FY 02

FIRST YEAR HIGHER SECONDARY MODEL EXAMINATION, AUGUST 2021

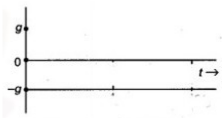
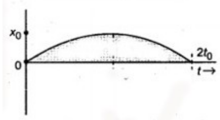
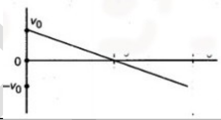
Part – III

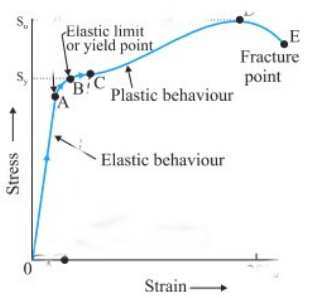
PHYSICS

Maximum : 60 Scores

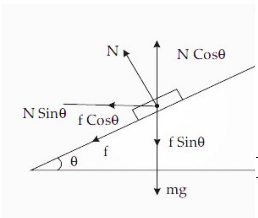
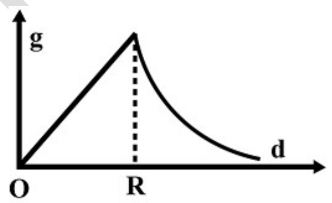
ANSWER KEY

Qn No	Qn Sub No	Split Scores	Total Score
1		b) Thermodynamics	1
2		c) Degree celsius	1
3		a) Zero	1
4		b) Strain	1
5		d) Becomes one fourth	1
6		a) Work	1
7		c) Varies linearly as its mass	1
8		d) Zero	1
9		$[x] = L$, $[x_0] = L$, $[v_0 t] = LT^{-1}T = L$ $[\frac{1}{2} at^2] = LT^{-2}T^2 = L$ Equation is dimensionally correct	2
10	a b	MLT^{-1} 1/2 score kgm/s 1/2 score Force or Weight or Tension 1 score	2
11	a b	πr $2r$ 1 score	2
12		$\vec{S} = \vec{X}_2 - \vec{X}_1$ 1 score $= (3-1)\hat{i} + (1-2)\hat{j} + (2-{}^{-}2)\hat{k} = 2\hat{i} - \hat{j} + 4\hat{k}$ 1 score *(Final answer only gives full credit)*	2
13		$F = \frac{\Delta P}{\Delta t}$ If larger glove is used time of impact increases so force decreases	2
14		$I = \Delta P$ 1 score $= m(v-u) = 0.15(12 - 12) = 3.60$kgm/s 1 score	2
15		$KE = \frac{P^2}{2m}$ 1 score $\frac{KE_1}{KE_2} = \frac{m_2}{m_1}$ 1 score	2

16	a b	Angular momentum 1 score Work or Energy 1 score	2
17		Nm^2/kg^2 or $kg^{-1}m^3s^{-2}$ 1 score $M^{-1}L^3T^{-2}$ 1 score	2
18	a b	Stress α Strain 1 Score Steel 1 Score	2
19		Collision — Conservation of momentum — 1/2 score Vector Addition — Parallelogram law — 1/2 score Moment of inertia — Perpendicular axes theorem — 1/2 score Velocity of sound — Laplace correction — 1/2 score	2
20		$\Delta Q = mL_f$ 1 score $= 2 \times 3.35 \times 10^5 = 6.70 \times 10^5$ J 1 score	2
21	a b	Energy 1 score Zero 1 score	2
22		$\eta = 1 - \frac{Q_2}{Q_1}$ 1 score $= 1 - \frac{300}{500} = 0.4$ or 40% 1 score	2
23		Derivation of equation $v = \sqrt{\frac{P}{\rho}}$ (final equation 1 score)	2
24	i ii	$\lambda = \frac{v}{f} = \frac{320}{400} = 0.8$ m 1 score Zero 1 score	2
25	i) ii) iii)	 1 score  1 score  1 score	3
26	a b	Uniformly accelerated motion 1 score Mathematical or Graphical derivation of 2 score $s = ut + \frac{1}{2} at^2$	3
27	a b	$R = \frac{u^2 \sin 2\Theta}{g}$ 1 score R is maximum when $\sin 2\Theta = 1$, $2\Theta = 90^0$, $\Theta = 45^0$ 1/2 score $R = 4H$, $\frac{u^2 \sin 2\Theta}{g} = 4 \frac{u^2 \sin^2 \Theta}{2g}$ 1 score	3

		$2\sin\Theta\cos\Theta = 2\sin^2\Theta$, $\cos\Theta = \sin\Theta$, $\Theta = 45^0$ 1/2 score	
28		$F_{AB} = \frac{\Delta P_A}{\Delta t} = \frac{P_A^I - P_A}{\Delta t}$ 1/2 score $F_{BA} = \frac{\Delta P_B}{\Delta t} = \frac{P_B^I - P_B}{\Delta t}$ 1/2 score $F_{AB} = -F_{BA}$ and substitution 1 score $P_A^I + P_B^I = P_A + P_B$ 1 score	3
29	a b c	i) negative ii) positive 1 score $W = F s\cos\Theta = mg \times h \times \cos 0 = mgh$ 1 score Displacement is along tangent and force is towards centre. So $\Theta = 90^0$ 1 score $w = FSco90^0 = 0$	3
30		Proof for Total energy = mgh at top point, intermediate point and at ground	3
31	a b	Statement of parallel axes theorem or equation $I = I_0 + ma^2$ 1 score $I = I_0 + ma^2 = \frac{MR^2}{2} + MR^2 = \frac{3}{2} MR^2$ 2 score	3
32	a b	Doubled 1 score $mg' = \frac{mgR^2}{(R+h)^2}$ 1 score $= \frac{mgR^2}{(R+\frac{R}{2})^2} = \frac{4mgR^2}{9R^2} = \frac{4}{9} \times 63 = 28N$ 1 score	3
33		 (Graph only give 1 score)	3
34		Derivation of equation $W = \mu R T \ln \frac{V_2}{V_1}$	3

		(Final expression only give 1 score)	
35		$P = \frac{1}{3}\, nm\, \overline{v^2}$ 1 score $= \frac{1}{3}\, \frac{N}{V}\, m\, \overline{v^2}$ $PV = \frac{1}{3}\, Nm\, \overline{v^2}$ $Nk_BT = \frac{1}{3}\, Nm\, \overline{v^2}$, $\frac{1}{2}\, m\, \overline{v^2} = \frac{3}{2}\, k_BT$, $\overline{KE} = \frac{3}{2}\, k_BT$ 2 score	3
36	a b	$T_m = 2\pi\sqrt{\frac{l}{g_m}} = 2\pi\sqrt{\frac{l}{\frac{g}{6}}} = \sqrt{6}\, 2\pi\sqrt{\frac{l}{g}} = \sqrt{6}\, T$ 1 score $T = 2\pi\sqrt{\frac{l}{g_m}}$ 1 score $\frac{T_1}{T_2} = \sqrt{\frac{l_1}{l_2}} = \sqrt{\frac{1.44}{1}} = 1.2$ 1 score	3
37	a b	Statement of principle of homogeneity 1 score Derivation of $T = 2\pi\sqrt{\frac{l}{g}}$ through dimensional method 3 score	4
38	a b	Derivation of $\frac{u^2 \sin^2\Theta}{2g}$ 2 score $T = \frac{2u \sin\Theta}{g}$ 1 score $= \frac{2 x 28 \sin 30^0}{9.8}$ =2.86 s 1 score	4
39	a b	Statement of Pascal's law 1 score (Name of law only gives 1/2 scores) Figure of hydraulic lift 1 score Explanation 2 scores	4
40	a b c	Thermal Expansion 1 score $\Delta l = \alpha\, l\, \Delta T$ 1 score $= 2.5 \times 10^{-5} \times 30 \times 10 = 7.5 \times 10^{-3}$ m 1 score Water at 4^0C 1 score	4
41	a b	$x(t) = \sin\omega t - \cos\omega t = \sin\omega t - \cos(\frac{\pi}{2} - \omega t)$ $= 2\cos(\pi/4)\sin(\omega t - \frac{\pi}{4}) = \sqrt{2}\sin(\omega t - \frac{\pi}{4})$ 2 scores	4

		$A = \sqrt{2}$ and $\varphi = -\frac{\pi}{4}$ 2 scores	
42	 i ii iii iv	$y = A \sin (kx - \omega t)$ $\lambda = 2\pi/k = 2\pi/80$ m $= 7.85$ cm 1 score $\nu = \omega/2\pi = 3/2\pi = 0.48$ Hz 1 score $T = \frac{1}{\nu} = 1/0.48 = 2.09$ s 1 score $v = \nu \lambda = 3.768$m/s 1 score	4
43	a b	A = Normal reaction B = Friction 2 score C = weight or gravitational force Figure 1 score Derivation of $v = \sqrt{rg\frac{\mu + \tan\Theta}{1 - \mu \tan\Theta}}$ 2 scores (If final Expression only give 1 score)	5
44	a b c	90^0 1 scores $\tau = rF\sin\Theta$ 1 score $20\sqrt{3} = 0.50 \times F \times \sin 60^0$ 1/2 score F = 80N 1/2 score $\tau = rF\sin\Theta$ 1 score r becomes high so torque becomes high 1 score	5
45	a b c	$g = \frac{GM}{R^2}$ 1 score Derivation of equation $g' = g\left(1 - \frac{d}{R}\right)$ 3 score 1 score	5
46	a b	Statement of Bernaulli's principle 1 score Proof 3 score No, because rapid flow of river is not streamline flow 1 score	5