DIRECTORATE OF GOVERNMENT EXAMINATIONS, CHENNAI – 6
HIGHER SECONDARY FIRST YEAR EXAMINATION- MARCH/APRIL-2023
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 – 1

Answer all the questions : 15×1=15

Q.No	Option	TYPE - A	Q.No	Option	TYPE - B
1	d	$M L^{-1} T^{-1}$	1	b	1
2	a	2 s	2	d	20.0
3	b	remains same	3	a	a straight line
4	a	a straight line	4	a	10 Hz
5	a	Momentum	5	d	Less than potential energy
6	b	4.30	6	d	Only in rotating frames
7	a	10 Hz	7	a	2 s
8	a	12 s	8	b	2.5 vHz
9	b	2.5 vHz	9	a	12 s
10	a	10 J	10	b	remains same
11	c	$\frac{L}{\sqrt{2}}$	11	a	10 J
12	d	Only in rotating frames	12	c	$\frac{L}{\sqrt{2}}$
13	d	Less than potential energy	13	a	Momentum
14	b	1	14	d	$M L^{-1} T^{-1}$
15	d	20.0	15	b	4.30

PART – II

Answer **any six** questions: **Question No. 24 is compulsory.** **6×2=12**

16	Any two rules		2
17	Scalar - Definition Example (any two)	1 ½+½	2
18	If the static friction is not able to provide enough centripetal force to turn, the vehicle will start to skid. (or) $\frac{mv^2}{r} > \mu_s mg$ (or) $\mu_s < \frac{v^2}{rg}$ (if formula alone) ----1Mark		2
19	Any two differences		2
20	1. The torque is zero when $\vec{r}$ and $\vec{F}$ are parallel or anti-parallel (or) If θ=0°, sin 0° =0 if θ=180°, sin180°=0 hence $\tau = 0$ 2. The torque is zero if the force acts at the reference point (or) $\vec{r}$ =0, $\tau = 0$	1 1	2
21	Newton's universal law of gravitation – correct statement (or) $\vec{F} = -\frac{GM_1M_2}{r^2}\hat{r}$ (If, formula alone) ----1Mark		2
22	Poisson's ratio is defined as the ratio of relative contraction (lateral strain) to relative expansion (longitudinal strain) (or) Poisson's ratio μ= $\frac{lateral\ strain}{longitudinal\ strain}$		2
23	Zero[th] law of thermodynamics - Correct statement		2
24	KE = $\frac{p^2}{2m}$ $KE_1 = \frac{(30)^2}{2x3} = \frac{900}{6}$ =150 J $KE_2 = \frac{(30)^2}{2x6} = \frac{900}{12}$ =75 J (or) (Any other alternate method) ----- (1½) $KE_1 \neq KE_2$ (They will not have same kinetic energy)	½ ½ ½ ½	2

PART – III

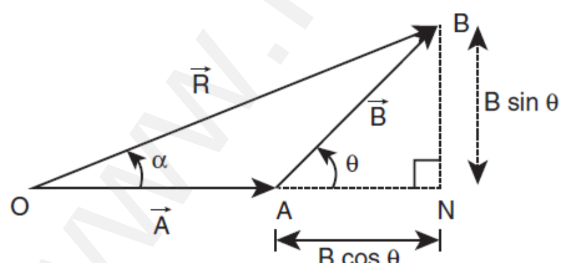
Answer **any Six** questions: **Question No. 33 is compulsory.** **6×3=18**

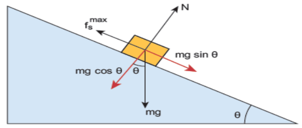
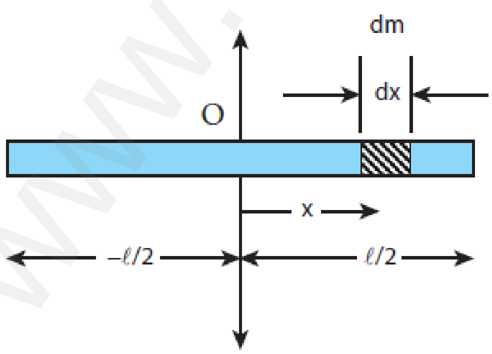
25	The error caused due to the shear carelessness of an observer is called **gross error** Any Two Reasons Gross errors can be minimized only when an observer is careful and mentally alert	1 1 1	3
26	Any Three properties	3×1	3
27	Any Three differences	3×1	3
28	1. Gravitational potential energy (statement) U=mgh where m-mass, g-acceleration due to gravity, h-height 2. Elastic potential energy (statement) $U=\frac{1}{2}kx^2$ where k-spring constant, x-Elongation or compression (or) Electrostatic potential energy is alone mentioned --1 Mark	½ ½ ½ ½ ½ ½	3
29	Satellites that orbiting the Earth at the height of about 36000 km and appears to be stationary when seen from Earth are called geo stationary satellite The satellite orbiting the Earth have different time periods corresponding to different radii. $R_E + h = \left(\frac{GM_ET^2}{4\pi^2}\right)^{1/3}$ India uses INSAT group of satellites that are basically geo- stationary satellites for the purpose of telecommunication	1 ½ ½ 1	3
30	Any Three applications	3×1	3
31	Laws of simple pendulum 1. Law of length – Statement (or) $T \alpha \sqrt{l}$ equation only - ½ Mark 2. Law of acceleration- Statement (or) $T \alpha \frac{1}{\sqrt{g}}$ equation only - ½ Mark 3. Time period of simple pendulum is independent of mass of the bob and amplitude of the oscillation	1 1 1	3

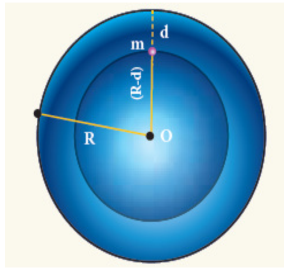
32	Any Three postulates	3×1	3
33	The efficiency of heat engine $\eta = 1 - \frac{Q_L}{Q_H}$ $\eta = 1 - \frac{200}{600}$ η = 0.6666 (or) η = 66.7%	1 1 1	3

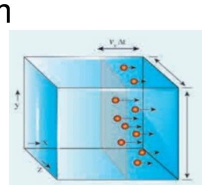
PART – IV

Answer all the questions **5×5=25**

34 a)	$T \alpha m^a l^b g^c$ $T = k m^a l^b g^c$ $[T^1] = [M^a] [L^b] [LT^{-2}]^c$ (or) $[M^0 L^0 T^1] = [M^a L^{b+c} T^{-2c}]$ a=0, b=1/2, c= -1/2 $T = k m^0 l^{1/2} g^{-1/2}$ (or) $T = k (\frac{l}{g})^{1/2}$ (or) $T = k\sqrt{\frac{l}{g}}$ $T = 2\pi\sqrt{\frac{l}{g}}$	½ ½ 1 1 1 1	5
	(OR)		
34 b)	Triangular law of addition (statement) Explanation & Diagram  AN = B cos θ BN = B sin θ Upto $R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$ $\alpha = \tan^{-1}(\frac{B \sin\theta}{A + B\cos\theta})$	1 1 1 1 1	5

35 a)	Explanation & Diagram  N = mg cos θ $f_s = f_s^{max} = \mu_s N = \mu_s$ mg cos θ f_s^{max} = mg sin θ $\mu_s = \frac{\sin\theta}{\cos\theta}$ (or) tan θ = μ_s (or) angle of repose is the same as angle of friction	1 1 1 1 1	5
	(OR)		
35 b)	W = $\int \vec{F}.\overrightarrow{dr}$ W = $\int dw = \int \frac{dW}{dt} dt$ $\int \vec{F}.\overrightarrow{dr} = \int (\vec{F}.\frac{\overrightarrow{dr}}{dt})dt = \int (\overrightarrow{F}.\vec{v})dt$ $\int \frac{dW}{dt} dt = \int (\overrightarrow{F}.\vec{v})dt$ (or) $\int (\frac{dW}{dt} - \vec{F}.\vec{v})\, dt = 0$ $\frac{dW}{dt} - \vec{F}.\vec{v} = 0$ (or) $\frac{dW}{dt} = \vec{F}.\vec{v} = P$	1 1 1 1 1	5
36 a)	Explanation & Diagram  dI = (dm) x^2 $dm = \lambda\, dx = \frac{M}{l}\, dx$ derivation upto I = $\frac{M}{l} \int x^2 dx$ derivation upto I = $\frac{1}{12} M l^2$	1 1 1 1 1	5

	(OR)		
36 b)	Explanation & Diagram  	1	
	$g' = \frac{GM'}{(R_e-d)^2}$	1	5
	Upto $M' = \frac{M}{R_e^3}(R_e - d)^3$	1	
	upto $g' = g\left(1 - \frac{d}{R_e}\right)$ (or) $g' =$ GM $\frac{(1-\frac{d}{R_e})}{R_e^2}$	1	
	$g' < g$ (or) As depth increases g' decreases	1	
37 a)	Explanation & Diagram  	1	
	F_G = mg (or) $F_G = \frac{4}{3}\pi r^3 \rho g$	½	
	U = $\frac{4}{3}\pi r^3 \sigma g$	½	5
	F = $6\pi\eta r v_t$	½	
	Downward force = upward force (or) $F_G - U = F$ $\frac{4}{3}\pi r^3 \rho g - \frac{4}{3}\pi r^3 \sigma g = 6\pi\eta r v_t$ $v_t = \frac{2}{9} \times \frac{r^2(\rho-\sigma)g}{\eta}$	2	
	$v_t \propto r^2$ (or) Terminal speed of the sphere is directly proportional to the square of its radius	½	
	(OR)		

37 b)	$dU = \mu C_v\, dT$ $Q = \mu C_p\, dT$	1	5
	$W = PdV$ $Q = dU + W$	1	
	$\mu C_p\, dT = \mu C_v\, dT + PdV$	½	
	$PV = \mu RT$ (or) $PdV + VdP = \mu RdT$	½	
	$dP = 0$	½	
	$C_p\, dT = C_v\, dT + RdT$	½	
	$C_p = C_v + R$ (or) $C_p - C_v = R$	1	
38 a)	Explanation & Diagram 	1	5
	Change in momentum of the molecule = $-2mv_x$ Change in momentum of the wall = $2mv_x$	1	
	upto $\Delta p = Av_x^2\, mn\Delta t$	1	
	$F = \frac{\Delta p}{\Delta t} = nm\, Av_x^2$ $P = \frac{F}{A} = nm\, v_x^2$	1	
	$P = \frac{1}{3} nm\overline{v^2}$ (or) $P = \frac{1}{3}\frac{N}{V} m\overline{v^2}$	1	
(OR)			

38 b)	Newton assumed that when sound propagates in air, temperature of the medium remains constant(or) isothermal process	½	
	PV= constant	½	
	P = -V $\frac{dP}{dV}$ = K_I	½	
	$v_T = \sqrt{\frac{K_I}{\rho}} = \sqrt{\frac{P}{\rho}}$	½	
	$v_T \approx 280$ ms^{-1}	½	5
	Laplace correction: Temperature is no longer considered as constant (or) adiabatic process	½	
	PV^γ = constant	½	
	γP = -V $\frac{dP}{dV}$ = K_A	½	
	$v_A = \sqrt{\frac{K_A}{\rho}} = \sqrt{\frac{\gamma P}{\rho}} = \sqrt{\gamma} v_T$	½	
	$v_A = 331.30$ ms^{-1}	½	