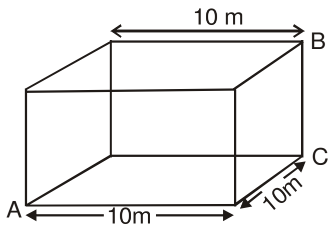
KINEMATICS

EXERCISE – I

SINGLE CORRECT

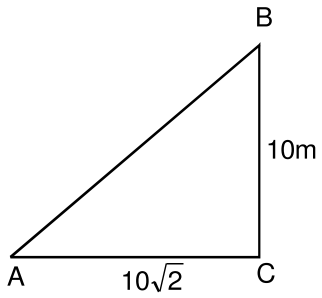
1. **B**



Fly start from A and reaches at B.

$\therefore \quad (AB)^2 = (AC)^2 + (BC)^2$

$AC = \sqrt{10^2 + 10^2} = 10\sqrt{2}$

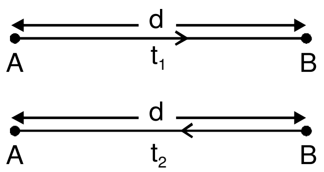


$\therefore \quad AB = \sqrt{(10\sqrt{2})^2 + 10^2} = 10\sqrt{3}m$

2. **B**

From A to B $t_1 = \frac{d}{20}$ hr

From B to A $t_2 = \frac{d}{30}$ hr

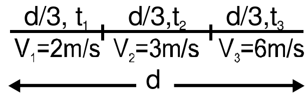


$\therefore \quad \text{Average Speed} = \frac{\text{Total Distance}}{\text{Total Time}}$

$= \frac{2d}{t_1 + t_2} = \frac{2d}{\frac{d}{20} + \frac{d}{30}}$

$v = 24$ km/hr

3. **A**



Now $t_1 = \frac{d/3}{v_1} = \frac{d}{6}$

$t_2 = \frac{d/3}{3} = \frac{d}{9}$

$t_3 = \frac{d/3}{6} = \frac{d}{18}$

$\text{Average Velocity} = \frac{d}{\frac{d}{6} + \frac{d}{9} + \frac{d}{18}} = \frac{18}{6} = 3 \text{ m/s}$

4. **B**

$t = 62.8$ sec

in each lap car travel a distance = $= 2\pi R$

$= 2 \times 3.14 \times 100 = 628$ m

In each lap displacement of the car = 0

Average speed

$= \frac{\text{Total Distance}}{\text{Total Time}} = \frac{628}{62.8} = 10 \text{ m/s}$

$\text{Average Velocity } \frac{\text{Total Displacement}}{\text{Total Time}} = 0$

5. **A**

$2s = gt^2$

$s = \frac{1}{2}gt^2$

$v = \frac{ds}{dt} = gt$

6. **D**

7. **C**

let the accelration of the body is a and $u = 0$

then $x_1 = \frac{1}{2}at^2 = \frac{1}{2}a(10)^2$

$x_2 = \frac{1}{2}a(20)^2 - x_1$

$= \frac{1}{2}a\,(20)^2 - \frac{1}{2}a\,(10)^2$

$= \frac{1}{2}a(10)(30)$

$x_3 = \frac{1}{2}a(30)^2 - \frac{1}{2}a\,(20)^2$

$= \frac{1}{2}a(10)(50)$

$\therefore\ x_1 : x_2 : x_3 = 1:3:5$

8. **B**

Stone is dropped
so time taken by stone to reach the bottom of the wall t_1

$\therefore\ h = \frac{1}{2}g{t_1}^2$

$= t_1 = \sqrt{\frac{2h}{g}}\ -(i)$

time taken by sound to comes from bottom to upper end $t_2 = \frac{h}{v}$ ...(ii)

$\therefore$ Total time $= t_1 + t_2 = \sqrt{\frac{2h}{g}} + \frac{h}{v}$

9. **B**

$x = 5\sin 10t$

$v_x = \frac{dx}{dt} = 50\cos 10t$

Similarly $y = 5\cos 10t$

$v_y = \frac{dy}{dt} = -50\sin 10t$

$V^2{}_{net} = {V_x}^2 + {v_y}^2$

$v_{net} = \sqrt{(50)^2(\sin^2 10t + \cos^2 10t)}$ = 50 m/sec

10. **D**

$v = \ell nx$ m/s (Given)

$a = v\frac{dv}{dx}$

$\Rightarrow a = \ell n\ x\ \frac{d}{dx}(\ell nx)$

$a = \frac{\ell nx}{x}$

$F_{net} = 0$

$\Rightarrow a = 0$

$\frac{\ell nx}{x} = 0$

x = 1 m

11. **C**

$\vec{F} = 2\sin 3\pi t\hat{i} + 3\cos 3\pi t\hat{j}$

$a = \frac{dv}{dt} = 2\sin 3\pi t\hat{i} + 3\cos 3\pi t\hat{j}$

$\int_0^v dv = 2\int_0^t \sin 3\pi t\ dt\,\hat{i} + 3\int_o^t \cos 3\pi t.dt\hat{j}$

$v = -\frac{2}{3\pi}[\cos 3\pi t]_o^t\hat{i} + \frac{3}{3\pi}[\sin 3\pi t]_o^t\hat{j}$

$\int_o^r dx = \int_o^t\left[\frac{-2}{3\pi}[\cos 3\pi t - 1]\hat{i} + \frac{1}{\pi}\sin 3\pi t\hat{j}\right].dt$

$\vec{r} = -\frac{2}{3\pi}\left[\int_0^t \cos 3\pi t - \int_0^t dt\right]\hat{i} + \frac{1}{\pi}\int_0^t \sin 3\pi t\,\hat{j}dt$

$= -\frac{2}{(3\pi)^2}[\sin 3\pi t]_o^t\,\hat{i} + \frac{2}{3\pi}t\hat{i} - \frac{1}{3\pi^2}[\cos 3\pi t]_o^t\,\hat{j}$

For t = 1 sec

$\vec{r} = \frac{2}{3\pi}\hat{i} + \frac{2}{3\pi^2}\hat{j}$

12. **B**

$F = Be^{-ct}$

$a = \frac{B}{m}e^{-ct}$

$\Rightarrow \int_0^v dv = \int_o^t \frac{B}{m}e^{-ct}dt$

$v = -\frac{B}{mc}\left[a^{-ct} - 1\right]_0^t$

At $t = \infty$ $\quad v = \frac{B}{mc}$

13. **B**

$v = t^2 - t$

$\therefore\ a = \frac{dv}{dt} = 2t - 1$

Motion is consider as Retards
when V & a are in opposite Direction

Case - 1

If v > 0 then a < 0
But $t^2 - t > 0$, t > 1
and a > 0 for t > 1
so not Possible

Case - 2

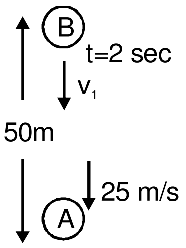
v < 0, a > 0
$t^2 - t < 0$, 2t – 1 . 0

$t \in (0,1)$, $t > \frac{1}{2}$

$\frac{1}{2} < t < 1$

14. A
distance Travelled by
ball in 2 sec = $5\times2+\frac{1}{2}\times10\times2^2$
= 30 m
and v at time 2 sec = $5+10\times2 = 25\,m/s$
Relative Method
w.r.t. A ball

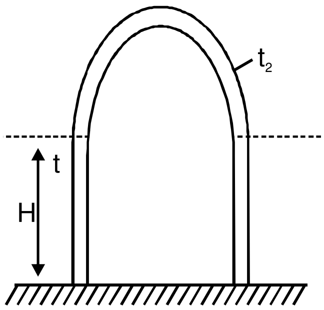
$t = \frac{30}{v_1 - 25} = 2\,sec$



$30 = 2v_1 - 50$

$v_1 = 40\,m/s$

15. D



16 C

$\therefore\ H_{max} = \frac{u^2}{2g} \Rightarrow u = \sqrt{2hg}$

Given $H_{max} = 5$ m

$t = \frac{u}{g} = \sqrt{\frac{2gh}{g}} = \sqrt{\frac{2H}{g}}$

$= \sqrt{\frac{2\times5}{10}} = 1sec$

$\therefore$ in 1 min = 60 Balls.

17. B
Length of groove is L

$t_1 = \sqrt{\frac{L}{g_{eff}}} = \sqrt{\frac{L}{g}}$

$t_2 = \sqrt{\frac{L}{g\sin30°}}$

$\Rightarrow t_1 : t_2 = 1 : \sqrt{2}$

18. C

$V_{inst} = \frac{dx}{dt}$ (slop of x-t graph)

At C tan θ =+ve At E $\theta > 90º(-\text{ve slop})$

At D $\theta = 0º$ At F $\theta < 90º(+\text{ve slope})$

$\therefore$ At E v_{inst} is negative

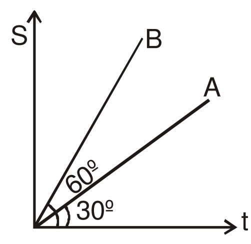
19. C
From graph it is clear that velocity is always positive during its motion
so displacement = distance
displacement = Area under V-t curve

$= \frac{1}{2}\times20\times1 + 20\times1 + \frac{1}{2}\times1\times10$

$+1\times10 + 1\times10$

$= 55$ m

20. D



$\frac{V_A}{V_B} = \frac{\tan 30º}{\tan 60º}$

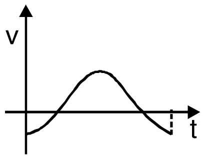
$\therefore \frac{V_A}{V_B} = \frac{1/\sqrt{3}}{\sqrt{3}} = \frac{1}{3}$

21. C

Equation of given sin curre is

$x = -A\sin t$

$V = \frac{dx}{dt} = -A\cos t$



22. D

From graph

$a = -AV + B$

$\int \frac{dv}{B - AV} = \int dt$

$\Rightarrow \frac{-1}{A}\int \frac{dk}{k} = \int dt$ let $(B - AV) = K$

$-\ln(B - AV) = At + c$

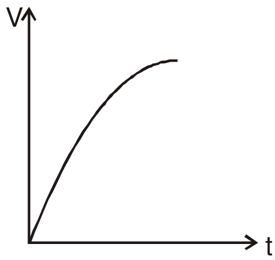
$c = -\ln B$ (When t = 0, V = 0)

$\therefore -\ln(B - AV) = At - \ln B$

$t = \frac{1}{A}\ln\left(\frac{B}{B - AV}\right)$

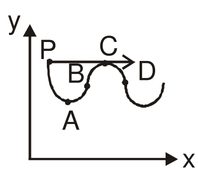
$e^{At} = \frac{B}{B - AV} \Rightarrow B - AV = Be^{-At}$

$\Rightarrow V = \frac{B}{A}\left(1 - e^{-At}\right)$



23. B

Point C



24. B

Area = $0.4\times0.2 + 0.4\times0.2 + 0.4\times0.2$

$+\frac{1}{2}\times0.4\times0.2 + 0.6\times0.2$

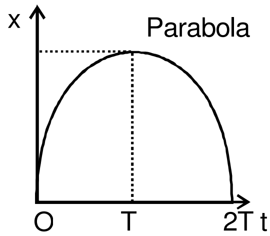
Area = 0.4 $\left[\int a.dx = \int vdv\right]$

Now, $v_f^2 - v_i^2 = 2(\text{Area})$

$v_f^2 = 0.8 + (0.8)^2$

V_f = 1.2 m/s

25. B

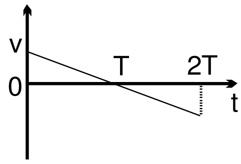


$x = -t(t - 2T)$

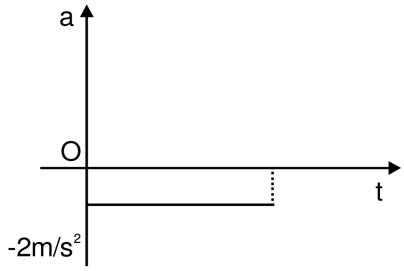
$x = -t^2 + 2Tt$

$\frac{dx}{dt} = -2t + 2T$

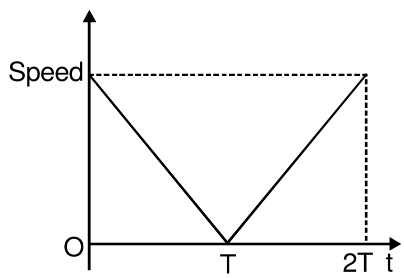
and $\frac{d^2x}{dt^2} = -2$



26. C



27. D



28. B
Particle comes to rest when v=0
on observing graphs $\rightarrow$ V=0 at t=0, 4.66 sec, 8 sec
Incorrect t=5 sec

29. C
Rate of change of velocity is maximum
t = 4 to 6 sec

$$a = \frac{-20-10}{6-4} = \frac{-30}{2} = -15 \text{ m/sec}^2$$

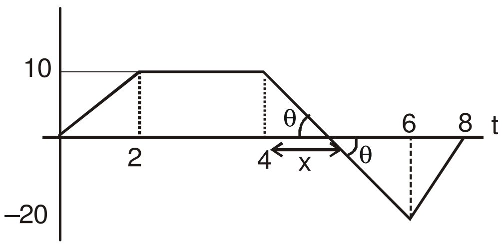
30. A

$a = 5 m/s^2$ (in time 0 to 2 sec)

$$x_f + 15 = \frac{1}{2} \times 5 \times (2)^2$$

$$\therefore \; x_f + 15 = 10 \Rightarrow x_f = -5m$$

31. A



$$\tan\theta = \frac{10}{x}$$

and $\tan\theta = \frac{20}{(2-x)}$

$$\therefore \; \frac{10}{x} = \frac{20}{2-x} \Rightarrow x = \frac{2}{3} \text{sec}$$

Maximum Displacement

$$= \frac{1}{2} \times 2 \times 10 + 2 \times 10 + \frac{1}{2} \times \frac{2}{3} 10$$

$$= 33.3 m$$

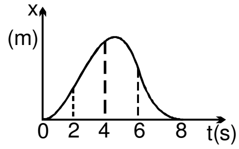
32. A
Total Distance = Upper walla area + Nichewala

$$= 33.3 + \frac{1}{2} \times \left(2 - \frac{2}{3}\right) \times 20 + \frac{1}{2} \times 2 \times 20$$

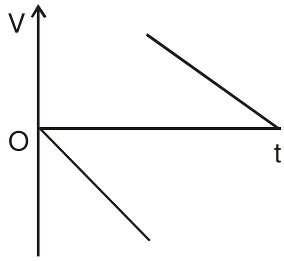
$$= 33.3 + 33.3$$

$$= 66.6 \text{ m}$$

33. C
v - t Displacement is zero



34. A

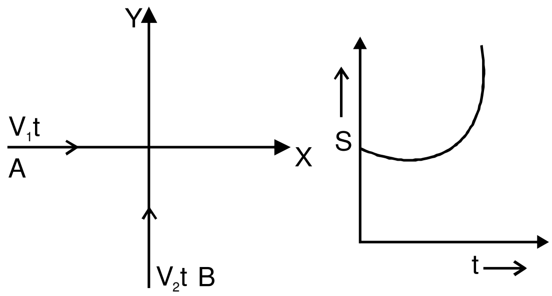


(upward direction is +ve)

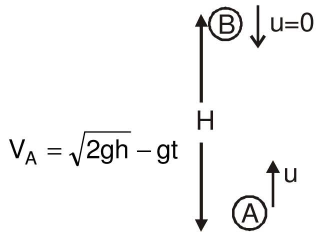
35. D
The slope of curve c_1 and c_2 is constant.
so, their Relative velocity is Non-zero constant not a variable quantity

36. D
$\therefore$ Slope of v-t curve gives aceleration
Here slope of P_1 > slope of P_2 $\quad (a_{p_1} > a_{p_2})$
$\therefore$ Relative velocity in their motion continousely increases.

37. D



38. C



$V_B = -gt$

$V_{AB} = V_A - V_B = -gt + \sqrt{2gH} + gt$

$= \sqrt{2gh}\left(\text{upto time } \frac{T}{2}\right)$

where T = Time period

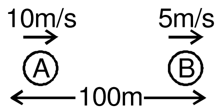
After $\frac{T}{2}$ $V_B = 0$

$\therefore V_{AB} = V_A - V_B$

$= -gt$

39. C

$V_{AB} = 10 - 5 = 5 m/s$



$t = \frac{100}{5} = 20 \sec$

40. B

$V_E = \frac{H}{60} m/s$ and $V_M = \frac{H}{180} m/s$

$t = \frac{H}{V_E + V_M} = \frac{H}{\frac{H}{60} + \frac{H}{180}} = \frac{180}{4}$

$\therefore t = 45 \sec$

41. B

a = acceleration of lift

u = velocity relative to lift

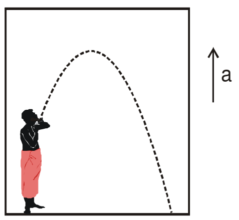
According to problem

$-u = u - (g + a) \times t$

$t = \frac{2u}{g+a}$

$\Rightarrow at + gt = 2u$

$\therefore = \frac{2u - gt}{t}$



42. D

Horizontal Component of velocity

Because $\rightarrow$ there is no acceleration in horizontal Direction

43. D

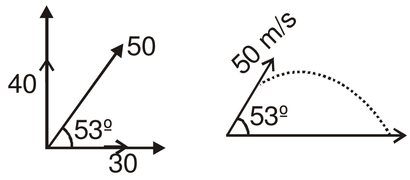
44. B

At maximumm height Vy = 0

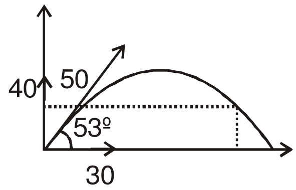
$\therefore V_x = u_x = \frac{u}{2} = u\cos\theta$

so range $= \frac{u^2 \sin 2\theta}{g} = \frac{\sqrt{3}}{2}\frac{u^2}{g}$

45. A



46. D



$H = 40t - \frac{1}{2} \times 10 \times t^2$

$5t^2 - 40t + H = 0$

Now, $t_1 + t_2 = \frac{40}{5} = 8 \sec$

47. A

By Equation of trajectory

$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$

$\theta = 53°$

$\Rightarrow y = \frac{4x}{3} - \frac{10x^2}{1800}$

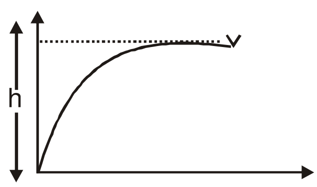
$\Rightarrow 180y = 240x - x^2$

48. B

$\vec{V} = a\hat{i} + (b - ct)\hat{j} = u_x\hat{i} + (u_y - gt)\hat{j}$

$R = \frac{2u_x u_y}{g} = \frac{2ab}{c}$

49. C



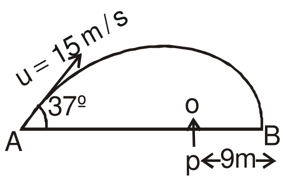
$h = \frac{U_y^2}{2g}$

$U_y = \sqrt{2gh}$

$$R = U_x T = \frac{U.2\sqrt{2gh}}{g}$$

$$R = 2U\sqrt{\frac{2h}{g}}$$

50. B

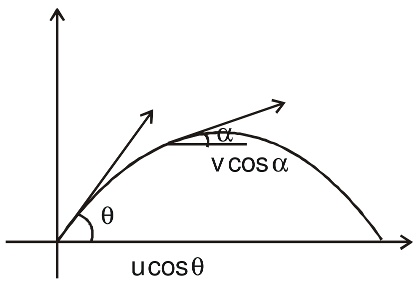


$$T = \frac{2u\sin 37°}{g}$$

$$= \frac{2\times 15\times 3}{10\times 5} = 1.8\,\text{Sec}$$

$$\text{Minimum Velocity} = = \frac{9}{1.8} = 5\,m/s$$

51. C

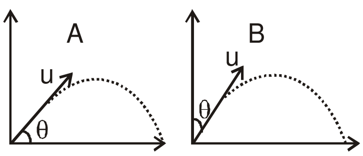


Horizontal Component

$u\cos\theta = v\cos\alpha$

$\therefore\ v = u\cos\theta\sec\alpha$

52. D



Both may have same time of flight

$$\therefore T = \frac{2u\sin\theta}{g}$$

53. B

$$\therefore H_{max} = \frac{{u_y}^2}{2g}$$

$$\Rightarrow u_y = \sqrt{2gH}$$

$$\therefore T = \frac{2u_y}{g} = \frac{2\sqrt{2gH}}{g} = 2\sqrt{2}\sqrt{\frac{H}{g}}$$

54. B

$s_y = u_y t - \frac{1}{2}a_y t^2 \qquad u_x = 50\cos 53º = 30 m/s$

$75 = 40.t - \frac{1}{2}\times 10\times t^2 \qquad u_y = 50\sin 53º = 40\ m/s$

$\Rightarrow t^2 - 8t + 15 = 0$

$\Rightarrow t^2 - 5t - 3t + 15 = 0$, $t_1 = 3sec$, $t_2 = 5sec$

$x_2 = 30\times 5 = 150m$

$x_1 = 30\times 3 = 90m$

$\therefore x_2 - x_1 = 150 - 90 = 60m$

55. A

In t = 2 sec

$x = 30\times 2 = 60m$

$y = 40\times 2 - \frac{1}{2}\times 10\times (2)^2$

$= 80 - 20 = 60m$

Distance $= 60\sqrt{2}m$

56. C

H=20 m, u = 0

$-Sy = ut - \frac{1}{2}gt^2$

$T = \sqrt{\frac{2\times 20}{10}} = 2\sec$

Range $= ut + \frac{1}{2}gt^2$

$= 0 + \frac{1}{2}\times 6\times (2)^2 = 12m$

57. C

${v_y}^2 - (4)^2 = -2\times 10\times 0.45$

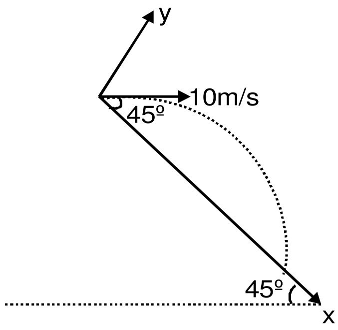
${v_y}^2 = 7m^2/s^2$

$v_x = 5\cos 53º = 3m/s$

$\therefore V_{net} = \sqrt{(V_x)^2 + (V_y)^2} = \sqrt{9+7}$

$= 4m/s$

58. C



$a_y = -\dfrac{g}{\sqrt{2}}\ m/s^2$

$a_x = \dfrac{g}{\sqrt{2}}\ m/s^2$

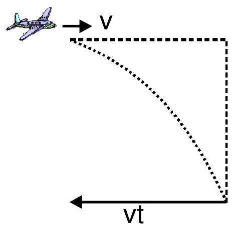
$$T = \frac{2u\sin\theta}{g_{eff}}$$

$$T = \frac{2\times\left(10/\sqrt{2}\right)}{g/\sqrt{2}} = 2\ \text{sec}$$

59. C

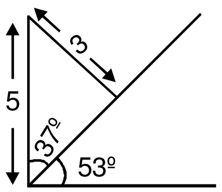
Time is depend only in vertical component V_y
but in both cases V_y=0
$\therefore$ Both will reach the ground at the same time

60. A



Horizontal velocity of bomb with respect to plane is zero.

61. A

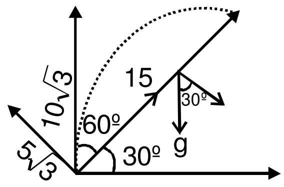


As particle has thrown $\perp$ from ground.

$$\therefore H_{max} = \frac{u^2}{2g} = 5m$$

$\therefore$ from inclined plane $H_{max} = 3m$

62. C

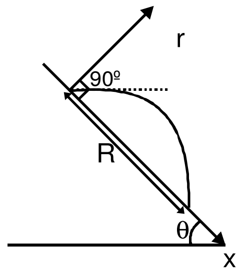


$$T = \frac{2u_y}{g\cos\theta}$$

$$T = \frac{2\times 5\sqrt{3}}{10\times\cos 30º}$$

$T = 2\text{sec}$

63. C

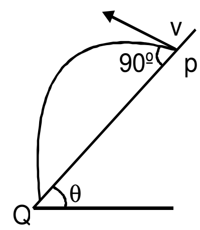


$a_y = -g\cos\theta$
$a_x = g\sin\theta$
$u_y = v$
$u_x = 0$

$$\text{Range} = \frac{1}{2}a_xT^2 \qquad T = \frac{2.v}{g\cos\theta}$$

$$= \frac{1}{2}g\sin\theta$$

64. D



$$R = u_xt + \frac{1}{2}a_xt^2$$

$$\left[\therefore u_x = 0.\ u_y = v\right]$$

$$\therefore\ T = \frac{2u_y}{g\cos\theta} = \frac{2v}{g\cos\theta}$$

$R = \frac{1}{2} \times g\sin\theta \times \frac{4v^2}{g^2\cos^2\theta}$

$= \frac{2v^2}{g}\tan\theta\sec\theta = Tv\tan\theta$

65. B

$a_{AB} = 0$

$\therefore$ Straight line

66. C

Given $V_1\cos\theta_1 = v_2\cos\theta_2 \Rightarrow v_{xA} = V_{xB}$

$\vec{v}_A = V_{XA}\hat{i} + V_{yA}\hat{j}$; $\vec{V}_B = V_{XB}\hat{i} + V_{yB}\hat{j}$

$\therefore \vec{v}_{AB} = V_{yA}\hat{j} - V_{yB}\hat{j}$ (Verticle Line)

$R = \frac{2u_x u_y}{g}$

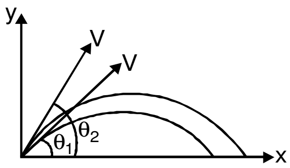
67. D

$T = \frac{2u_y}{g}$ $\therefore$ same

$H = \frac{u_y{}^2}{2g}$

$\vec{V}_{AB} = V_{xA}\hat{i} - V_{xB}\hat{i}$

68. B



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

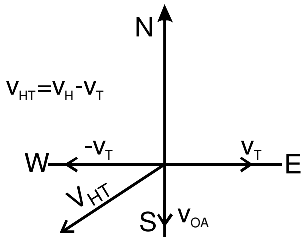
when angle in θ and $90-\theta$ Range is Same

$v_{21} = v_{2x}\hat{i} - v_{2y}\hat{j} - v_{1x}\hat{i} - v_{1y}\hat{j}$

$\tan\theta = \left(\frac{v_{2y} - v_{1y}}{v_{2x} - v_{1x}}\right) \begin{matrix} v_{2y} < v_{1y} \\ v_{2x} > v_{1x} \end{matrix}$

$\tan\theta = -ve$

69. D



South - West

70. D

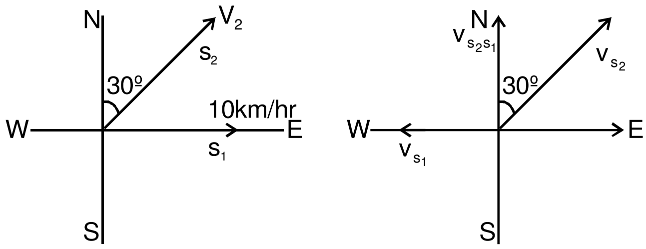
$\vec{v}_r = \vec{v}_1 - \vec{v}_2$

$|\vec{v}_r| = \sqrt{v_1{}^2 + v_2{}^2 - 2v_1v_2\cos\theta}$

$|\vec{v}_r|$max when $\cos\theta = -1$ $\theta = \pi$

$\Rightarrow v_r = v_1 + v_2$

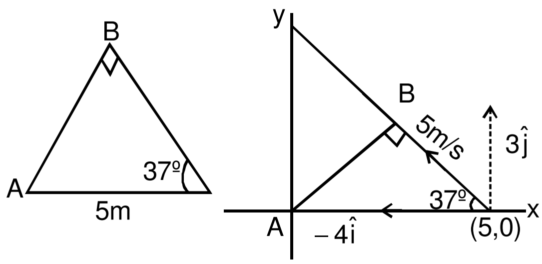
71. C



East component of both ship must be same.
from fig : - $v_2 \sin 30º = v_{s1}$

$Vs_2 = \frac{10}{1/2} = 20$ km/hr

72. A



Draw a perpendicular from A on the line of a velocity of the particle B.

$\sin 37º = \frac{AB}{5}$

AB = 3m

73. A

Each porticle move perpendicular with the neighbour particle so no component of v along the line of motion of neighbour velocity so vel. of approach = v

$\Rightarrow t = \dfrac{a}{v}$

74. A

Given $v_r + v_{br} = v_b$

$\Rightarrow v_r + v_{br} = 16$ -(1)

$v_{br} - v_r = 8$ -(2)

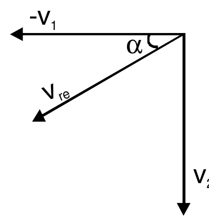
from equation (1) and (2)

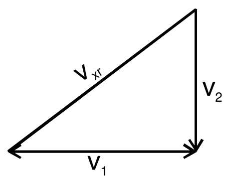
$v_{br} = 12$ km/h

$v_r = 4$ km/h

75. A

Drops of rain move parallel to the walls if v_{rp} makes α angle with the horizontal.





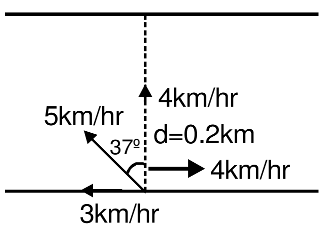
$\vec{V}_{RC} = \vec{V}_R - \vec{V}_C$

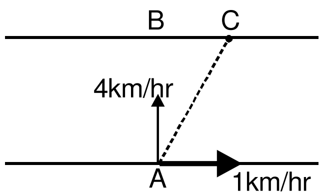
$= \vec{V}_R \hat{j} - \vec{V}_C \hat{i}$

$\tan \alpha = \dfrac{v_2}{v_1} = \dfrac{6}{2}$

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

76. B





Given : V_{br} = 5 km/hr

v_r=4 km/hr d = 0.2 km

$t = \dfrac{0.2}{4}$

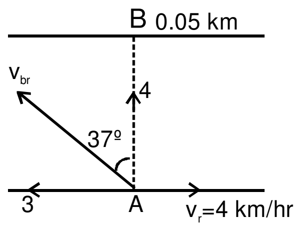
= 0.05 hr = 3 min

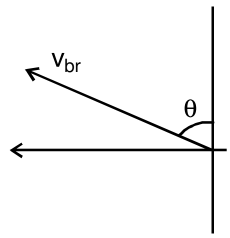
$t_2 = = \dfrac{0.05}{3} \times 60$

= 1 min

$t_1 + t_2 = 4$ min

77. B





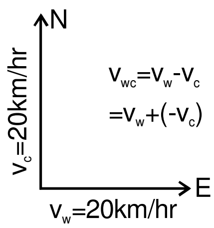
V_{br} = 5 km/hr

$\sin \theta = \dfrac{v_r}{5}$

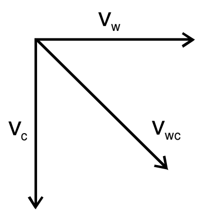
$t = \dfrac{d}{v_{br} \cos\theta} \Rightarrow \cos\theta = \dfrac{4}{5} \Rightarrow \theta = 37º$

$\sin 37º = \dfrac{v_r}{5} \Rightarrow v_r = 3\text{km/hr}$

78. C

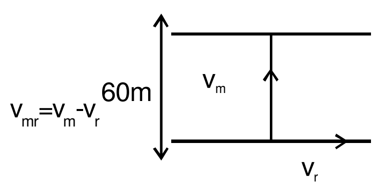


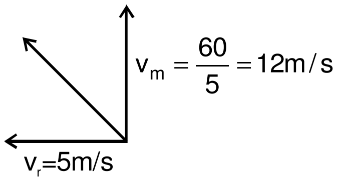
∴



79. B

v_r=5m/s





$\therefore$

$v_{mr} = \sqrt{(12)^2 + (5)^2} = 13 m/s$

80. B

81. A
$-5-5-5+v_B=0$
$V_B=15 m/s \downarrow$

82. A
$+2-v_B-v_B+1=0$
$v_B = \frac{3}{2} m/s \uparrow$

83. A
$-a-a_B-a_B+f=0$
$a_B = \left(\frac{f}{2} - \frac{a}{2}\right) = \frac{1}{2}(f-a) \uparrow$

84. A
$-a_c+2+2-1-1-a_c=0$
$a_c = 1\ m/s^2 \uparrow$

EXERCISE – II | MULTIPLE CHOICE QUESTIONS

1. **A,B,C,D**

$X=\alpha T^2-\beta t^3$

(A) $0=\alpha t^2-\beta t^3$

$\Rightarrow t=\frac{\alpha}{\beta}$

(B) $v=\frac{dx}{dt}=2\alpha t-3\beta t^2$

$v=0 \Rightarrow t=\frac{2\alpha}{3\beta}$

(C) $a=\frac{d^2x}{dt^2}=2\alpha-6\beta t$

when t=0

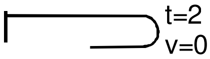
$a=2\alpha$; v=0

(D) Acceleration at $t=\frac{\alpha}{3\beta}$; a=0

$\therefore$ net force = 0

2. A,C

v=10-5t



When v = 0 at t = 2 sec.

Max displacement $= 10t-\frac{5t^2}{2}$

put t=2 $\Rightarrow$ 20-10=10m

Distance traveled in first 3 seconds

$= 10+\left(0+\frac{1}{2}\times5\times(1)^2\right)$

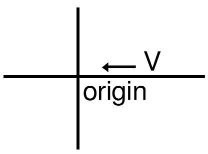
= 12.5 m

3. B,C,D

$a=\frac{dv}{dt}$

(C) $\overrightarrow{v}$ $\overleftarrow{a}$ Object is slowing down.

(D)



the particle is moving towards origin.

4. B,D

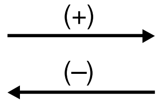
$F_{net}=f-kv$

$\Rightarrow a=\frac{f}{m}-\frac{kv}{m}$

As $v\uparrow, a\downarrow$

and when a=0, velocity remains constant

5. C,D



$\overrightarrow{v}$, $\overrightarrow{a}$ • $(v)\uparrow$ $\overleftarrow{v}$, $\overleftarrow{a}$ • $(v)\uparrow$

$\overrightarrow{v}$, $\overleftarrow{a}$ • $(v)\downarrow$ $\overleftarrow{v}$, $\overrightarrow{a}$ • $(v)\downarrow$

(C) Moving with costant velocity

(D) No

6. A,C

$|\vec{V}|\uparrow$, $\vec{V}\uparrow$

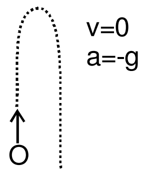
$\vec{a}=\frac{d\vec{V}}{dt}$

(C) In circular motion speed may be constant but velocity will not be constant and particle have some acceleration.

7. A,C

(A) At the top of the motion v = 0 but a = –g.

(A, B) $a=\frac{dv}{dt}$

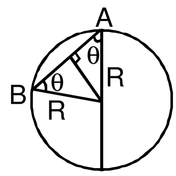


(C) If particle is moving with costant velocity

(D) No

8. A,D

AB=l=2Rcosθ



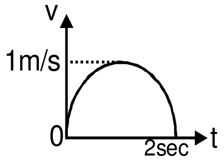
$a=g\cos\theta$

$v^2=2\times g\cos\theta\times2R\cos\theta$

$v\alpha\cos\theta$ and $2R\cos\theta=\frac{1}{2}g\cos\theta\, t^2$

$t^2 = \frac{4R}{g}$

9. C



Area = $\frac{\pi(1)^2}{2} = \frac{\pi}{2}m$

Av velocity = $\frac{\pi}{2\times2} = \frac{\pi}{4}m/s$

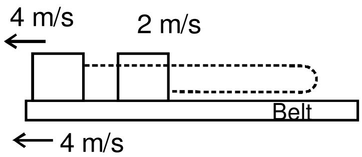
10. A,B,C,D
(a) At T (velocity changes its direction)
(b) slope constant
(c) Upper wala area = Niche wala area
(d) Initial speed = final speed.

11. B,C,D

$s = ut - \frac{1}{2}at^2$

$\therefore -4 = 2 + a \times 4$

$a = -\frac{3}{2}\ m/s^2$



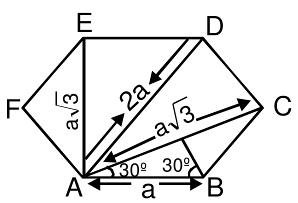
(B) Now $s = 2\times4 - \frac{1}{2}\times\frac{3}{2}\times(4)^2$
$= 8 - 12 = -4m$ (w.r.t. ground)
w.r.t. Belt
(C) $u_i = 6m/s$ and $v=0$

$s = 6\times4 - \frac{1}{2}\times\frac{3}{2}\times(4)^2$
$= 24 - 12 = 12\ m$
(D) Displacement w.rt. ground is zero

$0 = 2\times t - \frac{1}{2}\times\frac{3}{2}\times t^2$

$t = \frac{8}{3}$ sec

12. A,C,D



(A) A to F

Average velocity = $\frac{\text{Total Desplacement}}{\text{Total time}}$

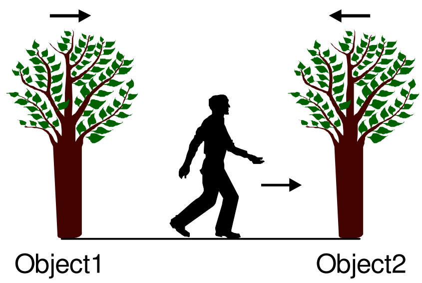
$= \frac{a}{5a/v} = \frac{v}{5}$

(B) A to D = $\frac{2a}{3a/v} = \frac{2}{3}v$

(C) A to C = $\frac{a\sqrt{3}}{2a/v} = \frac{v\sqrt{3}}{2}$

(D) A to B $= \frac{a}{a/v} = v$

13. A,B,C



14. C,D
From theory.

15. C,D

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

$\sqrt{3} = \frac{20 \sin^2\theta}{10} \Rightarrow \sin 2\theta = \frac{\sqrt{3}}{2}$

$\therefore \theta = 30º$

(A) $H_{max} = \frac{u^2 \sin 2\theta}{2g} = \frac{(\sqrt{20})^2 \times \frac{1}{4}}{2\times10} = 0.25m$

(B) Minimum Velocity $u\cos\theta$

$= \sqrt{20} \times \cos 30º$

$= \sqrt{20} \times \frac{\sqrt{3}}{2} = \sqrt{15}m/s$

16. A,B,C,D

$h = \frac{u^2}{2g} \Rightarrow u = \sqrt{2gh}$

(a) $R_{max} = \frac{u^2}{g} = 2h$

(b) $R = nH_{max}$

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

$4 = n \tan\theta$

$\theta = \tan^{-1}\left(\frac{4}{n}\right)$

(c) $gT^2 = g\times\frac{4u^2 \sin^2\theta}{g^2} = \frac{2\times u^2 \sin 20}{g}\times\tan\theta$

$gT^2 = 2 R \tan\theta$

(d) $T = \frac{2u_y}{g}, H_{max} = \frac{{u_y}^2}{2g}$

$\therefore$ Ratio 1:1

17. A,B

Put the value of T, R, H, in the given equation and solve each option.

18. A,B,C,D

$y = x \tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$

Given $y = ax - bx^2$

on comparing $\tan\theta = a \quad b = \frac{g}{2u^2\cos^2\theta}$

$\therefore 1 + \tan^2\theta = \sec^2\theta = 1 + a^2$

$b = \frac{g}{2u^2}(1+a^2) \Rightarrow u = \left(\frac{g}{2b}(1+a^2)\right)^{1/2}$

$\therefore u_x = u\cos\theta = u.\frac{1}{\sqrt{1+a^2}}$

and $\theta = \tan^{-1}(a)$

19. A,C,D

$T = \sqrt{\frac{2H}{g}} \Rightarrow 0.4 = \sqrt{\frac{2H}{g}}$

$\Rightarrow H = 0.8m$

R= 0.4 × 4 = 1.6m

and Uy= $\sqrt{2gH} = \sqrt{2\times10\times0.8} = 4m/s$

$\theta = 45º$

20. B

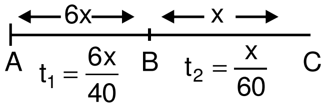
As $\theta\uparrow$, H and T both increases

But R $\uparrow$ from 0º to 45º & at $\theta = 45°$ Max then decreases

Ans (B) R$\uparrow$ then $\downarrow$ [θ from from 30º to 60º]

while H$\uparrow$ and T$\uparrow$.

EXERCISE – III
SUBJECTIVE PROBLEMS

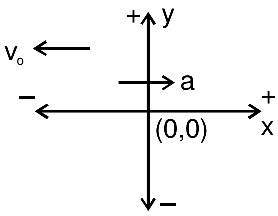
1. 

Average speed = $\frac{\text{Total distance travelled}}{\text{Total time taken}}$

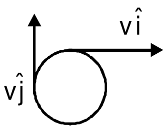
$= \frac{7x}{\frac{6x}{40}+\frac{x}{60}}$

= 42 km/hr

2. As the particle is left



3.



Change in velocity = $v_{\hat{j}} - v_{\hat{i}}$

$v = \frac{2\pi R}{60} = \frac{2\pi \times 10}{60} = \frac{\pi}{3}\,\text{cm/min}$

$|\Delta v| = \sqrt{2}v = \sqrt{2}\times\frac{\pi}{3} = \frac{\sqrt{2}\pi}{3}$ cm / min

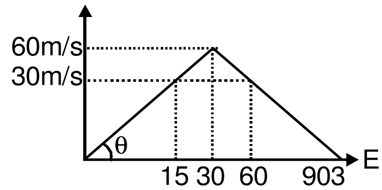
4.
v_i = 54km/hr = 15 m/s
v_f=0 ∴ 0=15-0.3t
⇒ t = 50 sec
Distance travelled by the locomotive

$s = ut - \frac{1}{2}at^2$

$s = 15(50) - \frac{1}{2}(0.3)(50)^2$

=375 m
Position of the locomotive = 400-375
= 25m

5.



$\tan\theta = \frac{v_{max}}{30}$

V_{max} =30×2
= 60 m/s

(a) Total Distance

$= \frac{1}{2}\times 30\times 60 + \frac{1}{2}\times 60\times 60$

= 2700m
=2.7 km

(b) Max Speed

$2 = \tan\theta = \frac{v_{max}}{30}$

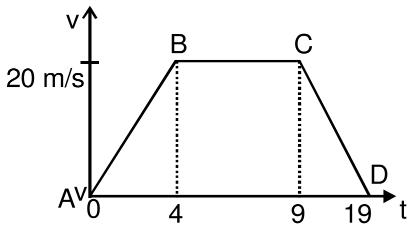
$v_{max} = 60\,\text{m/s}$

(c) Positions of the train

I^{st} Positon = $\frac{1}{2}\times 15\times 30 = 225$m

II^{nd} Position = $2700 - \frac{1}{2}\times 30\times 30$ =2250m

6.

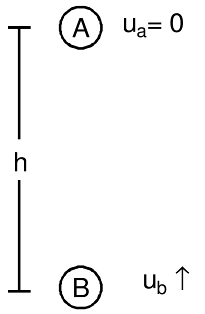


for AB 20=0+5t ⇒ t=4 sec
for CD 0=20-2t ⇒ t= 10 sec

Area covered = $\frac{1}{2}\times 20\times 4 + 5\times 20 + \frac{1}{2}\times 10\times 20$

= 240 m

7. Max height of B

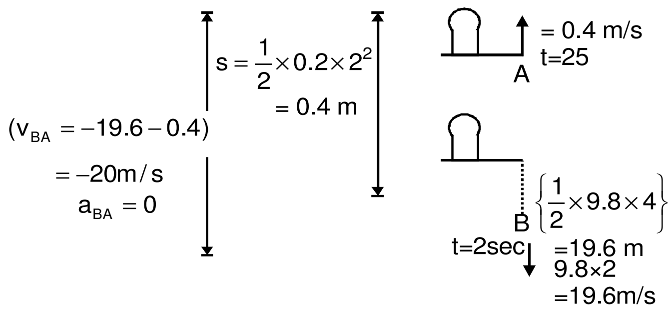


$\frac{u^2}{2g} = 4h \Rightarrow u_B = \sqrt{8gh}$

Relative velocity $V_{AB} = 0 - \sqrt{8gh} = -\sqrt{8gh}$

$t = \frac{h}{\sqrt{8gh}} = \sqrt{\frac{h}{8g}}$

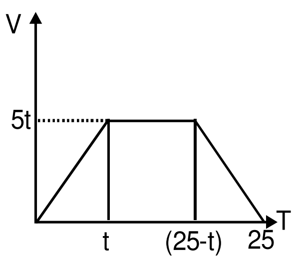
8.



for next 1.5 sec
= 20 ×1.5 = 30 m
Total Distnace = 20 + 30
= 50 m

9. Area of V–T curve give displacement.
Distnace travelled by the particle
= 50 + 50
= 100 m
Av. velocity = zero

10.



$\tan\theta = \frac{v_{max}}{t} = 5$

$v_{max} = 5t$

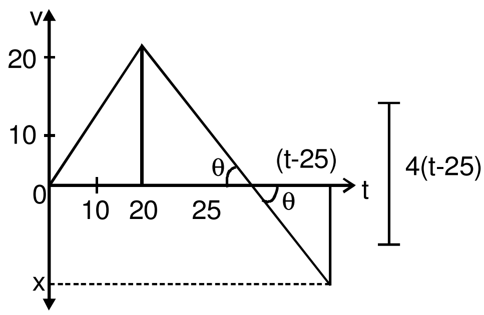
Displacement $= \frac{1}{2} \times t \times 5t + (25 - 2t) \times 5t + \frac{1}{2} \times t \times 5t$

$= 125t - 5t^2$

Aaerage velocity $20 = \frac{125t - 5t^2}{25}$

$125\,t - 5t^2 = 500$
t = 20, 5
ans t= 5 sec

11. Particle return to starting point
it means displacement = 0
$\therefore$ upper wala area = Niche wala area



$\tan\ \theta = \frac{20}{5}$

$\tan\ \theta = \frac{x}{(t-25)} \Rightarrow x = 4(t-25)$

Now, $\frac{1}{2} \times 20 \times 20 + \frac{1}{2} \times 5 \times 20 = \frac{1}{2}(t-25) \times 4(t-25)$

On solving t = 36.2 sec

12.

At t= 2 sec $\therefore \theta = 45^\circ$

$\therefore v_y = v_x$

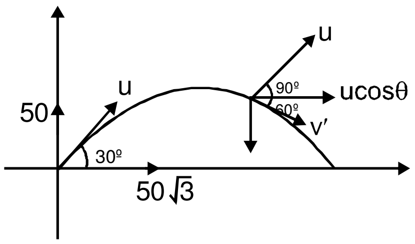
for t = 4 sec, $u_y = 0$

$T = \frac{u_y}{g} \Rightarrow u_y = 40$ m/s

st t= 2 sec $v_y = 40 - 20 = 20$

$\therefore v_y = v_x = 20$

$v = \sqrt{(20)^2 + (40)^2} = 20\sqrt{5}$

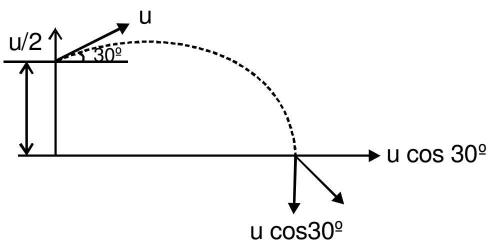
13.


$u_x = 50\sqrt{3}$ m/s
$u_y = 50$ m/s
$V_x = u_x = 50\sqrt{3}$
$V_y = u_y - gt = 50 - 10t$
$\tan(-60) = \frac{50-10t}{50\sqrt{3}}$
t = 20 sec

14. $y = \sqrt{3}x - \frac{gx^2}{2}$

$y = x\tan\theta - \frac{gx^2}{2u^2\cos^2\theta}$

on comparing $\tan\theta = \sqrt{3}$ $\theta = 60°$
and $u^2\cos^2\theta = 1$
$u = 2\text{m/s}$

15.


$-\frac{u\sqrt{3}}{2} = \frac{u}{2} - 10\times5$

$u = \frac{100}{\sqrt{3}+1} = 50(\sqrt{3}-1)\text{m/sec}$

16.

$s = 100\times3 + \frac{1}{2}\times30\times3^2$
= 435 m

$H_{max} = \frac{(190)^2}{2\times10}\times\sin^2 53º = 1155.2$

(a) Total = 348 + H_{max}
= 348 + 1155.2
= 1503.2 m = maximum altitude

(b) u=190 sin 53º; – a_y =10 : s_y = – 348

$-348 = 152t - \frac{1}{2}\times10\times t^2$

$5t^2 - 152t - 348 = 0$
t = 32.54 sec
Total = 35.54 sec

(c) R = 435cos 53º + 190 cos 53 × 32.54

$= 435\times\frac{3}{5} + 190\times\frac{2}{5}\times32.54$
= 3970.56m

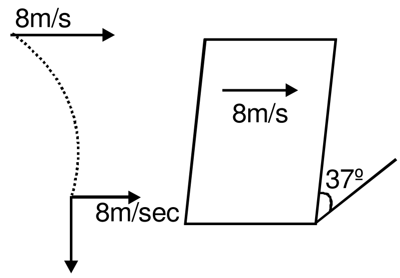
17.

$\sqrt{\frac{2h}{g}} = 5\text{sec}\ (h = y)$
y= 125 m

Now, $\tan 37º = \frac{125}{x} \Rightarrow \frac{3}{4} = \frac{125}{x}$

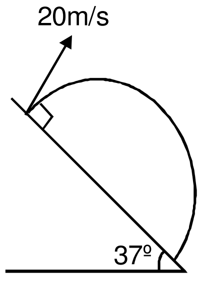
$x = 500/3$

$\therefore\ x = u\times5 \Rightarrow u = \frac{100}{3}\text{m/s}$

18.


g sin (37º) t=6

$V = \sqrt{6^2+8^2} = 10\text{m/s}$

19.


$T = \frac{2u}{g\cos37º} = \frac{2\times20}{10\times4/5}$

$R = \frac{1}{2}a_xT^2$

$$R = \frac{1}{2} \times 10 \sin 37^\circ \times T^2$$

$$= \frac{1}{2} \times 10 \times \frac{3}{5} \times (5)^2 = 75m$$

20.

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

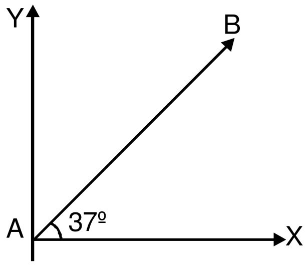
$$T = \frac{2u\sin\theta}{g};\ a_x = g/2$$

Due to acceleration in x-direction range will increase.

Now, $$R' = u\cos\frac{(2u\sin\theta)}{g} + \frac{1}{2} \times \frac{g}{2} \times \left(\frac{2u\sin\theta}{g}\right)^2$$

$$R' = \frac{u^2 \sin 2\theta}{g} + \frac{u^2 \sin^2\theta}{g} = R + 2H$$

21.



$$\vec{v}_{bw} = \vec{v}_b - \vec{v}_w$$

$$\vec{v}_b = \vec{v}_{bw} + \vec{v}_w$$

$$= 10\hat{i} + 12\hat{j} + u\hat{i}$$

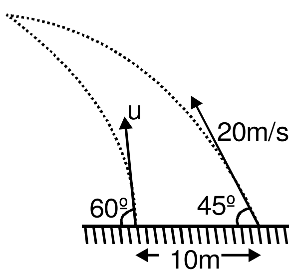
$$= (10 + u)\hat{i} + 12\hat{j}$$

$$\tan 37^\circ = \frac{12}{10+u} \Rightarrow \frac{3}{4} = \frac{12}{10+u}$$

$$10 + u = 16$$

$$u = 6m/s$$

22. Vertical component of both particle be same for collision of particle.



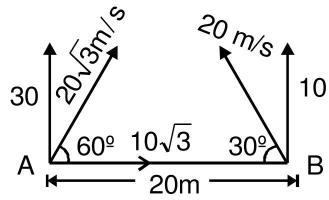
$$\frac{u\sqrt{3}}{2} = \frac{20}{\sqrt{2}}$$

$$u = \frac{40}{\sqrt{6}}$$

$$u = 20\sqrt{\frac{2}{3}}$$

23.

w.r.t. B

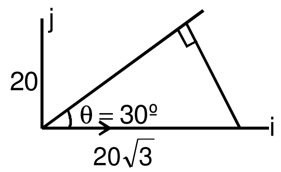


$v_{ABX} = 10\sqrt{3} - (-10\sqrt{3}) = 20\sqrt{3}\,m/s$

$v_{ABy} = 30 - 10 = 20$ m/s

$\vec{V}_{AB} = 20\sqrt{3}\hat{i} + 20\hat{j}$

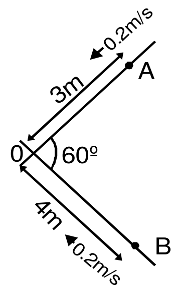
$$\tan\theta = \frac{20}{20\sqrt{3}}$$



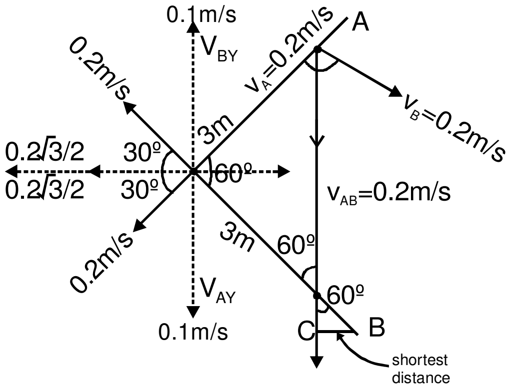
$$\tan\theta = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30^\circ$$

$$x = 20\sin 30^\circ \Rightarrow x = 10m$$

24.



Now, we solve the problem w.r.t. B then



shortest Distance BC = 1 sin 60º

$$= \frac{\sqrt{3}}{2} m = 50\sqrt{3} cm$$

25.

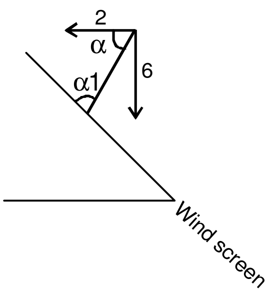
$$\vec{v}_{rw} = \vec{v}_r - \vec{v}_w$$

$$\vec{v}_r = \vec{v}_{rw} + \vec{v}_w = -20\hat{j} + 15\hat{i}$$

$$\vec{v}_{rm} = \vec{v}_r - \vec{v}_m = -20\hat{j} + 15\hat{i} - 5\hat{i} = 10\hat{i} - 20\hat{j}$$

$$\tan\theta = \frac{10}{20} \Rightarrow \theta = \tan^{-1}\left(\frac{1}{2}\right)$$

26.

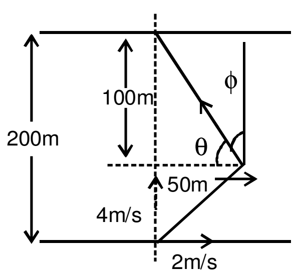


$$\vec{v}_{rc} = \vec{v}_r - \vec{v}_c$$

$$\tan\alpha = \frac{6}{2} \Rightarrow \alpha = \tan^{-1}(3)$$

27.

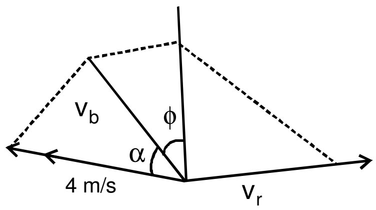
$$t = \frac{200}{4} = 50 \sec$$



$\tan\theta = 2$

$$\tan\phi = \frac{1}{2}$$

4 sin α = 2 sin (90+ φ)



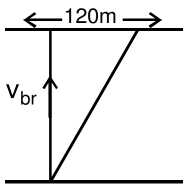
4 sin α = 2 cos φ

$$\sin\ \alpha = \frac{2\cos\phi}{4} = \frac{2}{4} \times \frac{2}{\sqrt{5}} = \frac{1}{\sqrt{5}}$$

$$t = \frac{100}{4\cos(\alpha+\varphi)} = \frac{100}{4(\cos\alpha\cos\varphi - \sin\alpha\sin\varphi)}$$

$$t = \frac{100}{4 \times \frac{3}{5}} = \frac{125}{3}$$

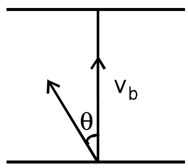
28. $t_{min} = \frac{d}{v_{br}} = 10 \times 60$ sec



t_{min} = 600 sec

120 = v_r × 600

$$v_r = \frac{1}{5} \text{ m/s}$$



$$\sin\theta = \frac{v_r}{v_{br}} = \frac{1}{v_{br} \times 5}$$

$$12.5 \times 60 = \frac{d}{v_{br}\cos\theta}$$

$$12.5 \times 60 = \frac{10 \times 60}{\cos\theta}$$

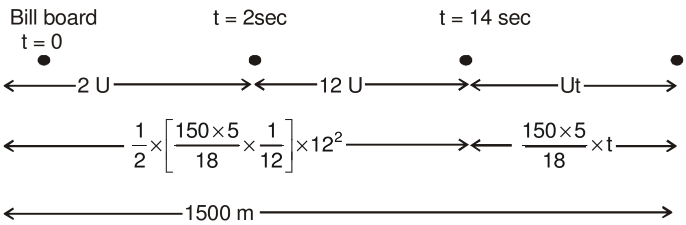
$$\cos\theta = \frac{4}{5} \Rightarrow \theta = 37º$$

$$\text{Now, } \frac{3}{5} = \frac{1}{v_{br}5}$$

$$v_{br} = \frac{1}{3} \text{ m/s}$$

EXERCISE – IV TOUGH SUBJECTIVE PROBLEMS

1



$$14\,U + Ut = 1500\text{m} \qquad ...(1)$$

$$\frac{1}{2}\times\frac{150\times5}{18}\times\frac{1}{12}\times12^2+\frac{150\times5}{18}\times t = 1500\text{ m}$$

$$\Rightarrow \quad t = 30\,\text{sec}$$

$$U(30 + 14) = 1500\text{ m} \Rightarrow U = 122.7\text{ km/hr}$$

2 Bullets will spread in a area of radius equal to the range of bullets. Therefore for area to be maximum. Range should be maximum. i.e. $\frac{v^2}{g}$

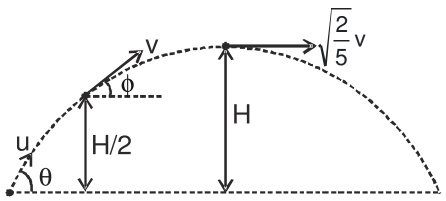
$$A = \frac{\pi v^4}{g^2}$$

3

$$v^2 - u^2 = 2\vec{a}.\vec{S}_y$$

$$\frac{2}{5}v^2 - u^2 = -2gH \Rightarrow v^2 - u^2 = -\frac{2gH}{2}$$

$$\frac{3}{5}v^2 = g\times\frac{(U\sin\theta)^2}{2g} \Rightarrow U\sin\theta = \sqrt{\frac{6}{5}}\,v$$



$$U\cos\theta = \sqrt{\frac{2}{5}}\,v$$

$$\tan\theta = \sqrt{3} \Rightarrow \theta = 60^\circ$$

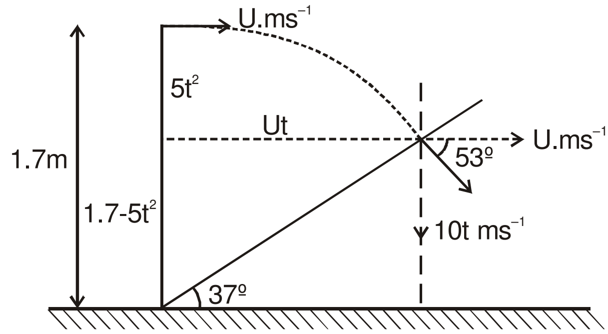
$$v\cos\phi = \sqrt{\frac{2}{5}}\,v \Rightarrow \phi = \cos^{-1}\sqrt{\frac{2}{5}}$$

4

$$\tan 53^\circ = \frac{10t}{U}$$

$$\Rightarrow \frac{4}{3} = \frac{10t}{U} \qquad ....(1)$$

$$\tan 53^\circ = \frac{Ut}{1.7 - 5t^2} \qquad .....(2)$$



from (1) & (2) : $t = \frac{2}{5}$sec

from (1) : $U = \frac{3}{4}\times10\times\frac{2}{5}$

$U = 3\text{ ms}^{-1}$

5 Let us choose the x and y directions along OB and OA respectively. Then,

$u_x = u = 10\sqrt{3}$ m/s, $u_y = 0$

$a_x = -g\sin 60^\circ = -5\sqrt{3}$ m/s^2

and $a_y = -g\cos 60^\circ = -5$ m/s^2

(a) At point Q, x-component of velocity is zero. Hence, substituting in

$v_x = u_x + a_xt$

$0 = 10\sqrt{3} - 5\sqrt{3}t \Rightarrow t = \frac{10\sqrt{3}}{5\sqrt{3}} = 2\text{s}$

Ans.

(b) At point Q, $v = v_y = u_y + a_yt$

$\therefore$ $v = 0 - (5)(2) = -10$ m/s **Ans.**

Here, negative sign implies that velocity of particle at Q is along negative y direction.

(c) Distance PO = |displacement of particle along y-direction| = $|s_y|$

Here, $s_y = u_yt + \frac{1}{2}a_yt^2 = 0 - \frac{1}{2}(5)(2)^2 = -10$ m

$\therefore$ PO = 10 m

Therefore, $h = PO \sin 30° = (10)\left(\frac{1}{2}\right)$ or $h = 5m$ **Ans.**

(d) Distance OQ = displaement of particle along x-direction = s_x

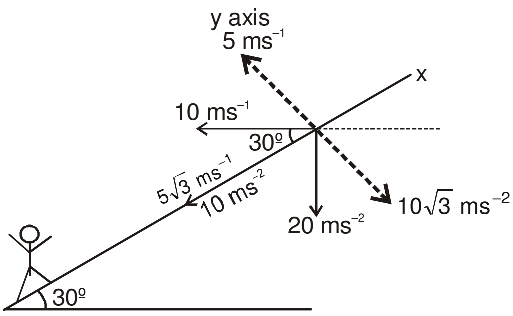
Here, $s_x = u_x t + \frac{1}{2}a_x t^2 = (10\sqrt{3})(2) - \frac{1}{2}(5\sqrt{3})(2)^2 = 10\sqrt{3}\,m$

or $OQ = 10\sqrt{3}\,m$

$PQ = \sqrt{(PO)^2 + (OQ)^2} = \sqrt{(10)^2 + (10\sqrt{3})^2} = \sqrt{100+300} = \sqrt{400}$

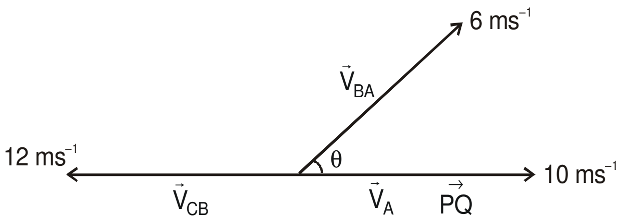
PQ = 20 m

6



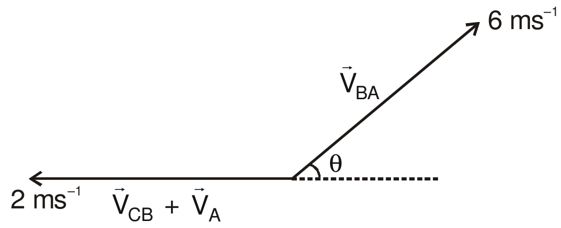
$O = 5T - \frac{1}{2}\times 10\sqrt{3}\,T^2 \Rightarrow T = \frac{1}{\sqrt{3}}$

7



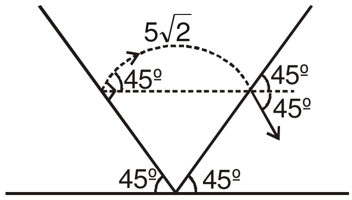
$\therefore \vec{V}_C = \vec{V}_{CB} + \vec{V}_B$

$= \vec{V}_{CB} + \vec{V}_{BA} + \vec{V}_A$



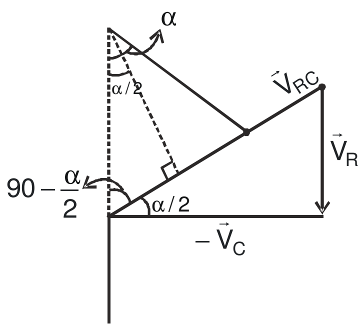
$|\vec{V}_C| = \sqrt{4+36+2\times 2\times 6\cos(\pi-\theta)} = 5\,ms^{-1}$

8



$T = \frac{2\times 5\sqrt{2}\sin 45º}{g} = 1\sec$

9



$\tan\alpha/2 = \frac{|\vec{V}_R|}{|-\vec{V}_C|} = \frac{2}{6} \Rightarrow \alpha = 2\tan^{-1}(1/3)$

10 $\frac{1}{2}gt^2 = 4$

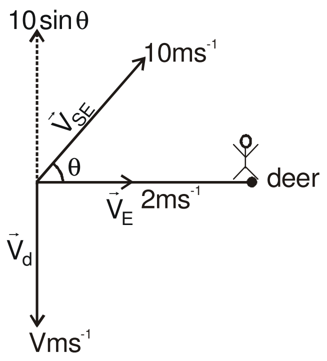
$\Rightarrow t = \frac{2}{\sqrt{5}}\sec$ [Time taken by spear to reach dear]

Motion in horizontal plane

$\vec{a}_{horizontal} = \vec{0}$

$10\sin\theta = V_d$

$(10\cos\theta + 2)\frac{2}{\sqrt{5}} = 4\sqrt{5}$



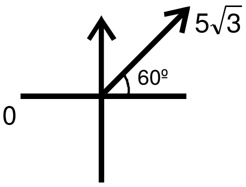
$\Rightarrow \quad \theta = 37^\circ$

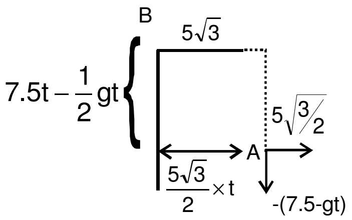
$\therefore \quad V_d = 6\,ms^{-1}$

EXERCISE – V

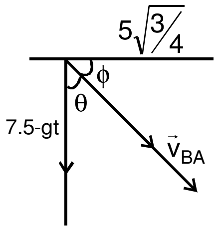
JEE QUESTIONS

1. t = 0





w.r.t A at t = t



$\tan\varphi = \dfrac{7.5-gt}{5\sqrt{3}/2}$

$= -\dfrac{\left(7.5t-\frac{1}{2}gt^2\right)}{\frac{5\sqrt{3}}{2}.t}$

$= 7.5- gt = -7.5+\dfrac{gt}{2}$

$15 = \dfrac{3gt}{2}$

t = 1 sec (Gap)

2.

$y = ax - bx^2$

$y = x\tan\theta - \dfrac{gx^2}{24^2\cos^2\theta}$ on comparing

$\tan\theta = a$ and $b = g/2u^2\cos^2\theta$

$\theta = \tan^{-1}(a)$

For u_{max} $\dfrac{dy}{dx} = 0 \Rightarrow a-2bx=0$

$x = \dfrac{a}{2b}$

3. Acceleration w.r.t. box is g cos θ

$T = \dfrac{2u_y}{a_y} = \dfrac{2u\sin\alpha}{g\cos\theta}$

for Box $a_x = 0$

$\therefore R = \dfrac{2u\sin\alpha . u\cos\alpha}{g\cos\theta}$

$= \dfrac{u^2\sin 2\alpha}{g\cos\theta}$

3(b) $\vec{v}_{PB} = \vec{v}_P - \vec{v}_B$

$\vec{v}_{PB} = u\cos(\alpha+\theta)\,\hat{i} + u\sin(\alpha+\theta)\,\hat{j}$

$\vec{v}_B = -v\cos\theta\hat{i} - v\sin\theta\hat{j}$

$\therefore \vec{v}_P = u\cos(\alpha+\theta)\,\hat{i} + u\sin(\alpha+\theta)\,\hat{j} - v\cos\theta\hat{i} - v\sin\theta\hat{j}$

3 (b) $\hat{i}$ component zero $\Rightarrow v = u\dfrac{\cos(\alpha+\theta)}{\cos\theta}$

4. B

Nahi...........

5. A

$\therefore v^2 = u^2 \pm 2gh$

$\therefore$ v – h graph gives parabola

initially v is ↓ and after collision v ↑

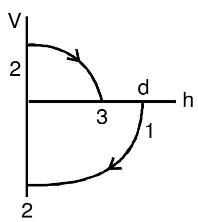
At t=0

h = d

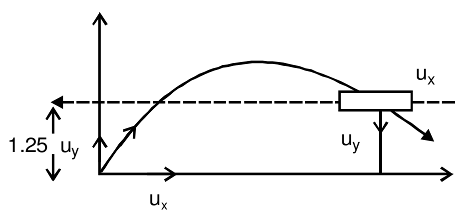
1 → 2 v ↑ (Downwards)

At 2 v change direction

At 2-3 v↓ (upwards)



6.



$v_y = u_y + a_y t$
$-u_x = u_y - gt$ -(1)

$u_x.t = 3 + \frac{1}{2} \times 1.5t^2$ - (2)

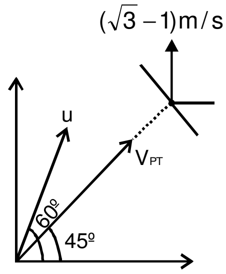
$1.25 = u_y t - \frac{1}{2} gt^2$ -(3)

on solving u = 7.29 m/sec
t= 1 sec

7.

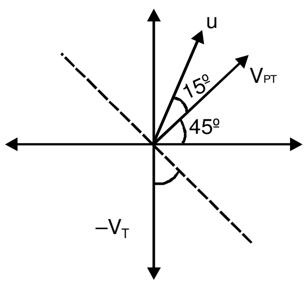
Socho

$\phi = 45 \times \frac{4}{3} = 60º$



$\vec{v}_{PT} = \vec{v}_P - \vec{v}_T$

$v_T \cos 45º = u \sin 15º$



$\frac{v_T}{\sqrt{2}} = \frac{u.\left(\sqrt{3}-1\right)}{2\sqrt{2}}$

u = 2 m/s

8. B

Area $= v_f - v_i$ a= $\frac{dv}{dt}$

$\frac{1}{2} \times 11 \times 10 = v_f - 0$ dv = $\int$ adt

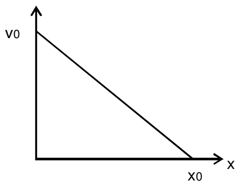
$v_f = 55$ m/s

9. C
Nahi.......

10. B

$v\frac{dv}{dx}$ is negative

$\frac{dv}{dx}$ is constant



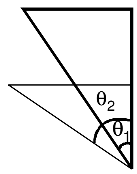
but , v is decreasing with x

$\therefore \left| v\frac{dv}{dx} \right|$ is decreasing

$\therefore$ B is correct.

11. B

$\theta_2 > \theta_1$



12. $t = \frac{2u\sin\theta}{g} \therefore t = \frac{2 \times 10 \times \sqrt{3}/2}{10} = \sqrt{3}$ sec

Now

$S = ut + \frac{1}{2} at^2$

$\therefore 1.15 = 5 \times \sqrt{3} - \frac{1}{2} \times a \times 3$

or $1.15 = 5\sqrt{3} - \frac{3a}{2}$

or a = 5 m/s^2