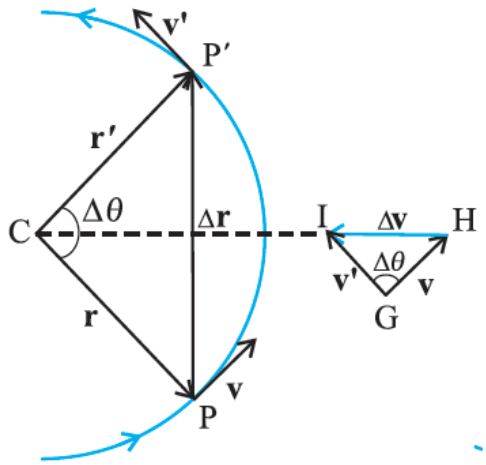
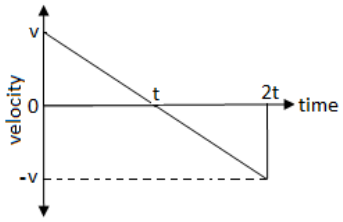
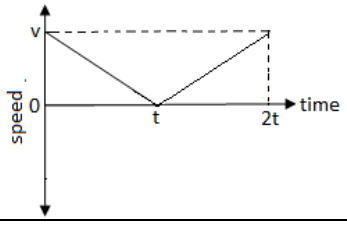
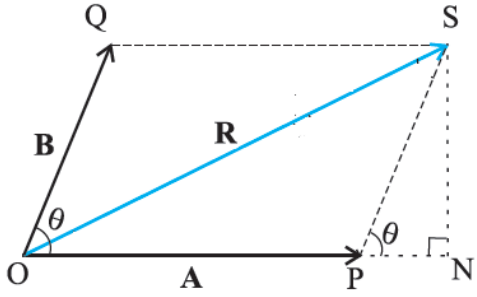
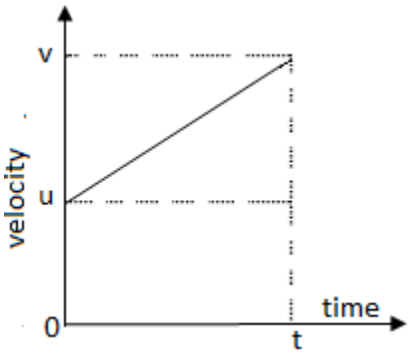
Paper Code No : 16

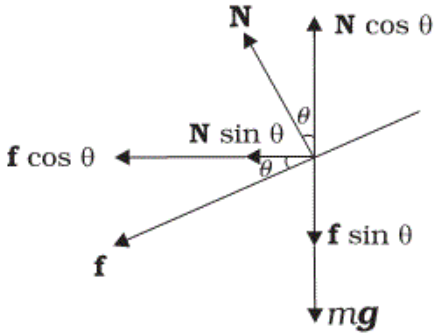
Higher Secondary Education
Half Yearly Examination 2017-18
PHYSICS

HSE I **Maximum Score 60**

Qn No.	Sub. Qn.	Scoring Indicators	Score	Total
Answer all questions from Qn No 1 to 4				
1		(i) Mechanics		1
2		240 metre		1
3		True		1
4		Mass of the body		1
Answer any five questions from Qn No 5 to 10				
5		Astronomical unit — Average distance of Sun from Earth Light year — Distance travelled by light in one year fermi — 10^{-15} m Angstrom — 10^{-10} m	½ x4	2
6		Forming the equation $E = km^x g^y h^z$ Remaining derivation leading to $E = mgh$	1 1	2
7		 Derivation of $a = \frac{v^2}{r}$	1 1	2
8	(a) (b)	Figure 2 Law of conservation of angular momentum	1 1	2
9	(a) (b)	Y= $\frac{150\times10^6}{0.002} = 7.5 \times 10^{10} Nm^{-2}$ $300 \times 10^6 Nm^{-2}$	1 1	2
10	(a)	Definition of bulk modulus	1	2

	(b)	Air, water, steel	1	
Answer any five questions from Qn No 11 to 16				
11	(a) (b)	Zero   	1 (1x2)	3
12	(a) (b)	 Derivation of R =$\sqrt{A^2 + B^2 + 2AB\cos\theta}$	1 2	3
13	(a) (b)	Definition of concurrent forces. Magnitude of resultant of F_1 and F_2 = $\sqrt{3^2 + 4^2}$ = $\sqrt{25}$ = 5 N Magnitude of F_3 = 5N	1 1 1	3
14	(a) (b)	W= F.d= 15+16+15 = 46 J $\left\vert\vec{F}\right\vert$= $\sqrt{3^2 + 4^2 + 5^2}$ = $\sqrt{50}$ N $\left\vert\vec{d}\right\vert$= $\sqrt{5^2 + 4^2 + 3^2}$ = $\sqrt{50}$ m $\cos\theta = \frac{\vec{F}.\vec{d}}{Fd} = \frac{46}{\sqrt{50}\times\sqrt{50}} = 0.92$ $\theta = 23.07^0$	1 1 1	3
15	(a) (b)	$mgh = {}^1/_2\, mv^2 + {}^1/_2\, I\omega^2$ $v = \sqrt{\frac{2gh}{1+\frac{K^2}{R^2}}}$ for a ring $K^2 = R^2$ Velocity of ring= $\sqrt{gh}$ For a solid cylinder $K^2 = \frac{R^2}{2}$ Velocity of solid cylinder $\sqrt{\frac{4gh}{3}}$ Solid cylinder	½ ½ ½ ½ 1	3

16	(a) (b)	Thin needle For a given force, pressure is inversely proportional to area of cross section $1.013 \times 10^5 Pa$	1 1 1	3
Answer any four questions from Qn No 17 to 21				
17	(a) (b)	Statement of principle of homogeneity of dimmensions Forming the equation $T = km^x l^y g^z$ Remaining derivation leading to $T = 2\pi\sqrt{\frac{l}{g}}$	1 1 2	4
18	(a) (b)	True  Derivation of $x = ut + \frac{1}{2}at^2$	1 1 2	4
19	(a) (b) (c)	Statement of Newton's second law of motion Derivation of $F = ma$ $F = \frac{dp}{dt} = m\frac{dv}{dt}$ If $F = 0$, v = a constant	1 2 1	4
20	(a) (b)	Law of conservation of momentum $m_1 v_{1i} = m_1 v_{1f} \cos\theta_1 + m_2 v_{2f} \cos\theta_2$ X – direction $0 = m_1 v_{1f} \sin\theta_1 - m_2 v_{2f} \sin\theta_2$ Y – direction Law of conservation of kinetic energy $\frac{1}{2}m_1 {v_{1i}}^2 = \frac{1}{2}m_1 {v_{1f}}^2 + \frac{1}{2}m_2 {v_{2f}}^2$ Any concept leading to change in momentum in the first case is more than that in the second case.	1 1 1 1	4

21	(a) (b)	Derivation of $g_{(h)} = g\left(1 - \frac{2h}{R}\right)$ $g = g_{(h)}\left(1 - \frac{2h}{R}\right)$ $h = R$	2 1 1	4
Answer any three questions from Qn No 22 to 25				
22	(a) (b) (c)	Figure showing the parabolic path Derivation of H = $\frac{v_0^2 sin^2\theta}{2g}$ T= $\frac{2v_0 sin\theta}{g}$ T= 2.86 s	1 2 1 1	5
23	(a) (b) (c)	 $v_{max} = \sqrt{Rg(\frac{\mu_s + tan\theta}{1 - \mu_s tan\theta})}$ $v = \sqrt{Rgtan\theta}$ v = 28.1 m/s	2 1 1 1	5
24	(a) (b) (c)	Statement of parallel axis theorem Derivation of $KE = \frac{1}{2}I\omega^2$ Using perpendicular axis theorem $I_{dia} = \frac{MR^2}{4}$ Using parallel axis theorem $I_{tang} = \frac{5}{4}MR^2$	1 2 1 1	5
25	(a) (b)	Gravitational force between planet and satellite. Derivation of $KE = \frac{GMm}{2(R+h)}$ $PE = -\frac{GMm}{(R+h)}$	1 1 1	5

		$E = -\frac{GMm}{2(R+h)}$	1	
	(c)	Planet – Satellite is a bound system	1	