	
	$E_A = m\frac{P_A}{\rho} + \frac{1}{2}mv_A{}^2 + mgh_A$ $E_B = m\frac{P_B}{\rho} + \frac{1}{2}mv_B{}^2 + mgh_B$	1	
	$E_A = E_B$	½	
	$\frac{P}{\rho} + \frac{1}{2}v^2 + gh = constant$ (or) $\frac{P}{\rho g} + \frac{1}{2}\frac{v^2}{g} + h = constant$	1	
35 (a)	**Work– Energy Theorem** Work and energy are equivalents. The work done by the force on the body changes the kinetic energy of the body.	1	5
	$W = FS$	½	
	$F = ma$ $a = \frac{v^2 - u^2}{2s}$ $F = m\left(\frac{v^2 - u^2}{2s}\right)$	1	
	$W = \frac{1}{2}mv^2 - \frac{1}{2}mu^2$ $W = \Delta KE$	1	
	The work-kinetic energy theorem inferences (Any 3).	1½	

	(OR)		
(b)	**Coefficient of performance (COP)** –correct definition A refrigerator is a Carnot's engine working in the reverse order **Diagram** and explanation  $Q_L + W = Q_H$ $\text{COP} = \beta = \frac{Q_L}{W}$ $\beta = \frac{Q_L}{Q_H - Q_L}$ $\frac{Q_H}{Q_L} = \frac{T_H}{T_L}$ $\beta = \frac{T_L}{T_H - T_L}$	1 ½ 1 1½ 1	5
36 (a)	**Explanation** $T\hat{j} - m_2 g\hat{j} = m_2 a\hat{j}$ $T\hat{j} - m_1 g\hat{j} = -m_1 a\hat{j}$ **Diagram**  (or)  $a = \left[\frac{m_1 - m_2}{m_1 + m_2}\right] g$ $T = m_2 g + m_2 \left[\frac{m_1 - m_2}{m_1 + m_2}\right] g$ (or) $T = \left[\frac{2m_1 m_2}{m_1 + m_2}\right] g$	1 ½ ½ 1 1 1	5
	(OR)		
(b)	**Law of orbits:** Each planet moves around the Sun in an elliptical orbit with the Sun at one of the foci. **Explanation** **Law of area** The radial vector (line joining the Sun to a planet) sweeps equal areas in equal intervals of time. **Explanation** **Law of period** The square of the time period of revolution of a planet around the Sun in its elliptical orbit is directly proportional to the cube of the semi-major axis of the ellipse . $T^2 \propto a^3$ (or) $\frac{T^2}{a^3} = constant$	1 ½ 1 ½ 1 1	5

37 (a)	**Velocity - time relation** $a = \frac{dv}{dt}$ (or) $dv = a\,dt$ $\int_u^v dv = \int_0^t a\,dt$ $v = u + at$	1½	5
	Displacement – time relation $v = \frac{ds}{dt}$ (or) $ds = v\,dt$ $\int_0^s ds = u\int_0^t dt + a\int_0^t t dt$ $s = ut + \frac{1}{2}at^2$	1½	
	Velocity – displacement relation $a = \frac{dv}{dt} = \frac{dv}{ds}\frac{ds}{dt} = \frac{dv}{ds}v$ $\int_u^v v\,dv = a\int_0^s ds$ $v^2 = u^2 + 2as$	1½	
	$s = \frac{(u+v)t}{2}$ (or) If only Four equations of motion are written- 2 marks	½	
(OR)			
(b)	**Mean free path Definition**	1	5
	Diagram and Explanation 	1	
	$\lambda = \frac{distance\ travelled}{Number\ of\ Collisions}$	½	
	$\lambda = \frac{1}{n\pi d^2}$	½	
	$\lambda = \frac{1}{\sqrt{2}n\pi d^2}$ (or) $\lambda = \frac{kT}{\sqrt{2}\pi d^2 P}$	1	
	The mean free path is inversely proportional to number density. (OR) λ α 1 / n When the number density increases the molecular collisions increases	1	

38 (a)	**Diagram and Explanation**  $dI = (dm)R^2$, $dm = \lambda\, dx = \frac{M}{2\pi R} dx$ upto $I = \frac{MR}{2\pi} \int dx$ $I = \frac{MR}{2\pi} \int_0^{2\pi R} dx$ $I = MR^2$	1 ½ ½ 1 1 1	5
(OR)			
(b)	**Closed organ pipes:** It is a pipe with one end closed and the other end open $L = \frac{\lambda_1}{4} (or) \lambda_1 = 4L$ $f_1 = \frac{v}{\lambda_1} = \frac{v}{4L}$  $L = \frac{3\lambda_2}{4} (or) \lambda_2 = \frac{4L}{3}$ $f_2 = \frac{3v}{4L} = 3f_1$  $L = \frac{5\lambda_3}{4} (or) \lambda_3 = \frac{4L}{5}$ $f_3 = \frac{5v}{4L} = 5f_1$  . 3 Diagrams only = ------------½,½ + ½ =1 ½mark	½ 1½ 1½ 1½	5