CLASS-XI
SAMPLE QUESTION PAPER (PHYSICS)
MARKING SCHEME

SECTION A

Q. No.		VALUE POINTS	TOT. MARKS ALLOTED
1.	C	1	
2.	B	1	
3.	B	1	
4.	A	1	
5.	C	1	
6.	D	1	
7.	A	1	
8.	D	1	
9.	A	1	
10.	C	1	
11.	A	1	
12.	A	1	
13.	B	1	
14.	C	1	
15.	A	1	
16.	D	1	

CLASS - XI
SAMPLE QUESTION PAPER (PHYSICS)
MARKING SCHEME

SECTION-B

Q.No.		Value Points	Tot. Marks Alloted
17	**First Method**		
	$\vec{F} = 5\hat{i} + 5\hat{j}$	$\frac{1}{2}$	
	$\vec{S} = 2\hat{i} + 2\hat{j}$	1	
	$W = \vec{F}.\vec{S} = (5\hat{i} + 5\hat{j}).(2\hat{i} + 2\hat{j})$	$\frac{1}{2}$	02
	$= 10 + 10 = 20\,J$		
	Second Method		
	$\vec{F} = 5\hat{i} + 5\hat{j}$		
	$\lvert\vec{F}\rvert = \sqrt{5^2+5^2} = 5\sqrt{2}\,N$	$\frac{1}{2}$	
	$\vec{S} = 2\hat{i} + 2\hat{j}$		
	$\lvert\vec{S}\rvert = \sqrt{2^2+2^2} = 2\sqrt{2}\,m$	$\frac{1}{2}$	
	$W = \lvert\vec{F}\rvert\lvert\vec{S}\rvert \cos 0$	$\frac{1}{2}$	
	$= 5\sqrt{2} \times 2\sqrt{2} = 20\,J$	$\frac{1}{2}$	02
18	Using principle of Moments		
	Load × Load arm = Effort × Effort arm	1	
	$20 \times 30 = 50 \times (50 - x)$	$\frac{1}{2}$	
	$600 = 50(50 - x)$		
	$x = 38\text{ cm}$	$\frac{1}{2}$	02
19 a)	Coefficient of thermal conductivity is defined as time rate of flow of heat in a material at given temperature difference.	$\frac{1}{2}$	
	S.I unit $J s^{-1} m^{-1} K^{-1}$ or $W m^{-1} K^{-1}$	$\frac{1}{2}$	
b)	i) Low specific heat	$\frac{1}{2}$	
	ii) high thermal Conductivity.	$\frac{1}{2}$	02

Q.No.		VALUE POINTS	TOT. MARK ALLOTED

OR

(19) a) At absolute zero, the energy of translatory motion ceases but other forms of energy such as intermolecular, potential energy of molecular motion do not become zero. Therefore absolute temperature is not the temperature of zero energy. — 1

b) For Isothermal Expansion -
Internal energy is constant. — $\frac{1}{2}$

For Adiabatic Expansion →
Internal energy decreases. — $\frac{1}{2}$ — 02

(20) As refractive Index 'n' is dimensionless
From Principle of homogeneity
'P' is dimensionless — 1
'Q' has dimension $[L^2]$ — 1

(21) a) Factors on which mean free path of gas molecules depend
i) Number of molecules per unit volume of the gas 'n' — $\frac{1}{2}$
ii) Diameter of molecule 'd' — $\frac{1}{2}$

b) Given $d = 2A^\circ = 2 \times 10^{-10} m$
$n = 3 \times 10^{19}$ per cm^3 $= 3 \times 10^{25} m^{-3}$

$$\lambda = \frac{1}{\sqrt{2}\pi n d^2}$$ — $\frac{1}{2}$

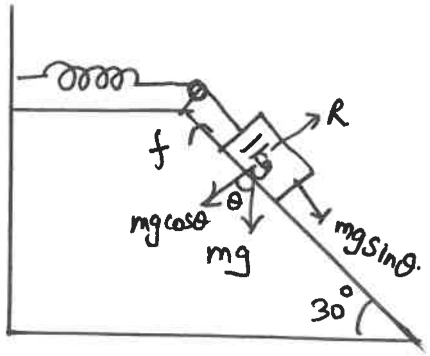
$$= \frac{1}{1.414 \times 3.14 \times 3 \times 10^{25} \times (2 \times 10^{-10})^2}$$

$\lambda = 1.9 \times 10^{-7} m$ — $\frac{1}{2}$ — 02

SECTION – C

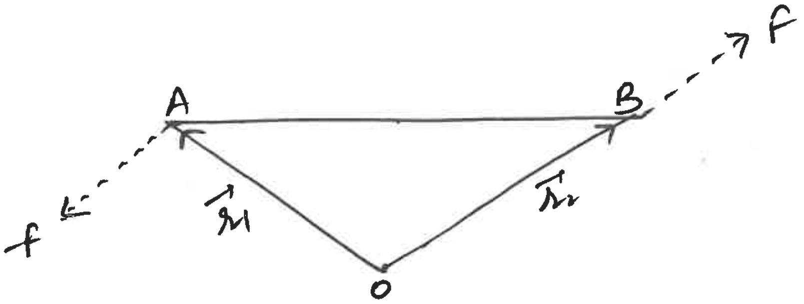
Q. No.		Value Points	Total Marks Alloted
22.	Applying Bernoulli's principle at points A and D with point D as reference for gravitational P.E. Considering speed of liquid at A is negligible		
	$P_A + 0 + \rho g(h+y) = P_D + \frac{1}{2}\rho v_D^2$	$\frac{1}{2}$	
	$v = \sqrt{2g(h+y)}$		
	$P_C + \frac{1}{2}\rho v_C^2 = P_D + \frac{1}{2}\rho v_D^2 - \rho g(H+h+y)$	$\frac{1}{2}$	
	$v_C = v_D$	$\frac{1}{2}$	
	$P_D - P_C = \rho g(H+h+y)$	1	
	$= 10^3 \times 10 \times (10+20+30) \times 10^{-2}$		
	$= 10^2 \times 60$	$\frac{1}{2}$	3
	$= 6 \times 10^3$ Pascal		
23. (a)	At $t = 2$ sec.		
	Impulse $= mv - mu$	$\frac{1}{2}$	
	$= 4(0 - \frac{20}{2})$	$\frac{1}{2}$	
	$= -40$ NS		
	At $t = 6$ sec.		
	Impulse $= mv - mu$	$\frac{1}{2}$	
	$= 4(-\frac{20}{2} - 0)$	$\frac{1}{2}$	
	$= -40$ NS		
(b)	Velocity at B = 0	$\frac{1}{2}$	
	∵ A while moving $t = 2$ sec to $t = 6$ sec, the position of particle remains same i.e at rest	$\frac{1}{2}$	3

Q. No.		VALUE POINTS	TOT. MARKS ALLOTED
(24)	Example 2.5 Page no. 20 of NCERT Physics (Part I)		
	$y = -\frac{1}{2} g t^2$	$\frac{1}{2}$	
	time interval of τ each	$\frac{1}{2}$	
	Table (2.2) Page no. 20 of NCERT First 4 calculations	$\frac{1}{2} \times 4$	3
	OR		
(24)	By first equation of motion		
	$v = u + at$ ——— (1)	$\frac{1}{2}$	
	$v = \frac{dx}{dt}$		
	$dx = v\,dt$	$\frac{1}{2}$	
	integrating both sides.		
	$\int_{S_{n-1}}^{S_n} dx = \int_{n-1}^{n} v\,dt$		
	Substituting from (1)	$\frac{1}{2}$	
	$\int_{S_{n-1}}^{S_n} dx = \int_{n-1}^{n} (u + at)\,dt$		
	$\int_{S_{n-1}}^{S_n} dx = \int_{n-1}^{n} u\,dt + a\int_{n-1}^{n} t\,dt$	$\frac{1}{2}$	
	$[x]_{S_{n-1}}^{S_n} = u\,[t]_{n-1}^{n} + \frac{1}{2} a\,[t^2]_{n-1}^{n}$	$\frac{1}{2}$	
	$S_n - S_{n-1} = u\,[n - (n-1)] + \frac{1}{2} a\,[n^2 - (n-1)^2]$		
	$S_{nth} = u + \frac{a}{2}\,[n^2 - (n^2 + 1 - 2n)]$	$\frac{1}{2}$	3
	$S_{nth} = u + \frac{a}{2}(2n - 1)$		

Q.No.		VALUE POINTS	TOTAL MARKS ALLOTED
25		1	
	$R = mg\cos\theta$ $R = \mu R = \mu mg\cos\theta$ Net force $= (mg\sin\theta - \mu mg\cos\theta)$ $= mg(\sin\theta - \mu\cos\theta)$	$\frac{1}{2}$	
	distance moved $x = 10\text{ cm} = 0.1\text{ m}$ $mg(\sin\theta - \mu\cos\theta)x = \frac{1}{2}kx^2$	$\frac{1}{2}$	
	$1\times10(\sin30 - \mu\cos30)\times0.1 = \frac{1}{2}\times50\times(0.1)^2$	$\frac{1}{2}$	
	$5 - 10\mu\frac{\sqrt{3}}{2} = 2.5$ $5\mu\sqrt{3} = 2.5$ $\mu = \frac{2.5}{5\sqrt{3}} = \frac{1}{2\sqrt{3}}$	$\frac{1}{2}$	3

Q. No.		VALUE POINTS	TOTAL MARKS ALLOTED

(26) (a)



$\frac{1}{2}$

Moment of couple = Sum of the moments of the two forces making the couple.

$= \vec{r_1} \times (-\vec{F}) + \vec{r_2} \times \vec{F}$

$= \vec{r_2} \times \vec{F} - \vec{r_1} \times \vec{F}$ 1

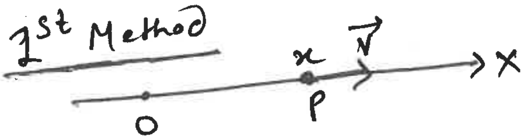
$= (\vec{r_2} - \vec{r_1}) \vec{F}$

But $\vec{r_1} + \vec{AB} = \vec{r_2}$ $\frac{1}{2}$

$\therefore \vec{AB} = \vec{r_2} - \vec{r_1}$

The moment of couple, therefore, is $\vec{AB} \times \vec{F}$. Clearly this is independent of the origin, the point about which we took the moments of the forces

b) 1st Method



$\vec{L} = \vec{r} \times m\vec{v}$

$= x\hat{i} \times mv\hat{i}$ $(\hat{i} \times \hat{i} = 0)$

$= 0$

2nd Method

Since $\vec{r}$ and $\vec{v}$ are in the same direction $\frac{1}{2}$

$\therefore \theta = 0$

$\therefore \vec{L} = \vec{r} \times m\vec{v}$ $\frac{1}{2}$

$= 0$ 3

(27) (a) The first law of thermodynamics is the general law of conservation of energy applied to any system in which energy transfer from or to the surroundings (through heat and work)

Q. No.		VALUE POINTS	TOT. MARKS ALLOTED
	is taken in to account. It states that $\Delta Q = \Delta U + \Delta W$ where ΔQ is the heat supplied to the system, ΔW is the work done by the system and ΔU is the change in internal energy of the system.	1	
b)	$dW = -300J$	½	
	Using 1st law of thermodynamics $dQ = dU + dW$	½	
	$dQ = -70\ Cal. = -70 \times 4.2J = -294J$	½	
	$\therefore dU = dQ - dW$ $= -70\times4.2 - (-300)$ $= -294 + 300$ $= 6J$.	½	3
(28)	$T = 2\pi\sqrt{\frac{m}{K}}$	½	
	The restoring force = Buoyant force = weight of liquid displaced	½	
	$f = -Ax\rho_1 g$	½	
	$f = -Kx \Rightarrow K = A\rho_1 g$	½	
	mass of cork $= m = Ah\rho$		
	$\therefore T = 2\pi\sqrt{\frac{Ah\rho}{A\rho_1 g}}$	½	
	$T = 2\pi\sqrt{\frac{h\rho}{\rho_1 g}}$	½	3

Q. No.		VALUE POINTS	TOT. MARK ALLOTED

SECTION-D

Q. No.		Value Points	Total Marks
(29)	(i) c	1	
	(ii) a	1	
	(iii) d	1	
	or		
	(iii) b		
	(iv) c	1	4
(30)	(i) a	1	
	(ii) a	1	
	(iii) b	1	
	or		
	(iii) a		
	(iv) b	1	4

Q. No.		VALUE POINTS	TOT. MARKS ALLOTED

SECTION - E

31 (a) Using Law of Conservation of momentum. $\frac{1}{2}$

$$m_1u_1 + m_2u_2 = (m_1+m_2)v$$

$$m_1u + 0 = (m_1+m_2)v$$

$$v = \frac{m_1 u}{m_1+m_2}$$ $\frac{1}{2}$

$$K_i = \frac{1}{2}m_1u^2$$ $\frac{1}{2}$

$$K_f = \frac{1}{2}(m_1+m_2)v^2$$

Loss in K.E

$$\Delta K = K_i - K_f$$ $\frac{1}{2}$

$$= \frac{1}{2}m_1u^2 - \frac{1}{2}(m_1+m_2)v^2$$

$$= \frac{1}{2}m_1u^2 - \frac{1}{2}(m_1+m_2)\frac{m_1^2u^2}{(m_1+m_2)^2}$$ $\frac{1}{2}$

$$= \frac{1}{2}\frac{m_1 m_2 u^2}{(m_1+m_2)}$$ $\frac{1}{2}$ (03)

b) Mass $m = 500g = 0.5Kg$

$$\vec{v} = 10\hat{i} + 20\hat{j}$$ $\frac{1}{2}$

$$\vec{a} = 0\hat{i} - 9.8\hat{j}$$

$$\vec{F} = m\vec{a} = -0.5 \times 9.8\hat{j}$$

$$= -4.9\hat{j}N$$ $\frac{1}{2}$

$$P = \vec{F}.\vec{v}$$ $\frac{1}{2}$

$$= (-4.9\hat{j}).(10\hat{i} + 20\hat{j})$$

$$P = -98 W$$ $\frac{1}{2}$ 02

Q. No.		VALUE POINTS	TOT. MARKS ALLOTED

(OR)

31 a) Using Law of Conservation of Energy

$$T.E_{surface} = T.E_{Height}$$ ½

$$(K.E + P.E)_{surface} = (K.E + P.E)_{Height}$$

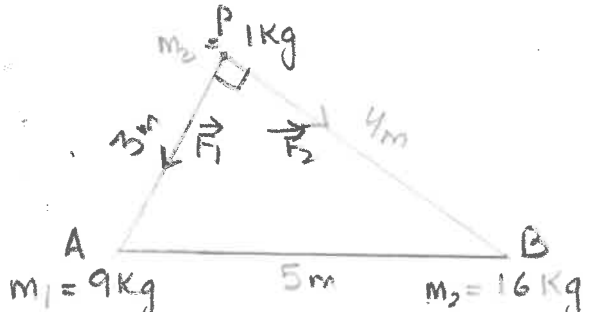
$$\frac{1}{2}mv^2 - \frac{GMm}{R} = 0 - \frac{GMm}{R+h}$$ ½

$$v^2 = 2GM\left[\frac{1}{R} - \frac{1}{R+h}\right]$$ ½

$$v^2 = 2gR^2\left[\frac{h}{R(R+h)}\right] \quad \because GM = gR^2$$ ½

$$h = \frac{v^2R}{2gR - v^2}$$ 1 03

b)



$$F_1 = \frac{Gm_1m_3}{(AP)^2}$$ ½

$$F_1 = G \text{ , along PA}$$

$$F_2 = \frac{Gm_2m_3}{(BP)^2}$$ ½

$$F_2 = G \text{ , along PB.}$$

Net force $F = \sqrt{F_1^2 + F_2^2}$ ½

$F = G\sqrt{2}$

$F = 9.43 \times 10^{-11}$ N ½

02

Q. No.		VALUE POINTS	TOT. MARKS ALLOTED

32 (a) $H = \frac{u^2 \sin^2\theta}{2g}$

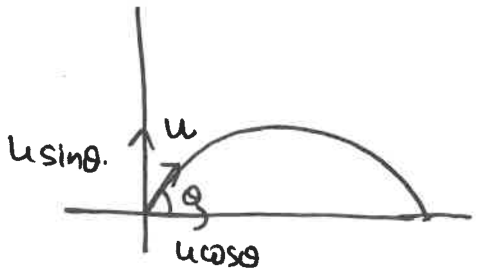
$\theta = 90^\circ \Rightarrow H_{max} = \frac{u^2}{2g}$ $\frac{1}{2}$

$R = \frac{u^2 \sin 2\theta}{g}$ $\frac{1}{2}$

$R_{max} = \frac{u^2}{g}$

$\Rightarrow R_{max} = 2H$

(b)



$u_x = u\cos\theta$, $u_y = u\sin\theta$, $a_x = 0$, $a_y = -g$ $\frac{1}{2}$

$x = u\cos\theta\, t$

$t = \frac{x}{u\cos\theta}$ —— ① $\frac{1}{2}$

$y = u\sin\theta\, t - \frac{1}{2} g t^2$

from ①

$y = u\sin\theta \frac{x}{u\cos\theta} - \frac{1}{2} g \left(\frac{x}{u\cos\theta}\right)^2$ $\frac{1}{2}$

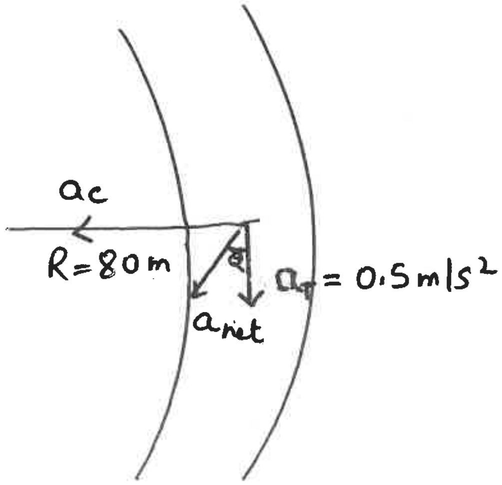
$y = x\tan\theta - \frac{1}{2} g \frac{x^2}{u^2\cos^2\theta}$.

$$y = x\tan\theta - \frac{1}{2}\frac{g}{u^2} x^2 \sec^2\theta.$$ $\frac{1}{2}$

Q. No.		VALUE POINTS	TOTAL MARKS ALLOTTED
	(c) $\vec{u} = 30\hat{i} + 40\hat{j}$ m/s		
	$a_x = 0$, $a_y = -g$, $u_x = 30$ m/s, $u_y = 40$ m/s	$\frac{1}{2}$	
	$v_y = u_y - gt$ $= 40 - 10\times3$	$\frac{1}{2}$	
	$= 10$ m/s	$\frac{1}{2}$	
	$v_x = u_x = 30$ m/s		
	$\tan\theta = \frac{v_y}{v_x} = \frac{10}{30} = \frac{1}{3}$	$\frac{1}{2}$	1+2+2 = 5
	$\theta = \tan^{-1}\left(\frac{1}{3}\right)$		
	OR		
	Diagram (a) on Page 41 NCERT Physics (Part 1)	$\frac{1}{2}$	
32. (a)	$\lvert\vec{a}\rvert = \lim_{\Delta t\to 0}\left\lvert\frac{\Delta \vec{v}}{\Delta t}\right\rvert$	$\frac{1}{2}$	
	$\left\lvert\frac{\Delta v}{v}\right\rvert = \left\lvert\frac{\Delta r}{l}\right\rvert$		
	$\lvert\Delta r\rvert = v\Delta t$		
	$\frac{\lvert\Delta r\rvert}{\Delta t} = v$	$\frac{1}{2}$	
	$\lim_{\Delta t\to 0}\frac{\lvert\Delta r\rvert}{\Delta t} = v$	$\frac{1}{2}$	
	$\Rightarrow a_c = \frac{v^2}{l}$		

Q. No.		VALUE POINTS	TOTAL MARKS ALLOTED

(b)



½

½

$$a_{net} = \sqrt{a_T^2 + a_c^2}$$

$$a_c = \frac{v^2}{R}$$

$$v = 36\ km/hr = 36 \times \frac{5}{18} = 10 m/s.$$

½

$$a_c = \frac{100}{80} = 1.25\ ,\quad a_T = 0.5\ m/s^2$$

$$a_{net} = \sqrt{(1.25)^2 + (0.5)^2}$$

$$= \sqrt{1.8125}$$

$$= 1.34\ m/s^2$$ ½

$$\tan\theta = \frac{a_c}{a_T} = \frac{1.25}{0.5}$$ ½

$$\tan\theta = 2.5$$

$$\theta = \tan^{-1}(2.5)$$ ½

Q. No.		VALUE POINTS	TOT. MARKS ALLOTED
33 (a)	Refer to fig. 10.18 on Page no. 218 of ncert-2.	1	
(b)	Using weins displacement Law	$\frac{1}{2}$	
	$\lambda_m \propto \frac{1}{T}$ or $\lambda_m = \frac{b}{T}$		
	using $\lambda_m = \frac{c}{\nu_m}$		
	$\therefore \nu_m = \frac{c}{\lambda_m} = \frac{c}{b/T}$		
	$\nu_m = \left(\frac{c}{b}\right)T$	$\frac{1}{2}$	
	$\frac{c}{b}$ is constant		
	$\therefore \boxed{\nu_m \propto T}$		
	Ans → (c)		
(c)	Using Stefan's Law $H = A\sigma T^4$	1/2	
	$\therefore T' = T + 5\%$ of T		
	$= T + \frac{5}{100}T$	1/2	
	$T' = \frac{21}{20}T$		
	$T' = 1.05T$		
	Now $H' = A\sigma(T')^4$		
	$H' = A\sigma(1.05T)^4$	1	
	$= A\sigma(1.05)^4 T^4$		

Q. No.		VALUE POINTS	TOT. MARKS ALLOTED
	$\frac{H'}{H} = \frac{A\sigma(1.05)^4 T^4}{A\sigma T^4}$		
	$= (1.05)^4$	½	
	$\therefore$ % increase $= \frac{H'-H}{H} \times 100$		
	$= (1.05^4 - 1) \times 100$		
	$= (1.21550625 - 1) \times 100$		
	$= 21.55$	½	
	$\simeq 22\%$		5

Q. No.		VALUE POINTS	TOT. MARKS ALLOTED
	OR		
(33) (a)	$V_{final} = V_{initial}$ $n \times \frac{4}{3}\pi r^3 = \frac{4}{3}\pi R^3$ $r = n^{-1/3} \cdot R$	$\frac{1}{2}$	
	Change in surface energy = Change in surface area × Tension	$\frac{1}{2}$	
	$= [n \cdot 4\pi r^2 - 4\pi R^2] \cdot T$	$\frac{1}{2}$	
	$= T \cdot 4\pi R^2 [1 - n^{1/3}] \cdot J$	$\frac{1}{2}$	
(b)	Work done = Increase in surface area × Tension	$\frac{1}{2}$	
	$= 2[4\pi(3\times10^{-3})^2 - 4\pi(2\times10^{-3})^2] \times 0.07$	$\frac{1}{2}$	
	$= 8.79 \times 10^{-6}$ J	1	
(c)	In case (I), $h_1 > h_2$	$\frac{1}{2}$	
	On increasing temperature, surface tension decreases As $h = \frac{2a\cos\theta}{r\rho g}$ height of liquid coloum decreases.	$\frac{1}{2}$	
			05