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Higher Secondary First Year Board Examination – March 2023

Physics – Key Answers

Total Marks: 70

Part – I

Q.No	OPTION	TYPE - A	Q.No	OPTION	TYPE - B
1	d	$ML^{-1}T^{-1}$	1	b	1
2	a	2 s	2	d	20.0
3	b	remains the 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 frame
7	a	10 Hz	7	a	2 s
8	a	12 s	8	b	2.5 υ Hz
9	b	2.5 υ Hz	9	a	12 s
10	a	10 J	10	b	remains same
11	c	$L/\sqrt{2}$	11	a	10 J
12	d	only in rotating frame	12	c	$L/\sqrt{2}$
13	d	less than potential energy	13	a	momentum
14	b	1	14	d	$ML^{-1}T^{-1}$
15	d	20.0	15	b	4.30

Part - II

(Question No:24 Compulsorily)

16	Volume - I Unit: 1 P.No.: 28 Out of seven rules any FOUR rules. Each rule carries ½ mark (Example not necessary) (OR) Without rule only examples 1 Mark	$4 \times \frac{1}{2}$	2
17	Scalar is a property which can be described only by magnitude Examples : Distance, Mass, Temperature speed and energy ONLY TWO or any other quantities having magnitude	1 1	2
18	If $\frac{mv^2}{r} > \mu_s mg$ OR $\mu_s < \frac{v^2}{rg}$ If the static friction is not able to provide enough centripetal force to turn, the vehicle will start to skid	1 1	2

19	Conservative	Non-Conservative		
	Work independent of path	Depends on path	Any	
	Work in a round trip is 0	$W \neq 0$	Four	
	Energy constant	Energy is dissipated	point	2
	Work - recoverable	Not recoverable	carries 2 Marks	
	$F = -dU/dx$	No such relation exists	$4 \times \frac{1}{2}$	
20	$\vec{\tau} = \vec{r} \times \vec{F}$ $\tau = rF\sin\theta$		1/2	
	$\theta = 0°$ $\tau = 0$		1/2	2
	$\theta = 180°$ $\tau = 0$		1/2	
	If the ~~torque~~ force acts at the reference point, the torque is zero		1/2	
21	Gravitational force between two masses is directly proportional to product of masses and inversely proportional to square of the distance between the masses		2	2
	OR			
	$\vec{F} = -\frac{Gm_1m_2}{r^2}\hat{r}$		1	

Karthikeyan Subramani 9894295401

22	Poisson's ratio is defined as the ratio of relative contraction (lateral strain) to relative expansion (longitudinal strain) OR $\mu = \frac{\text{Lateral Strain}}{\text{Longitudinal Strain}}$ OR $\mu = -\frac{Ld}{lD}$	2 1	2
23	If two systems A and B, are in thermal equilibrium with a third system, C, then A and B are in thermal equilibrium with each other.	2	2
24	$KE = \frac{p^2}{2m}$ For 3 kg $KE_1 = \frac{(30)^2}{2\times3} = \frac{900}{6} = 150\,J$ For 6 kg $KE_2 = \frac{(30)^2}{2\times6} = \frac{900}{12} = 75\,J$ $KE_1 \neq KE_2$ Heavier body lesser KE than lighter body	1/2 1/2 1/2 1/2	2

Karthikeyan Subramani 9894295401

Part – III

(Question No:33Compulsorily)

25	Error caused due to carelessness Reading an instrument without proper setting Without bothering errors and precaution Wrong Observations Using Wrong Values Minimised by observer is careful & mentally alert	1/2 1/2 1/2 1/2 1/2 1/2	3
~~26~~ 27	Volume 1 Unit : 3 P. No : 156 ~~Out~~ Six points given Each point carries 1/2 marks	$6 \times \frac{1}{2}$	3
26	Volume 1 Unit : 2 P. No : 53 Out of 11, any six points carries 3 marks	$6 \times \frac{1}{2}$	3

28	The energy possesed by the body due to gravitational force gives rise to gravitational potential energy $U = mgh$	1	3
	The energy due to spring force and other similar forces gives rise to elastic potential energy $U = \frac{1}{2} kx^2$	1	
	The energy due to electrostatic force on charges gives rise to electrostatic potential energy	1	
29	$T^2 = \frac{4\pi^2}{GM_E}(R_E + h)^3$ $R_E + h = \left(\frac{GM_E T^2}{4\pi^2}\right)^{1/2}$	1	3
	$T = 86400\ s$ $h = 36,000\ km$	½	
	They appear stationary seen from Earth	1	
	INSAT Group - Used for Telecommunication	½	
30	Volume - II Unit : 7 P. No : 80		3
	Point : 1	1	
	Point : 2	½	
	Point : 3	½	
	Point : 4	1	

Karthikeyan Subramani 9894295401

31	i) For a given g, the time period is directly proportional to square root of length (Formula Only $T \propto \sqrt{l}$) ii) For a fixed length, the time period is inversely proportional to square root of acceleration due to gravity (Only formula $T \propto \frac{1}{\sqrt{g}}$)	1½ 1 1½ 1	3
32	Volume 2 Unit 9 P. No: 164 Out of 10, any six points carries 3 marks.	$6 \times \frac{1}{2}$	3
33	$\eta = 1 - \frac{Q_L}{Q_H}$ $\eta = 1 - \frac{200}{600} = 1 - \frac{1}{3}$ $\eta = 1 - 0.33 = 0.67$ efficiency 67%.	1 1 1	3

Karthikeyan Subramani 9894295401

Part – IV

34 a	$T \propto m^a l^b g^c$	1	5
	$T = k m^a l^b g^c$	1/2	
	$[T^1] = [M^a][L^b][LT^{-2}]^c$	1	
	$[M^0 L^0 T^1] = [M^a L^{b+c} T^{-2c}]$	1/2	
	$a = 0 \quad b+c=0 \quad -2c = 1$	1/2	
	$a = 0 \quad b = 1/2 \quad c = -1/2$	1/2	
	$T = k\left(\frac{l}{g}\right)^{1/2} = 2\pi\sqrt{l/g}$	1	
b	Statement	1	5
	Diagram	1	
	..$AN = B\cos\theta \quad BN = B\sin\theta$	1	
	Upto $R = \sqrt{A^2+B^2+2AB\cos\theta}$	1	
	Upto $\alpha = \tan^{-1}\left(\frac{B\sin\theta}{A+B\cos\theta}\right)$	1	

35 a	Angle of repose statement	1	
	Diagram + Explanation	1	
	$N = mg \cos\theta$	1/2	
	$f_s = f_s^{max} = \mu_s N = \mu_s mg \cos\theta$	1/2	5
	$f_s^{max} = mg \sin\theta$	1/2	
	$\mu_s = \sin\theta / \cos\theta$	1/2	
	$\tan\theta = \mu_s$	1/2	
	Angle of repose = Angle of friction	1/2	
b	$W = \int \vec{F} \cdot d\vec{r}$	1/2	
	$W = \int dW = \int \frac{dW}{dt} dt$	1/2	
	$\vec{v} = \frac{d\vec{r}}{dt}$	1/2	5
	$\int \vec{F} \cdot d\vec{r} = \int (\vec{F} \cdot \vec{v}) dt$	1/2	
	$\int \frac{dW}{dt} dt = \int (\vec{F} \cdot \vec{v}) dt$	1/2	
	$\int \left(\frac{dW}{dt} - \vec{F} \cdot \vec{v} \right) dt = 0$	1/2	
	Relation is true for any orbitary value dt	1	
	$dW - \vec{F} \cdot \vec{v} = 0 \quad dW/dt = \vec{F} \cdot \vec{v} = P$	1	

Karthikeyan Subramani 9894295401

36 a	Diagram + Explanation	1	
	$dI = dm\, x^2$		
	$\lambda = \frac{M}{l}$ $dm = \frac{M}{l} dx$	1	
	... $I = \frac{M}{l} \int x^2 dx$	1	5
	.... $I = \frac{M}{l} \left[2 \left(\frac{l^3}{24} \right) \right]$	1	
	$I = \frac{Ml^2}{12}$	1	
b	Diagram + Explanation	1	
	... $g' = \frac{GM'}{(R_e - d)^2}$	1	
	... $\rho = \frac{M}{V}$	1	5
	.... $M' = \frac{M}{R_e^3} (R_e - d)^3$	1	
	... $g' = g \left(1 - \frac{d}{R_e} \right)$	1	

Karthikeyan Subramani 9894295401

37 a	Definition of terminal Velocity	1	5
	Diagram + Explanations	1	
	$F_G = \frac{4}{3}\pi r^3 \rho g$ $U = \frac{4}{3}\pi r^3 \sigma g$	1	
	$F = 6\pi\eta r v_t$	1/2	
	Downward Force = Upward Force	1/2	
	Upto $v_t = \frac{2}{9} \frac{r^2(\rho - \sigma)g}{\eta}$	1	
b	Explanations	1	5
	$dU = \mu C_v dT$	1/2	
	$Q = \mu C_p dT$	1/2	
	$W = P\,dV$	1/2	
	$Q = dU + W$	1/2	
	$\mu C_p dT = \mu C_v dT + P dV$	1/2	
	$PV = \mu RT \Rightarrow P dV + V dP = \mu R dT$	1/2	
	$dP = 0$	1/2	
	$C_p = C_v + R$ (or) $C_p - C_v = R$	1/2	

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38 a	Diagram + Explanations (9.2)	2	
	..... change in momentum of the wall $= 2mu_x$	1	5
	..... $\Delta p = A u_x^2 m n \Delta t$	1	
	.... $P = \frac{1}{3} \frac{N}{V} m\overline{v^2}$	1	
b	Newton's formula:		
	Explanation	1/2	
	$PV =$ constant	1/2	
	.... $P = -V \frac{dP}{dV} = K_T$	1/2	
		1	5
	.... $v_T = 280\ ms^{-1}$		
	Laplace's correction		
	Explanation	1/2	
	$PV^{\gamma} =$ constant	1/2	
	$\gamma = C_p/C_v$ $\quad \gamma P = -V \cdot \frac{dP}{dV} = k_A$	1/2	
		1/2	
	$v_A = \sqrt{\gamma}\, v_T = 331.3\ ms^{-1}$	1/2	

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