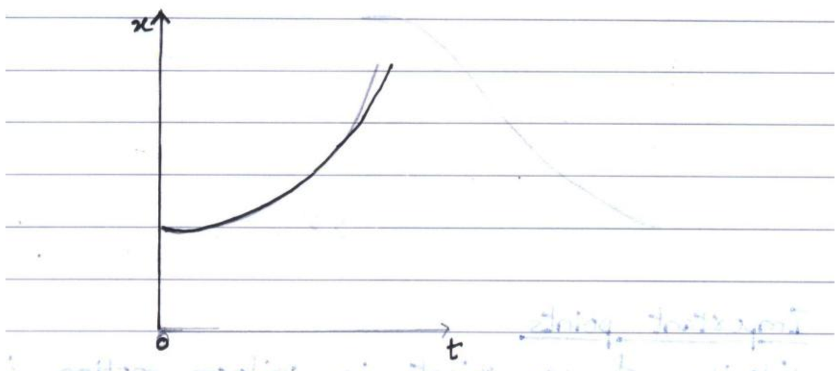
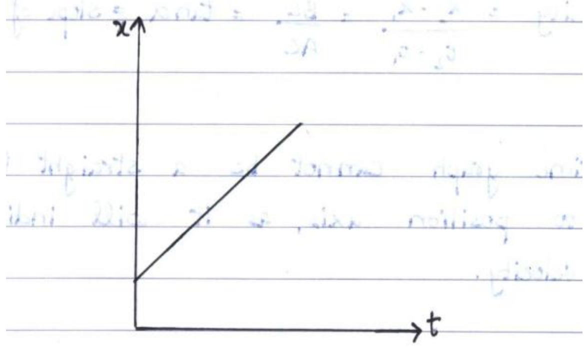
UNIT TEST I(MS)
SUBJECT- PHYSICS
CLASS -XI

Ans.1	a =[MLT^{-2}] b = [$ML^{0}T^{-2}$]	½ ½
Ans.2	$\frac{v_A}{v_B} = \frac{\tan 30^0}{\tan 60^0} = \frac{\frac{1}{\sqrt{3}}}{\sqrt{3}}$ $\frac{v_A}{v_B} = \frac{1}{3}$	½ ½
Ans.3	1. It is a **coherent** system of units, i.e. it is based on a certain set of fundamental units from which the derived units are obtained by multiplication or division without introducing numerical factors. 2. It is a **rational** system of units(i.e. one quantity one unit) 3. It is an **absolute** system of units(no gravitational units of system) 4. It is a **metric** system (i.e. multiples of units are expressed as power of 10. (Any 2)	1 1
Ans.4	$v = \frac{dx}{dt}$ $v = \frac{d}{dt}\left(3t^2 + 7t - 9\right)$ $= \frac{d}{dt}\left(3t^2\right) + \frac{d}{dt}\left(7t\right) - \frac{d}{dt}(9)$ $= 6t + 7 + 0$ $v = 6t + 7$ $a = \frac{dv}{dt}$ $= \frac{d}{dt}\left(6t + 7\right)$ $= \frac{d}{dt}\left(6t\right) + \frac{d}{dt}(7)$ $= 6ms^{-2}$ OR $\vec{A} = \hat{i} + 5\hat{j} + n\hat{k}$ $\vec{B} = 2\hat{i} - \hat{j} + \hat{k}$ $\vec{A}\cdot\vec{B} = (\hat{i} + 5\hat{j} + n\hat{k})\cdot(2\hat{i} - \hat{j} + \hat{k})$ $= 2 - 5 + n$ ATQ $\vec{A}\cdot\vec{B} = 0$ [$\because \vec{A}$ & $\vec{B}$ are $\perp^r$] $n - 3 = 0$ $n = 3$	 1 1 1 1

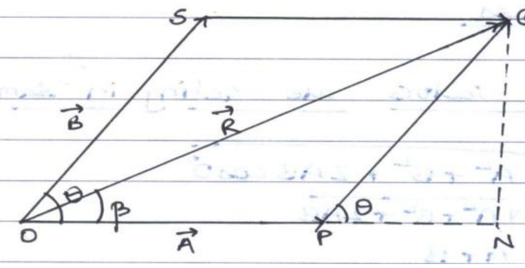
Ans.5	$X = \frac{a^2 b}{\sqrt{c}}$ $\frac{\Delta X}{X} \times 100\% = \pm\left(2\frac{\Delta a}{a} \times 100\% + \frac{\Delta b}{b} \times 100\% + \frac{1}{2}\frac{\Delta c}{c} \times 100\%\right)$ $= \pm\left(2 \times 2\% + 1 \times 3\% + \frac{1}{2} \times 4\%\right)$ $= \pm 9\%$	1 1
Ans.6	$D_n = u + \frac{a}{2}(2n-1)$ $D_3 = u + \frac{a}{2}(2 \times 3 - 1)$ $4 = u + \frac{5}{2}a$ —— (1) $D_5 = u + \frac{a}{2}(2 \times 5 - 1)$ $12 = u + \frac{9}{2}a$ —— (2) (2) − (1) $8 = 2a$ $a = 4 ms^{-2}$ from (1) $u = 4 - \frac{5}{2} \times 4 = -6 ms^{-1}$ Now, $S_5 = -6 \times 5 + \frac{1}{2} \times 4 \times 25$ $= -30 + 50$ $= 20 m$ $S_8 = -6 \times 8 + \frac{1}{2} \times 4 \times 64$ $= -48 + 128$ $= 80$ Now, $S = S_8 - S_5$ $= 80 - 20$ $\boxed{S = 60 m}$	½ ½ ½ ½ ½ ½
Ans.7	(a) Relative velocity in one dimension The relative velocity of an object w.r.t another is the velocity with which one object moves w.r.t another object.	½

	(b) When both the objects are moving in the same direction $v_{AB} = v_A - v_B$ [$\because v_{AB}$ - velocity of A w.r.t B] opposite direction $v_{AB} = v_A + v_B$	½ ½
	(c) $v_A + v_B = \frac{200}{10} = 20$ —① $v_A - v_B = \frac{200}{20} = 10$ —② ① + ② → $2v_A = 30$ $v_A = 15\ ms^{-1}$ from ① $15 + v_B = 20$ $v_B = 5\ ms^{-1}$	½ ½ ½
Ans.8	$v \ \alpha (mg)^a r^b \eta^c$ $v = km^a g^a r^b \eta^c$ $[LT^{-1}] = [M]^a [LT^{-2}]^a [L]^b [ML^{-1}T^{-1}]^c$ $[LT^{-1}] = [M]^{a+c} [L]^{a+b-c} [T]^{-2a-c}$ $a + c = 0$ $a + b - c = 1$ $-2a - c = -1$ $On\, solving$ $a = 1, c = -1, b = -1$ $v = km^1 g^1 r^{-1} \eta^{-1}$ $v = k\frac{mg}{r^1 \eta^1}$	½ ½ 1½ ½

Ans.9	(i) (a) Object moving with uniform positive acceleration  (b) Object moving with zero acceleration  (ii) Consider an object moving in a straight line with uniform acceleration 'a'. $a = \frac{dv}{dt}$ $dv = a\,dt$ when $t = 0$, $v = u$ $= t$, $v = v$ Integrating both sides $\int_u^v dv = \int_0^t a.dt$ $\int_u^v dv = a\int_0^t dt$ $[v]_u^v = a[t]_0^t$ $v - u = a(t-0)$ $\boxed{v = u + at}$	½ ½ 2
Ans.10	Statement + diagram 1 Derivation (R and tan β) 2 Case (i) and (ii) 1 + 1	

② Parallelogram law of vector addition

Consider 2 vectors $\vec{A}$ & $\vec{B}$, inclined at an angle θ be acting on a particle at the same time and are represented in magnitude & direction by two adjacent sides $\vec{OP}$ & $\vec{OS}$ of parallelogram OPQS drawn from point O.



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Produce ~~OQ~~ OP & draw QN ⊥ OP

In rt. ΔONQ

$$OQ^2 = ON^2 + QN^2$$

$$R^2 = (A + PN)^2 + QN^2$$

In rt. ΔPNQ

$$\cos\theta = \frac{PN}{PQ}, \quad PN = B\cos\theta$$

$$\sin\theta = \frac{QN}{PQ}, \quad QN = B\sin\theta$$

∴ eqn ① becomes

$$R^2 = (A + B\cos\theta)^2 + B^2\sin^2\theta$$

$$= A^2 + B^2\cos^2\theta + 2AB\cos\theta + B^2\sin^2\theta$$

$$\boxed{R = \sqrt{A^2 + B^2 + 2AB\cos\theta}}$$

Let the resultant $\vec{R}$ makes an angle β with the direction of $\vec{A}$. 2

$$\boxed{\tan\beta = \frac{QN}{ON} = \frac{B\sin\theta}{A + B\cos\theta}}$$

	(i) When the vectors are acting in same direction $(\theta = 0^\circ)$ $R = \sqrt{A^2+B^2+2AB\cos 0^\circ}$ $= \sqrt{A^2+B^2+2AB}$ $R = A+B$ $\tan\beta = \frac{B\sin 0^\circ}{A+B\cos 0^\circ} = 0^\circ$	1
	(ii) Vectors $\perp^r$ to each other $R=\sqrt{A^2+B^2}$, $\tan\beta = \frac{B}{A} \Rightarrow \beta = \tan^{-1}\left(\frac{B}{A}\right)$	1

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