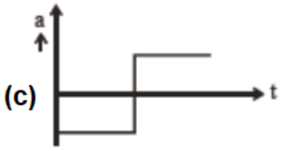
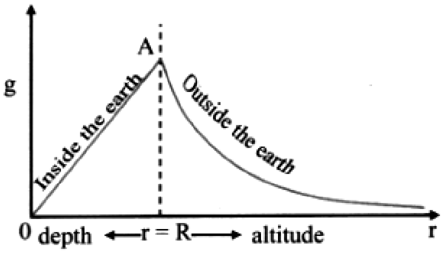
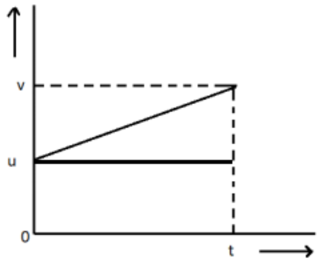
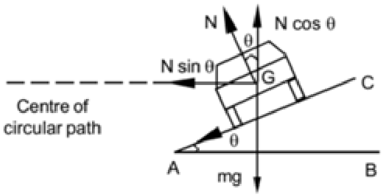
SESSION ENEDING EXAM 2024-25

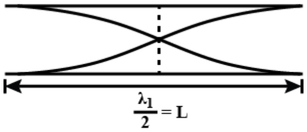
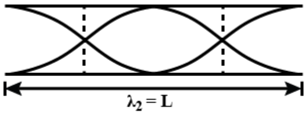
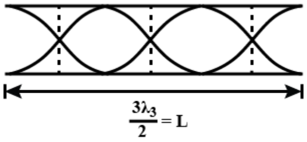
CLASS XI PHYSICS

MODEL ANSWER SHEET

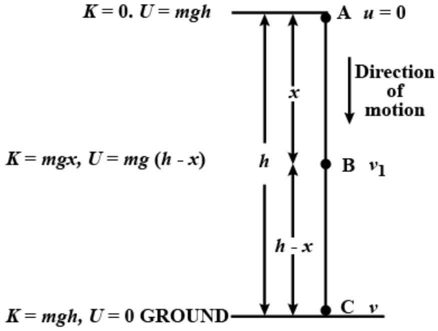
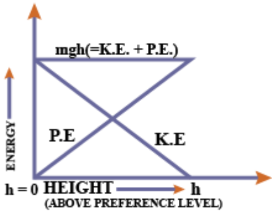
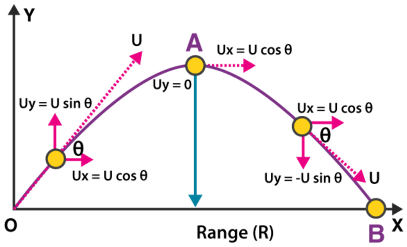
	SECTION A (MULTIPLE CHOICE QUESTIONS)	**MARKS**
1.	(a) Moment of inertia and moment of force	1
2.	(d) 1:16	1
3.		1
4.	(d) 90°	1
5.	(d) not changed	1
6.	(a)$\vec{F}.\vec{v}$	1
7.	(c)(2,2)	1
8.	(d) 4F	1
9.	(c)90∞	1
10.	(b) $- 10^{\circ}$C	1
11.	(d)$1 + \frac{2}{f}$	1
12.	(b)$T/\sqrt{2}$	1
	ASSERTION-REASON QUESTIONS	
13.	(c) Assertion is true but Reason is false	1
14.	(a)Both Assertion and Reason are true and Reason is the correct explanation of Assertion	1
15.	(a)Both Assertion and Reason are true and Reason is the correct explanation of Assertion	1
16.	(d) Both Assertion and Reason are false	1
	SECTION B (2 MARKS QUESTIONS)	
17.	(i) At a height h >> R, $g' = g\left(1 + \frac{h}{R}\right)^{-2}$ (ii) At a depth d, $g' = g\left(1 - \frac{d}{R}\right)$ 	1/2 1/2 1
18.	Using dimensions, $\eta \propto P^a A^b T^c$ $\eta = k P^a A^b T^c$ Putting dimensions $[ML^{-1}T^{-1}] = k [MLT^{-1}]^a [L^2]^b [T]^c$ $[ML^{-1}T^{-1}] = k [M]^a [L]^{a + 2b} [T]^{-a + c}$ On comparing the powers of M, L and T	1

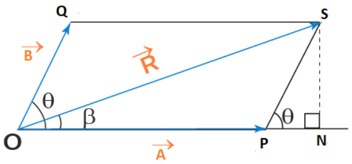
	a = 1, a + 2b = -1, -a + c = -1	1/2
	On solving a = 1, b = -1, c = 0	
	Therefore, η = $k\,P^{1}A^{-1}T^{0}$	1/2
19.	Given, x = $4t^2$ - 15t + 25	
	Instantaneous velocity, v = $\frac{dx}{dt}$ = 8t - 15	1/2
	At t = 0 s, v = -15 m/s	1/2
	Instantaneous acceleration, a = $\frac{dv}{dt}$ = 8	1/2
	At t = 0 s, a = 8 m/s^2	
	Acceleration is constant throughout the motion.	1/2
	OR	
		½(graph)
	The v-t graph for accelerated motion is shown	
	Area of v-t graph = area of triangle + area of rectangle	1/2
	= 1/2 x t x (v-u) + u x t	
	= 1/2t (at) + ut (since v = u + at)	1/2
	Therefore, area of v-t graph = ut + 1/2 at^2	
	But area under v-t graph = displacement s	1/2
	Therefore, s = ut + 1/2 at^2	
	Hence proved.	
20.	No,	1/2
	Hollow sphere will have greater moment of inertia as mass is distributed away from the axis of rotation.	1 1/2
21.	RMS velocity of hydrogen molecule, $v_{H2} = \sqrt{\frac{3kT_H}{m_H}}$	1/2
	RMS velocity of oxygen molecule, $v_{O2} = \sqrt{\frac{3kT_O}{m_O}}$	1/2
	Given that $v_{H2} = v_{O2}$, T_O = 47℃ + 273 = 320 K, m_H = 2, m_O = 32	1/2
	Therefore, $\frac{T_H}{m_H} = \frac{T_O}{m_O}$	1/2
	$T_H = \frac{T_O}{m_O}m_H = \frac{320 \times 2}{32}$ = 20 K	
	SECTION C (3 MARKS QUESTIONS)	

22.	**Banking of roads:** Raising of outer edge of the road a little above the inner edge in hilly areas. It is done to provide the necessary centripetal force for a vehicle to move with a reasonable speed without skidding.  From fig, $N \cos \theta = Mg$ $N \sin \theta = \frac{Mv^2}{R}$ $\text{Tan}\ \theta = \frac{v^2}{Rg}$ Angle of banking, $\theta = \tan^{-1} (\frac{v^2}{Rg})$	1 1/2 1/2 (fig.) 1/2 1/2
23.	We have, $\vec{L} = \vec{r}\ x\ \vec{p}$ Differentiating wrt t $\frac{d\vec{L}}{dt} = \frac{d\vec{r}}{dt}\ x\ \vec{p} + \vec{r}\ x\ \frac{d\vec{p}}{dt}$ $= \vec{v}\ x\ m\vec{v} + \vec{r}\ x\ \vec{F}$ $= 0 + \vec{\tau}$ $\vec{\tau} = \frac{d\vec{L}}{dt}$	1/2 1 1 1/2
24.	**Escape velocity:** The velocity required by a body to be projected from the surface of the Earth so as to overcome the gravitational pull of the Earth. The percentage increase in the orbital velocity of moon required to escape the gravitational pull of the Earth $\frac{v_e - v_o}{v_o}$ x 100 = $\frac{\sqrt{2gR} - \sqrt{gR}}{\sqrt{gR}}$ x 100 $= (\sqrt{2} - 1) x\ 100$ = (1.414 - 1) x 100 = 41.4 % ≈42% **OR** (i) **Kepler's third law of periods:** The square of time period of revolution of a planet is directly proportional to the cube of semi-major axis of the elliptical orbit. $T^2 \propto R^3$ (ii) The orbital velocity of satellite $v_0 = \sqrt{\frac{GM}{R+H}}$, Hence, lesser the height, greater will be the velocity of the satellite. So, satellite at a height H_1 will have more velocity.	1 1 1 1 1 1

25.	*(a) brass is a good conductor of heat, it readily transfers heat away from your body when you touch it, while wood is a poor conductor, so very little heat is transferred from your hand to the wood.* *(b) the lower layers of the earth's atmosphere reflect infrared radiations(heat) from earth back to the surface of the earth; thus the heat radiation received by the earth from the sun during the day are kept trapped by the atmosphere.* *(c) because steam contains more heat compared to hot water.*	1 1 1
26.	F = mg = 50 kg x 9.8 ms^{-2} = 490 N Use Hooke's law F = kx 490 = k x 0.20 K = 2450 N/m	1 1 1
27.	y (x,t) = 10 sin 2π(t - 0.005x) Comparing with y = A sin (ωt - kx) (i) $k = \frac{2\pi}{\lambda}$ = 2π x 0.005, λ = 1/0.005 = 200 cm (ii) w = 2πν = 2π, ν = 1 Hz (iii) V = ν λ = 1 x 200 = 200 cm/s	1 1 1
28.	**Open organ pipe:** We have $\lambda = \frac{2L}{n}$ **First mode of vibration**: n = 1,λ = λ_1, λ_1 = 2L, L = $\lambda_1/2$ Frequency $v_1 = \frac{v}{\lambda_1} = \frac{1}{2L}\sqrt{\frac{\gamma P}{\rho}}$ = fundamental frequency first harmonic  Case 1 or **Second mode of vibration**: n = 2,λ = λ_2, λ_2 = L, L = $\lambda_2/2$ Frequency $v_2 = \frac{v}{\lambda_2} = \frac{1}{L}\sqrt{\frac{\gamma P}{\rho}}$ = 2v_1 second harmonic  Case 2 **Third mode of vibration**: n = 3,λ = λ_3, λ_3 = 2L/3, L = 3λ_3/2 Frequency $v_3 = \frac{v}{\lambda_1} = \frac{31}{2L}\sqrt{\frac{\gamma P}{\rho}}$ = 3v_1 third harmonic  Case 3 Hence, $v_{1:}v_{2:}v_3$ = 1:2:3 Hence proved	1 1 1
29.	**SECTION D (CASE-STUDY BASED QUESTION 4 MARKS)**	
(i)	(b) in the absence of an external force	1

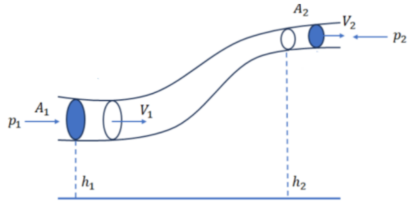
(ii)	(c) 100 m/s	1
(iii)	(c) 1:2	1
(iv)	(a) 0.2 m/s **OR** (a)less than that of the bullet	1
30.		
(i)	(c)equal to heat given to the system	1
(ii)	(d)adiabatic process	1
(iii)	(a)70J	1
(iv)	(b)800 J **OR** (b)ΔW	1
	SECTION E (LONG ANSWER QUESTION 5 MARKS)	
30.	(i) **Elastic collision**	1/2
	(ii) **Inelastic collision**	1/2
	(iii) **Perfectly inelastic collision**	1/2
	In an elastic collision, velocity of approach = velocity of separation In an inelastic collision, velocity of approach > velocity of separation	1/2
	Elastic collision in one dimension: Linear momentum of the system remains conserved $m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$ ………………………..(1)	½
	Kinetic energy of the system is also conserved $\frac{1}{2} m_1u_1^2 + \frac{1}{2} m_2u_2^2 = \frac{1}{2} m_1v_1^2 + \frac{1}{2} m_2v_2^2$……………(2)	½
	From (1) and (2) $m_1 (u_1 – v_1) = m_2 (v_2 – u_2)$…………..(3) $m_1 (u_1^2 – v_1^2) = m_2 (v_2^2 - u_2^2)$………..(4) Dividing (4) by (3) $u_1 + v_1 = v_2 + u_2$	½
	$v_2 = u_1 + v_1 - u_2$ Putting the value of v2 in eq (1) $m_1u_1 + m_2u_2 = m_1v_1 + m_2(u_1 + v_1 - u_2)$ Therefore $v_1 = \frac{(m_1 - m_2) + 2m_2u_2}{m_1 + m_2}$ Similarly, $v_2 = \frac{(m_2 - m_1) + 2m_1u_1}{m_1 + m_2}$	1
	If masses are equal, $m_1 = m_2 = m$ So, $v_1 = u_2$ and $v_2 = u_1$	½
	Hence, in an elastic collision in one dimension of equal masses, velocities are interchanged. **OR** For a freely-falling body of mass m falling from a height h,	1 (fig.)

		1
	At point A,	1
	P.E. = mgh, K.E. = 0	
	T.E. = P.E. + K.E. = mgh ………………….(1)	
	At point B,	
	P.E. = mg (h-x), K.E = ½ m v^2	
	Using $v^2 = u^2 + 2gx$	
	$v^2 = 0 + 2gx$	
	K.E. = ½ m (2gx) = mgx	1
	T.E. = mg(h – x) + mgx = mgh ………….(2)	
	At point C	
	P.E. = 0	
	K.E. = ½ m V^2	
	Using $V^2 = u^2 + 2gh$	
	$V^2 = 2gH$	1
	K.E. = 1/2m (2gh) = mgh	
	T.E. = mgh………………………………………..(3)	
	Hence, mechanical energy of a freely falling body remains conserved.	
		
31.	**Projectile:** A body which when thrown moves under the effect of gravity alone.	1/2
		½
	For motion along X-axis	(fig.)
	$u_x = u \cos \theta$, $a_x = 0$	
	using $S_x = u_x t + ½ a_x t^2$	½
	x = (u cos θ)t ……………………(1)	
	For motion along Y-axis	
	$u_y = u \sin \theta$, $a_y = -g$	
	Using $S_y = u_y t + ½ a_y t^2$	½
	y = u sin θ t– ½ gt^2 ……………….(2)	

	Putting the value of t from (1) in (2)	
	$y = u \sin\theta \frac{x}{u\cos\theta} - ½ g \left(\frac{x}{u\cos\theta}\right)^2$	½
	$y = x \tan\theta - ½ g \frac{x^2}{u^2\cos^2\theta}$	1/2
	Since, $y \alpha x^2$	
	hence, the motion of projectile is parabolic.	
		1/2
	Range $R = \frac{u^2\sin 2\theta}{g}$,	1/2
	Maximum height attained $H_{max} = \frac{u^2\sin^2\theta}{2g}$	
	For equal range and maximum height, $R = H_{max}$	
	$\frac{u^2\sin 2\theta}{g} = \frac{u^2\sin^2\theta}{2g}$	
	$2 \sin\theta \cos\theta = \sin^2\theta/2$	1
	Tan $\theta = 4$	
	$\Theta = \tan^{-1}(4)$ approx 75.96 degrees	
	OR	1/2(fig.)
	Parallelogram law of vector addition- "If two co-initial vectors can be represented in magnitude and direction by the two adjacent sides of a parallelogram, then their resultant will be represented completely in magnitude and direction by the diagonal of that parallelogram".	
		½
	Construction- Draw a perpendicular from S to OP produced.	½
	From right angled triangle SNP,	
	$\frac{SN}{PS} = \sin\theta$ or $SN = PS \sin\theta = B \sin\theta$	
	$\frac{PN}{PS} = \cos\theta$ or $PN = PS \cos\theta = B \cos\theta$	½
	Using Pythagoras theorem in right angles triangle ONS,	1/2
	$OS^2 = ON^2 + SN^2 = (OP + PN)^2 + SN^2$	
	Or $R^2 = (A + B\cos\theta)^2 + (B\sin\theta)^2$	
	$= A^2 + B^2(\cos^2\theta + \sin^2\theta) + 2AB\cos\theta$	
	$= A^2 + B^2 + 2AB\cos\theta$	1/2
	Or $R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$	
	$R^2 = A^2 + B^2 + 2AB\cos\theta$	1/2
	Given $A = B = x$, $R^2 = 3AB = 3X^2$	1/2
	$R^2 = x^2 + x^2 + 2x^2\cos\theta = 2x^2(1 + \cos\theta)$	1/2
	$3x^2 = 2x^2(1 + \cos\theta)$	1/2
	$1 + \cos\theta = 3/2$	
	$\cos\theta = 1/2$, $\theta = 60°$	

33. **(i) Bernoulli's theorem:** 1

" It states that for an ideal liquid (non-viscous, incompressible) in a streamlined flow, the sum of pressure energy, kinetic energy, potential energy per unit volume remains constant provided there is no source or sink of fluid throughout its flow".



1/2 (fig.)

Work done per sec by the pressure energy at A = $P_1A_1v_1 = P_{1\Delta V}$

Work done per sec by the pressure energy at B = $P_2A_2v_2 = P_{2\Delta V}$

$= (P_1 - P_2)\Delta V$……(1) 1/2

Change in potential energy from A to B = mg $(h_2 - h_1)$……………………,(2) 1/2

Change in kinetic energy from A to B = 1/2 m $(v_2^2 - v_1^2)$…………………(3) 1/2

Using work-energy conservation,

Work done per sec by pressure energy = Change in P.E. + Change in K.E.

$(P_1 - P_2)\Delta V = mg\,(h_2 - h_1) + 1/2\, m\,(v_2^2 - v_1^2)$

Dividing by ΔV

$(P_1 - P_2) = \rho g\,(h_2 - h_1) + 1/2\, \rho(v_2^2 - v_1^2)$ 1

Or $\frac{P_1}{\rho} + \frac{1}{2}\rho v_1^2 + \rho g h_1 = \frac{P_2}{\rho} + \frac{1}{2}\rho v_2^2 + \rho g h_2$

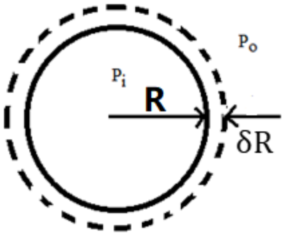
$\frac{P}{\rho} + \frac{1}{2}\rho v^2 + \rho g h = \text{constant}$

Hence proved. 1

(ii) When a train is passing on the railway track, the velocity of air between the train and the person increases and pressure decreases, while the atmospheric pressure is greater behind him. The pressure difference will pull him towards the train.

OR

(i) Excess pressure inside a soap bubble:



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Work done in increasing the area of the bubble

$W = (p_i - p_o) \times 4\pi R^2 \times \delta R$…………(1) 1

Increase in surface energy = ΔU = Surface tension x Increase in surface area

	$= \sigma\, x\, 2\, [\, 4\pi\, (\, R + \delta R)^2 - 4\pi R^2]$ (since a soap bubble has two surfaces) $\Delta U = 2\sigma$ x $[4\pi\, (\, R^2 + \delta R^2 + 2R\delta R - R^2]$ Since $\delta R << R$, neglecting δR^2 $^{\Delta U} = 16\pi R\delta R\sigma$ ……………………….(2)	1
	From (1) and (2) $W = \Delta U$ $(p_i - p_o)$ x $4\pi R^2$ x $\delta R = 16\pi R\delta R\sigma$ $(p_i - p_o) = \frac{4\sigma}{R}$	1
	(ii) Volume of 8 small drops = Volume of 1 big drop $8 \text{ x } \frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3$ $R = 2r$	1
	Surface energy of big drop $U_1 = 4\pi R^{2\sigma}$ Surface energy of small drop $U_2 = 4\pi r^{2\sigma}$ $\frac{U_1}{U_2} = \frac{R^2}{r^2}$ $U_1 : U_2 = 4 : 1$	