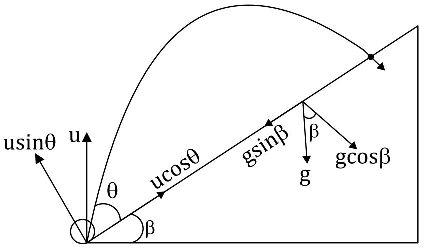
DPP – 03

Solution

Link to View Video Solution: Click Here

1. $\because$ for inclined projectile



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

If it will hit the ground with 90°

i.e. $v_x = 0$.

$\because v_x = u_x - a_x T \Rightarrow 0 = u_x - a_x T.$

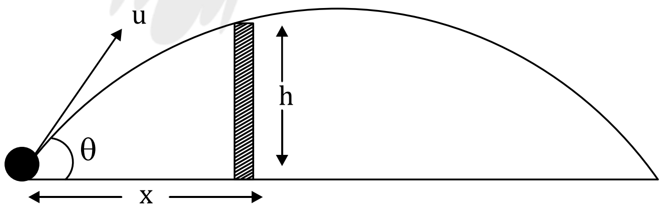
$u_x = a_x T$

$u\cos\theta = g\sin\beta \cdot \dfrac{2u\sin\theta}{g\cos\beta}$

$\theta = \cot^1 [2\tan\beta]$

i.e. $k = 2$.

2.



$h = x\tan\theta - \dfrac{gx^2}{2u^2\cos^2\theta}$ [standard eq.]

$h = x\tan\theta - \dfrac{gx^2\sec^2\theta}{2u^2}$

Link to View Video Solution: Click Here

$$h = x\tan\theta - \frac{gx^2}{2u^2}(1+\tan^2\theta)$$

$$2u^2h = 2u^2x\tan\theta - gx^2(1+\tan^2\theta).$$

$$gx^2\tan^2\theta - 2u^2x\tan\theta + 2u^2h + gx^2 = 0 \quad \_\_\_\_\_(1)$$

for crossing the wall roots of above equation should be real.

i.e. $4u^4x^2 - 4gx^2(2u^2h + gx^2) \ge 0$

$$u^4 - 2u^2gh - g^2x^2 \ge 0$$

$$u^4 - 2u^2gh + h^2g^2 - g^2x^2 - h^2g^2 \ge 0$$

$$(u^2 - gh)^2 \ge g^2(x^2 + h^2).$$

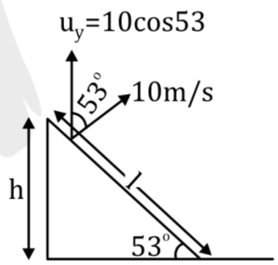
$$u \ge \sqrt{hg + g\sqrt{x^2+h^2}}$$

$$u \ge \sqrt{g\left(h + \sqrt{h^2+x^2}\right)}$$

3. $h = l\sin 53 = 10\sin 53$

$h = 8$ meter

$u_y = 10\cos 53 = 6$



$$\therefore\ h = u_yt + \frac{1}{2}gt^2$$

$$\therefore -8 = 6t + \frac{1}{2}\times 10\times t^2$$

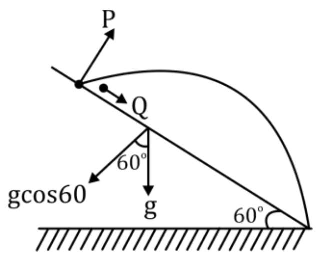
$$5t^2 - 6t - 8 = 0$$

$$(t-2)(5t+4) = 0$$

$t = 2$ seconds

Link to View Video Solution: Click Here

4. If particle P and Q are collide to each other after 4 seconds i.e. flight time of P is 4 seconds.

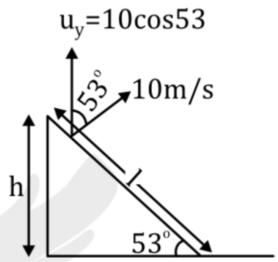


$$T = \frac{2u}{g\cos 60} = \frac{2u}{10\times\frac{1}{2}}$$

$$4 = \frac{4u}{10}$$

$$u = 10 \text{ m/seconds}$$

5. $h = l\sin 53 = 10\sin 53$



$h = 8$ meter

$u_y = 10\cos 53 = 6$

$$\therefore\ h = u_y t + \frac{1}{2}gt^2$$

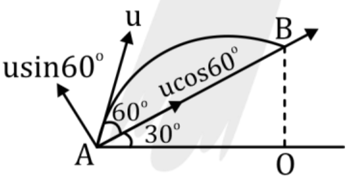
$$\therefore -8 = 6t + \frac{1}{2}\times 10\times t^2$$

$$5t^2 - 6t - 8 = 0$$

$$(t-2)(5t+4) = 0$$

$t = 2$ seconds

6.

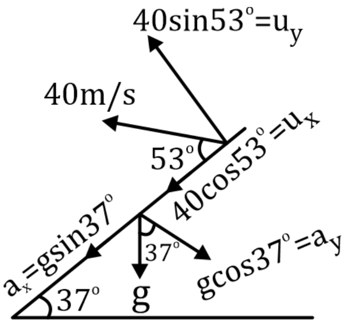


$$\text{Range} = AO = u_x \times t = u\cos 60 \times t = \frac{ut}{2}.$$

$$AB = \frac{AO}{\cos 30} = \frac{ut}{\sqrt{3}}$$

Link to View Video Solution: Click Here

7. $\because T = \frac{2u_y}{a_y}$



$T = \frac{2 \times 40 \sin 53}{g \cos 37}$

$T = 8 \text{seconds}$

$\because a_x = g \sin 37 = 6$

$a_y = g \cos 37° = 8$

$u_y = 40 \sin 53 = 32$

$u_x = 40 \cos 53 = 24$

$R = u_x T + \frac{1}{2} a_x T^2$

$= 24 \times 8 + \frac{1}{2} \times 6 \times 8^2$

$= 192 + 3 \times 64$

$R = 384 \text{ meter}$

particle will cover maximum height in half flight of time.

i.e. $t = 4$ seconds

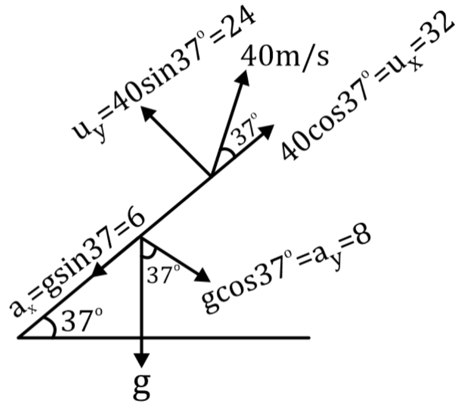
$h = 32 \times 4 - \frac{1}{2} \times 8 \times 4^2$

$h = 64$

Link to View Video Solution: Click Here

8. $T = \frac{2u_y}{a_y} = \frac{2\times24}{8}$

$T = 6$ seconds



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

$= 32 \times 6 + \frac{1}{2} \times (-6) \times 6^2$

$R = 84$

$h = 24 \times 3 - \frac{1}{2} \times 8 \times (3)^2$

$h = 36$ m