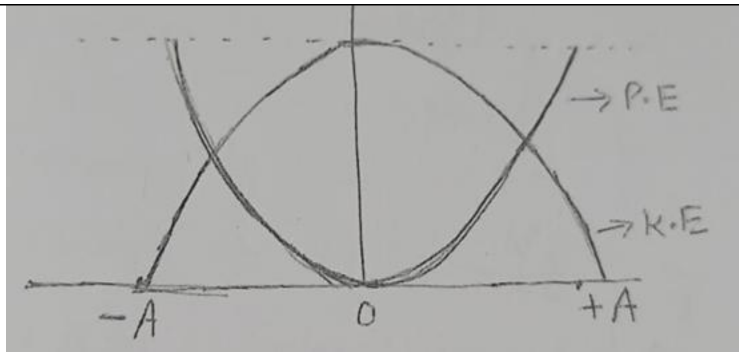
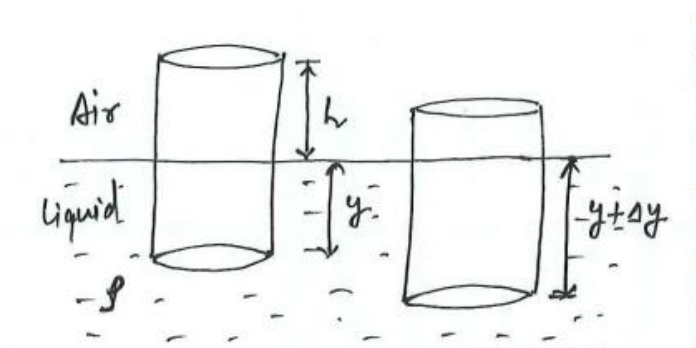
CLASS XI (SESSION: 2023-2024)

MAKRING SCHEME PHYSICS

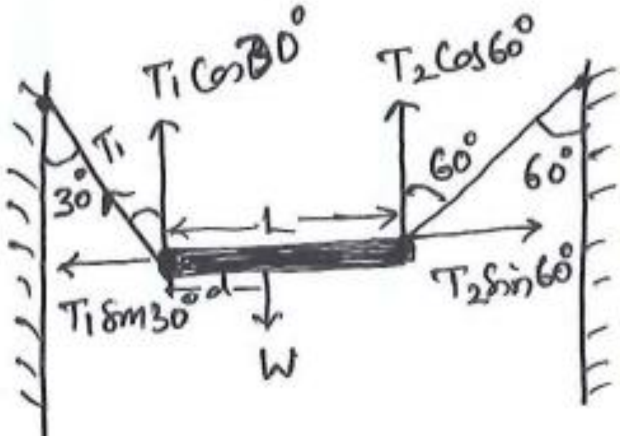
D.A.V. SAMPLE QUESTION PAPER (THEORY)

Q.No.	SECTION A	Value Points	Max. Marks
1	b. (3.0) cm cos πt	1	1
2	a. 0.869 g/cm^3	1	1
3	a. $W_2 > W_1 > W_3$	1	1
4	d. (9/7)R	1	1
5	c. $\frac{YX^2A}{2L}$	1	1
6	a. 15/16	1	1
7	b. Planck's Constant and Angular Momentum	1	1
8	c. 14 m/s	1	1
9	d. ML^2/12	1	1
10	d. 2.33 m/s^2	1	1
11	a. 2 W	1	1
12	c. 20 rad/s^2	1	1
13	a. Both Assertion and Reason are true and reason is correct explanation of Assertion.	1	1
14	b. Both Assertion and Reason are true but reason is not the correct explanation of Assertion.	1	1
15	d. Both Assertion and Reason are false.	1	1
16	c. Assertion is true but Reason is false.	1	1
	SECTION B		
17	Volume of big drop = (27) volume of small drop $\frac{4}{3}\pi R^3 = 27\left(\frac{4}{3}\pi r^3\right)$ $R^3 = 27\, r^3$ $R = 3r$ $\frac{V_R}{V_r} = \frac{\frac{2}{9}R^2(\rho-\sigma)g/9\eta}{\frac{2}{9}r^2(\rho-\sigma)g/9\eta}$ $V_R = (9)\, V_r$ $V_R = 1.35$ m/s	 ½ ½ ½ ½	02

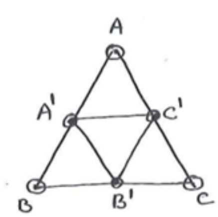
18	 Periodicity of Kinetic Energy = $\frac{T}{2}$ Periodicity of Potential Energy = $\frac{T}{2}$	½ + ½ ½ + ½	02
19	$v_A = \frac{dX_A}{dt}$ = 2 + 4t $v_B = \frac{dX_B}{dt}$ = 8 - 2t Given $v_A = v_B$ (2 + 4t) = (8 - 2t) t = 1 s	½ ½ ½ ½	02
	(OR) (i) At 20 s I = m (v-u) = 5 (0-2) = -10 kg ms^{-1} (ii) Velocity at (t = 40s) = 0 Since, position of the object does not change between t = 20s to t = 40s.	½ ½ ½ ½	02
20	$a_c = a \cos 30^0$ $= \frac{8\sqrt{3}}{2}$ $v = \sqrt{a_c\, r}$ $v = \sqrt{8\frac{\sqrt{3}}{2} \text{x} \frac{1}{\sqrt{3}}}$ v = 2 m/s	½ ½ ½ ½	02
21	$\vec{r} = 3\,\hat{\imath} + 4\,\hat{\jmath}$ $\overrightarrow{\Delta p} = -2mv\,\hat{\imath}$ $\overrightarrow{\Delta L} = \vec{r} \text{ x } \overrightarrow{\Delta p}$ $\overrightarrow{\Delta L} = 8\,\hat{k}$ kg $m^2\ s^{-1}$	½ ½ ½ ½	02

	SECTION C		
22	$N_R = k\rho^a v^b \eta^c D$ $[N_R] = M^0L^0T^0$ $[\rho] = ML^{-3}$ $[v] = LT^{-1}$ $[\eta] = ML^{-1}T^{-1}$ $[D] = L$ $[M^0L^0T^0] = [ML^{-3}]^a\ [LT^{-1}]^b\ [ML^{-1}T^{-1}]^c\ [L]$ Equating the powers of M, L and T a = 1, b = 1, c = -1 $\therefore N_R = \frac{K\rho v D}{\eta}$	½ 1 ½ ½ ½	03
23	 Length of the cylinder = L Cross-sectional area = A Density of cylinder = d Density of liquid = ρ_l Weight of the cylinder = Upthrust due to liquid displaced $Ahdg = A\, y\, \rho_l g$ The restoring force (F) is $F = A\,(y+\Delta y)\rho_l\, g - A\, y\, \rho_l\, g$ $= A\,\rho_l\, g\,.\,\Delta y$ $\therefore a = \frac{F}{m} = \frac{\rho_l g \Delta y}{hd}$ In S.H.M., $T = 2\pi\sqrt{\frac{\Delta y}{a}}$ $\nu = \frac{1}{T} = \frac{1}{2\pi}\sqrt{\frac{\rho_l g}{hd}}$	½ ½ ½ ½ ½ ½	03

24	$\vec{u} = 2\hat{i} + 3\hat{j}$ $\vec{a} = 8\hat{i} + 2\hat{j}$ $\vec{s} = \vec{u} + \frac{1}{2}\vec{a}\,t^2$ $(x\hat{i} + y\hat{j}) = (2\hat{i}+3\hat{j})\,t + \frac{1}{2}(8\hat{i} + 2\hat{j})\,t^2$ (a) Comparing coefficients of $\hat{i}$ on both sides $x = 2t + 4t^2$ Put x = 6 in above equation, we get $t=1$, $t = -\frac{3}{2}$ $\therefore t = 1s$ (b) Comparing coefficients of $\hat{j}$ on both sides $y = 3t + t^2$ Put t = 1 y = 4m	½ ½ ½ ½ ½ ½	03
25	For closed organ pipe $\nu_n = (2n-1)\frac{v}{4l}$ $440 = (2n - 1)\frac{340}{4 \times 0.2}$ $n = 1.035 \approx 1$ ∴ The closed organ pipe is resonantly excited by fundamental mode of vibration of first harmonic. For open organ pipe $\nu_n = P \times \frac{v}{4l}$ $440 = \frac{P \times 340}{2 \times 0.2}$ P = 0.517 P is not an integer ∴ It can be concluded that open organ pipe will not be in resonance with source.	½ ½ ½ ½ ½ ½	03
26	(a) Yes, when the gas undergoes adiabatic compression the work done on the gas converts into its internal energy and therefore its temperature increases. (b) dQ = dU + dW as dU = 0 ⇨ dQ = dW (c) av = constant $a \propto \frac{1}{v}$	1 ½ ½ 1	03

27		1	03
	$T_1 \sin 30^0 = T_2 \sin 60^0$	½	
	$\therefore T_1 = \sqrt{3}\, T_2$	½	
	$T_1 \cos 30^0 . d = T_2 \cos 60^0 (L-d)$	½	
	$\sqrt{3}\, T_2 \left(\frac{\sqrt{3}}{2}\right) .d = T_2 \times \left(\frac{1}{2}\right) (L-d)$		
	$d = \frac{L}{4}$	½	
	(OR)		
	(a) Statement of Kepler's law of areas	1	03
	Proof : N.C.E.R.T Class XI-Physics Part-I Page No. 185 (OLD BOOK)	1	
	(b) From conservation of angular momentom		
	$m_P v_P\, r_P = m_Q v_Q r_Q$	½	
	$\frac{v_P}{v_Q} = \frac{r_Q}{r_P}$	½	
	[Since $m_P = m_Q = m$]		
28	Refer : N.C.E.R.T. PHYSICS CLASS XI Page No. 122 (OLD BOOK)		
	$E_A = \frac{1}{2}\, m{v_o}^2$	½	03
	$T_A - mg = \frac{m{v_o}^2}{L}$	½	
	$E_c = \frac{1}{2}\, m{v_c}^2 + 2mgL$	½	
	$mg = \frac{m{v_c}^2}{L}$		
	$E_c = \frac{5}{2} mgL$	½	
	$E_A = E_C$		
	$\frac{5}{2} mgL = \frac{m{v_o}^2}{2}$		

	$v_o = \sqrt{5gl}$ $v_o = \sqrt{5 \text{ x } 10 \text{ x } 2}$ $v_o = 10m/s$	½ ½	
	SECTION D		
29	(i) a. Surface Tension of Liquid (ii) c. Obtuse (iii) b. [OR] c. (iv) b. $4 \text{ x } 10^{-1}$ J	1 1 1 1	04
30	(i) d. R (ii) c. 90 m (iii) c. 5 kg m/s [OR] a. 270^o (iv) c. 400 m	1 1 1 1	04
	SECTION E		
31	(a) Refer: NCERT CLASS XI PHYSICS Page No. 255 (OLD BOOK) Diagram--- Equation of Continutiy--- According to Bernoulli equation will become $v_1 = \sqrt{2gh + \frac{2(P - P_a)}{\rho}}$ When P>>Pa and 2gh may be ignored, the speed of efflux is determined by the container pressure. If the tank is open to the atmosphere then $P = P_a$ $v_1 = \sqrt{2gh}$ (b) Equation of continuity $A_1 V_1 = A_2 V_2$ $(10 \pi \text{ x } 10^{-6}) V_1 = (8 \text{ x } 10^{-4}) \text{ x } \frac{11.5}{60}$ $V_1 = 4.88$ m/s (OR) (a) Definition of Angle of contact	 1 ½ ½ ½ ½ ½ 1 ½ 1	 03 02 03

	Expression : h = $\frac{2T\cos\theta}{r\rho g}$ When θ is obtuse, then $\cos\theta$ $is - ve$ ∴ h will be negative & liquid will get depressed. (b) Force on second piston F_2 = mg = 1350 x 9.8 N $F_1 = \frac{F_2}{A_2}$ x A_1 = 1.47 x 10^3 N Then P = $\frac{F_1}{A_1}$ P = 18.7 Pa	1 ½ ½ ½ ½ ½ ½	02
32	(a) Refer: NCERT CLASS XI PHYSICS PART (I) Page No. 195 (OLD BOOK) KE = $\frac{1}{2}mv^2$ $= \frac{GmM_E}{2(R_E + h)}$ Potential Energy at distance (R+h) $PE = -\frac{GmM_E}{(R_E + h)}$ Total Energy = KE + PE $= -\frac{GmM_E}{2(R_E + h)}$ (b)  Initial G.P.E. = - $\frac{Gm_1m_2}{r}$ - $\frac{Gm_2m_3}{r}$ - $\frac{Gm_3m_1}{r}$ = - 140 G Final G.P.E. = - $\frac{G \times 10 \times 20}{5}$ - $\frac{G \times 20 \times 40}{5}$ - $\frac{G \times 10 \times 40}{5}$ = -280 G	½ ½ 1 ½ ½ ½ ½ ½	02 03

	It indicates that gravitational potential energy becomes more negative i.e. system loses gravitaional potential energy.	½	
	(OR) (a) REFER: NCERT PHYSICS CLASS –XI Part 1 Page No. 129 (OLD BOOK) (6.12.2) Loss in kinetic energy on collision $= \frac{1}{2} m_1 v_1^2 [1- \frac{m_1}{m_1+m_2}]$	2	02
	(b) mgh $= \frac{1}{2} mv^2$ $(1 \times 10 \times 0.1) = \frac{1}{2} \times 1 \times v^2$ $v = \sqrt{2}$ m/s Since collisoin is elastic and balls are identical, so ball A will transfer all its energy to ball B. $\therefore v_B = \sqrt{2}$ m/s Ball A will come to rest $v_A = 0$ m/s	½ ½ ½ ½ 1	03
33	(a) Refer: NCERT PHYSICS CLASS XI Page No. 104 (OLD BOOK) (5.10) Diagram--- $v_{max} = \left[Rg \frac{\mu_s + \tan\theta}{1 - \mu_s \tan\theta} \right]$	 1 2	 03
	(b) $\tan\theta = \frac{v^2}{rg}$ $\tan\theta = \frac{150 \times 150}{10 \times 1000 \times 10}$ $\theta = \tan^{-1} (0.225)$	½ 1 ½	02
	[OR] (a) Refer: NCERT PHYSICS CLASS XI PAGE NO. 79 (OLD BOOK) (4.11) Diagram--- Derivation	 1	 03

	$a_c = \frac{v^2}{R}$ or $a_c = \omega^2 R$	2	
	b) $a = \sqrt{a_c{}^2 + a_T{}^2}$	½	02
	$a_c = \frac{v^2}{R} = 0.5625\ m/s^2$, $a_T = 1\ m/s^2$	1	
	$a = 1.147\ m/s^2$	½	