Sri Chaitanya IIT Academy, India

A.P, TELANGANA, KARNATAKA, TAMILNADU, MAHARASHTRA, DELHI, RANCHI

A right Choice for the Real Aspirant

ICON CENTRAL OFFICE, MADHAPUR-HYD

Sec: Sr. IPLCO **Date: 01-08-15**

Time: 9:00 AM to 12:00 Noon **RPTM-1** **Max.Marks: 360**

KEY SHEET

PHYSICS		CHEMISTRY		MATHS	
Q.NO	ANSWER	Q.NO	ANSWER	Q.NO	ANSWER
1	1	31	3	61	3
2	2	32	4	62	2
3	3	33	1	63	4
4	1	34	2	64	2
5	2	35	3	65	4
6	1	36	4	66	2
7	4	37	3	67	3
8	1	38	3	68	4
9	2	39	3	69	3
10	3	40	4	70	3
11	4	41	3	71	2
12	2	42	2	72	3
13	4	43	3	73	3
14	2	44	3	74	1
15	3	45	2	75	2
16	1	46	4	76	2
17	2	47	1	77	3
18	2	48	1	78	3
19	2	49	2	79	3
20	3	50	4	80	2
21	2	51	3	81	2
22	3	52	1	82	4
23	4	53	2	83	4
24	1	54	4	84	1
25	3	55	1	85	3
26	3	56	3	86	3
27	4	57	4	87	3
28	4	58	4	88	3
29	1	59	3	89	3
30	3	60	4	90	2

Physics

1. (1) $V = l \times b \times h$, The answer should have 3 significant digits.

2. (2) $\frac{\Delta V}{V} \times 100 = \left\{ \frac{2\Delta r}{r} + \frac{\Delta l}{l} \right\} \times 100$

3. (3) 1 MSD = 0.1 cm
   LC = 0.02 cm
   LC = 1 MSD – 1VSD
   1 VSD = 1 – 0.02 =0.08
   1 VSD = m/n

4. (1) $V = a^3$
   The answer should have only 2 significant digits.

5. (2)
   $1\,VSD = \left(\frac{n}{n+1}\right)a$
   $1MSD = a$
   $LC = 1MSD - 1VSD$
   $= a\left(\frac{1}{n+1}\right)$

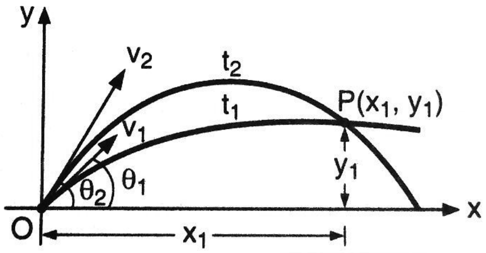
6. (1) $LC = 1 - \frac{N}{N+m} = \frac{m}{N+m}$

7. (4) $\frac{\Delta g}{g} = \frac{\Delta l}{l} + \frac{2\Delta T}{T}$

8. (1) $LC = \frac{p}{N} = \frac{1mm}{100} = 0.01mm$
   The instrument has a positive zero error,
   $e = +n(LC) = +(6 \times 0.01) = +0.06\,mm$
   Linear scale reading = $2 \times (1mm) = 2\,mm$
   Circular scale reading = $62 \times (0.01mm) = 0.62\,mm$
   $\therefore$Measured reading = $2 + 0.62 = 2.62mm$ or
   True reading = $2.62 - 0.06 = 2.56mm$.

9. (2) The instrument has a negative error,
   $e = (-5 \times 0.01)cm$
   or $e = -0.05cm$
   Measured reading = $(2.4 + 6 \times 0.01) = 2.46cm$
   True reading = Measured reading – e
   $= 2.46 - (-0.05)$
   $= 2.51cm$
   Therefore, diameter of the sphere is 2.51 cm.

10. (3) Let the jets meet at $P(x_1, y_1)$. Then these coordinates must satisfy the trajectory equations of both jets at the point o intersection.. Substituting x_1, y_1 in the corresponding trajectory equations,

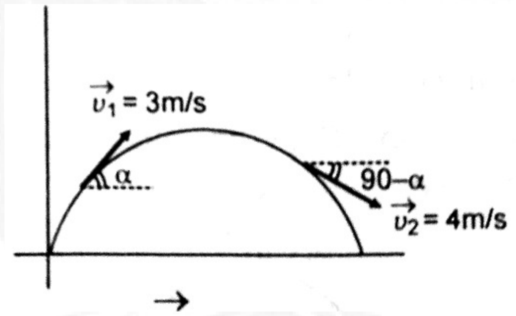


We have, $y_1 = x_1 \tan\theta_1 - \dfrac{gx_1^2}{2v\cos^2\theta_1}$ ....(1)

And $y_1 = x_1 \tan\theta_2 - \dfrac{gx_1^2}{2v\cos^2\theta_2}$ ....(2)

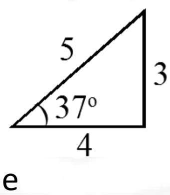
Solving equations (1) and (2), we have, $x_1 = \dfrac{2v^2\cos\theta_1\cos\theta_2\sin(\theta_1-\theta_2)}{g(\cos^2\theta_2-\cos^2\theta_1)} = \dfrac{\sqrt{3}v^2}{10g}$

11. (4) Given that $\vec{v}_1 \perp \vec{v}_2$



Therefore, if $\vec{v}_1$ makes an angle to α with horizontal then $\vec{v}_2$ will make an angle $90^o - \alpha$ with horizontal. Now horizontal component of velocity remains unchanged.
Therefore,

$v_1\cos\alpha = v_2\sin\alpha$ or $\tan\alpha = \dfrac{v_1}{v_2} = \dfrac{3}{4}$ or $\alpha = 37^o$



Now minimum kinetic energy will be

$$K_{\min} = \frac{1}{2}m(v_1\cos\alpha)^2$$

$$= \frac{1}{2}(2)\left\{(3)\left(\frac{4}{5}\right)\right\}^2 = 5.76\,J$$

12. (2) For the projectile to pass through (30 m, 40 m):

$$40 = 30\tan\alpha - \frac{g(30)^2}{2u^2}(1+\tan^2\alpha)$$

Or $900\tan^2\alpha - (6u^2\tan\alpha) + (900 + 8u^2) = 0$

For real value of α.

$$(6u^2)^2 \geq 3600(900+8u^2)$$

or $(u^2-800u^2) \geq 900,00$

or $(u^2-400)^2 \geq (25,0000)$

or $u^2-400 \geq 500$

or $u^2 \geq 900$ or $u \geq 30\ m/s$

$\tan\alpha = 3$

and $R = \dfrac{u^2 \sin 2\theta}{g}$

13. (4)

Co-ordinates of point *P* are $(R,-h)$. These co-ordinates should satisfy the equation of projectile i.e.

$$-h = R\tan\theta - \frac{gR^2}{2(2ag)}(1+\tan^2\theta)$$

or $R^2\tan^2\theta - 4aR\tan\theta + (R^2-4ah) = 0$

for θ to be real $(4aR)^2 \geq 4R^2(R^2-4ah)$

or $4a^2 \geq (R^2-4ah)$

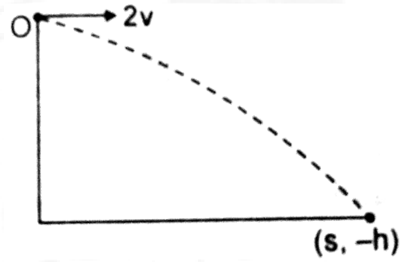
or $R^2 \leq 4a(a+h)$

or $R^2 \leq 2\sqrt{a(a+h)}$

$\therefore$ The maximum range is $R_{\max} = 2\sqrt{a(a+h)}$

14. (2) Assuming particle 2 to be at rest,

Substituting in $y = x\tan\theta - \dfrac{gx^2}{2u^2\cos^2\theta}$ $(\theta = 0^o)$



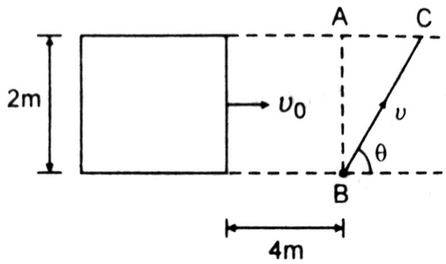
We have $-h = \dfrac{-gs^2}{2(4v^2)}$

or $v = \sqrt{\dfrac{g}{8h}}s$

Which is a straight line passing through origin with slope $\sqrt{\dfrac{g}{8h}}$.

15. (3)

Let the man starts crossing the road at an angle θ as shown in figure. For safe crossing the conditions is that the man must cross the road by the time the truck describes the distance $4+AC\ or\ 4+2\cot\theta$

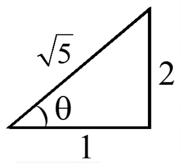


$\therefore \dfrac{4+2\cot\theta}{8} = \dfrac{2/\sin\theta}{v}$

or $\quad v = \dfrac{8}{2\sin\theta + \cos\theta}$ ....(1)

For minimum $v, \dfrac{dv}{d\theta} = 0$

or $\dfrac{-8(2\cos\theta - \sin\theta)}{(2\sin\theta + \cos\theta)^2} = 0$

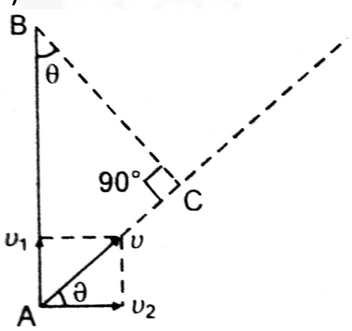


or $2\cos\theta - \sin\theta = 0$

or $\tan\theta = 2$

From equation (1) $v_{\min} = \dfrac{8}{2\left(\dfrac{2}{\sqrt{5}}\right) + \dfrac{1}{\sqrt{5}}} = \dfrac{8}{\sqrt{5}} = 3.57\, m/s$

16. (1)



$AB = a$

$v^2 = v_1^2 + v_2^2$

$\tan\theta = \dfrac{v_1}{v_2}$

$\cos\theta = \dfrac{v_2}{\sqrt{v_1^2 + v_2^2}} = \dfrac{v_2}{v}$

$and \quad \sin\theta = \dfrac{v_1}{\sqrt{v_1^2 + v_2^2}} = \dfrac{v_1}{v}$

Minimum distance between A and B is :

$time = \frac{AC}{v} = \frac{AB\sin\theta}{v} = \frac{av_1}{v^2}$

17. (2)

From the graph, velocity-displacement equation can be written as:

$v = v_0 + \alpha x$ ....(1)

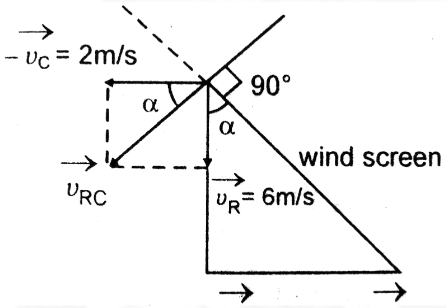
Here v_0 and α are positive constants.

Differentiating (1) with respect to *x* we get $\frac{dv}{dx} = \alpha$=constant

Acceleration of the particle can be written as $a = v.\frac{dv}{dx} = (v_0 + \alpha x)\alpha$

$a - x$ equation is a linear equation. Thus, acceleration increases linearly with *x*.

18. (2) Velocity of rain with respect to car $\vec{v}_{RC} - \vec{v}_R - \vec{v}_C$ should be perpendicular to the wind screen.



i.e. components of $\vec{v}_R$ and $-\vec{v}_C$ parallel to wind screen should cancel each other.

or $6\cos\alpha = 2\sin\alpha$

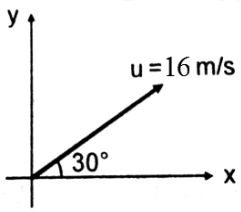
or $\tan\alpha = 3$

or $\alpha = \tan^{-1}(3)$

19. (2) Components of velocity of ball relative to ground are :

$u_x = 16\cos 30^o$

$= 8\sqrt{3}\, m/s$



And $u_y = 16\sin 30^o$

$= 8\, m/s$

u_y relative to lift = 8 – 4 = 4 m/s

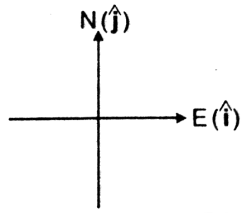
and acceleration of ball relative to lift is $12 m/s^2$ in negative *y*-direction or vertically downwards. Hence time of flight $T = \frac{2u_y}{12} = \frac{u_y}{6} = \frac{4}{6} = \frac{2}{3}s$

20. (3)

$\vec{V}_w = \frac{v}{\sqrt{2}}\hat{i} + \frac{v}{\sqrt{2}}\hat{j}$

$\vec{V}_m = (at)\hat{j}$

$\vec{V}_{wm} = \frac{v}{\sqrt{2}}\hat{i} + \left(\frac{v}{\sqrt{2}} - at\right)\hat{j}$

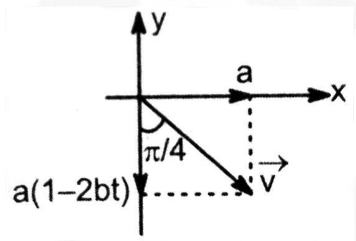


It appears due east when, $\frac{v}{\sqrt{2}} - at = 0 \quad t = \frac{v}{\sqrt{2a}}$

21. (2) $\vec{v} = \left(\frac{dx}{dt}\right)\hat{i} + \left(\frac{dy}{dt}\right)\hat{j} = a\hat{i} + a(1-2bt)\hat{j}$

$\vec{A} = 0\hat{i} + (-2ab)\hat{j}$

Hence acceleration $\vec{A}$ is along negative y-axis. Hence when $\vec{A}$ and $\vec{v}$ enclose $\pi/4$ between them the velocity vector makes angle $\pi/4$ with negative y-axis. Hence



$\tan\frac{\pi}{4} = \frac{a}{|a(1-2bt)|} \Rightarrow |1-2bt| = 1$

$\Rightarrow 1-2bt = \pm 1 \Rightarrow t = \frac{1}{b}$ or 0

22. (3) Let at any time *t* the displacement of first particle be S_1 and that of second particle be S_2.

$S_1 = \frac{1}{2}at^2$ and $S_2 = u\left(t - \frac{1}{a}\right)$

For required conditions $S_2 > S_1$

$\Rightarrow u\left(t-\frac{1}{a}\right) > \frac{1}{2}at^2 \Rightarrow t^2 - \frac{2u}{a}t + \frac{2u}{a^2} < 0$

$\Rightarrow \frac{1}{a}\left(u - \sqrt{u^2-2u}\right) < t < \frac{1}{a}\left(u + \sqrt{u^2-2u}\right)$

Hence the duration for which particle 2 remains ahead of particle 1.

$\Rightarrow \frac{1}{a}\left[\left(u+\sqrt{u^2-2u}\right) - \left(u - \sqrt{u^2-2u}\right)\right]$

$= \frac{2}{a}\sqrt{u(u-2)}$

23. (4) $\vec{\upsilon} = \upsilon_x\hat{i} + \upsilon_y\hat{j} \Rightarrow |\vec{\upsilon}| = \sqrt{\upsilon_x^2 + \upsilon_y^2}$

$$\Rightarrow \frac{d|\vec{\upsilon}|}{dt} = \frac{\left(2\upsilon_x \frac{d\upsilon_x}{dt} + 2\upsilon_y \frac{d\upsilon_y}{dt}\right)}{2\sqrt{\upsilon_x^2 + \upsilon_y^2}}$$

$$\Rightarrow \frac{d|\vec{\upsilon}|}{dt} = \frac{\upsilon_x a_x + \upsilon_y a_y}{\sqrt{\upsilon_x^2 + \upsilon_y^2}}$$

$$= \frac{3\times 2 + 4\times 1}{\sqrt{3^2+4^2}} = 2m/s^2$$

24. (1)

$$\vec{v} = (ay)\hat{i} + (V_0)\hat{j}$$

$$\Rightarrow V_x = ay \quad and \quad V_y = V_0$$

$$\Rightarrow \frac{dx}{dt} = ay \quad and \quad \frac{dy}{dt} = V_0$$

$$\Rightarrow \frac{dy}{dx} = \frac{V_0}{ay} \Rightarrow \int ay\,dy = \int V_0\,dx$$

$$\Rightarrow \frac{1}{2}ay^2 = V_0 x + c$$

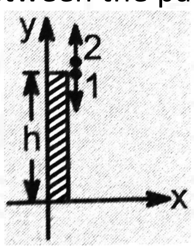
$$\Rightarrow \frac{1}{2}ay^2 = V_0 x, \quad (\because (0,\ 0)\ satisfies)$$

$$\Rightarrow y = \pm\sqrt{\frac{2V_0}{\underbrace{a}_{negative}}x}$$

$$\Rightarrow y = \sqrt{\frac{2V_0 x}{a}}, \qquad (\because V_y = V_0 > 0)$$

Also for y to be real x must be negative.

25. (3) At any time t the distance d between the particle is :



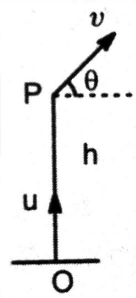
$$d = \left|\left(h - \frac{1}{2}gt^2\right) - \left(h + ut - \frac{1}{2}gt^2\right)\right|$$

$$= |(-u)t| = ut$$

26. (3) Let u be the initial speed of the particle

$$\upsilon^2 = u^2 - 2gh$$
$$u^2 = v^2 + 2gh$$
$$u_x^2 + u_y^2 = \upsilon_x^2 + \upsilon_y^2 + 2gh(\upsilon_x = u_x)$$
$$u_y^2 = \upsilon_y^2 + 2gh$$
$$u_y^2 = 2^2 + 2(10)(0.4) = 12$$
$$u_y = \sqrt{12}\, m/s$$
$$u_y = \upsilon_x = 6m/s$$
$$\tan\theta = \frac{u_y}{u_x} = \frac{\sqrt{12}}{6} = \frac{1}{\sqrt{3}}$$
$$so, \theta = 30^o$$

27. (4) Relative acceleration between the particles is zero. The distance between them at time *t* is:



$$s = \sqrt{\left\{h - (\upsilon - \upsilon\sin\theta)t\right\}^2 + (\upsilon\cos\theta t)^2}$$
$$or \quad s = \{h - (\upsilon - \upsilon\sin\theta)t\}^2 + (\upsilon\cos\theta t)^2$$
's' is minimum when $\frac{ds^2}{dt} = 0$
$$2\{h - (\upsilon - \upsilon\sin\theta)t\}(\upsilon\sin\theta - v) + 2\upsilon^2\cos^2\theta t = 0$$
$$t = \frac{h}{2\upsilon}$$

28. (4) Since the graph is like a parabola
$\therefore let \;\; x(t) = At + Bt^2 + C$
From graph $x(0) = 0 \Rightarrow C = 0$
$$x(t) = Bt^2 + At$$
$$x(4) = 0 \Rightarrow 16B + 4A = 0 \quad ....(1)$$
$$\left(\frac{dx}{dt}\right)_0 = 1 \Rightarrow (A + 2Bt)_{t=0} = 1$$
Put in (1), we get $B = \frac{1}{4}$
$$\therefore \quad x = t - \frac{t^2}{4}$$
max. *x* coordinate = 1 (from max. and min.)

$\rightarrow$ Since motion is a straight line motion

$\rightarrow$ total distance travelled = $2 \times 1 = 2m$

Average speed = $\frac{2}{4} = 0.5\ m/\sec$

29. (1) $\frac{22.4 \times 10^{-3}}{N_A \times \frac{4}{3}\pi r^3}$

30. (3)

Sun's angular diameter $\alpha = 1920''$

$$= 1920 \times 4.85 \times 10^{-6}\ rad$$

$$= 9.31 \times 10^{-3}\ rad$$

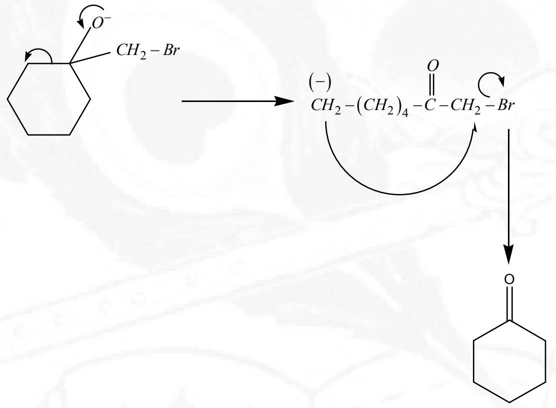
Sun's diameter

$$d = \alpha D$$

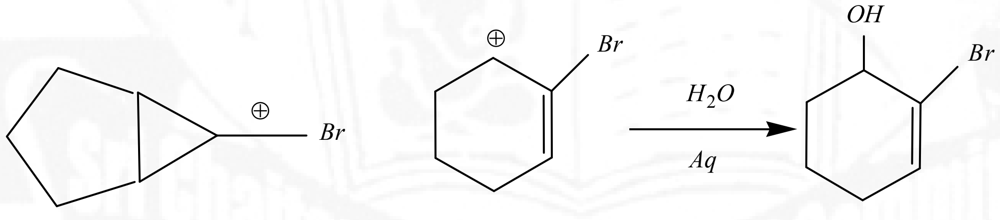
$$= \left(9.31 \times 10^{-3}\right) \times \left(1.496 \times 10^{11}\right) m$$

$$= 1.39 \times 10^{9}\ m$$

CHEMISTRY-SOLUTIONS

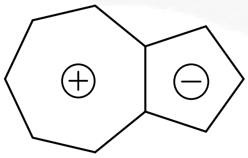


31.



32.

42. Azulene is polar



43. Based on hyper conjugation

47 Hybridisation of nitrogen changes from $sp^2 \rightarrow sp^3$ pyrrole