



$$g = 9.81 \text{ ms}^{-2}$$

Calculate, max height, time of flight & range.

$$V_H = 35 \cos 25^\circ = 31.72 \text{ ms}^{-1}$$

$$V_V = 35 \sin 25^\circ = 14.79 \text{ ms}^{-1}$$

Considering vertical constant acceleration motion to highest point.

$$E_k \rightarrow E_{\text{grav}}$$

$$\frac{mv^2}{2} = mgh$$

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

$$= \frac{14.79^2}{2 \times 9.81}$$

$$= 11.15 \text{ m}$$

$$v^2 = u^2 + 2as$$

$$s = ?$$

$$u = 14.79 \text{ ms}^{-1}$$

$$v = 0 \text{ ms}^{-1} \quad \therefore u^2 = -2as$$

$$a = -9.81 \text{ ms}^{-2}$$

$$t \times \quad \therefore s = \frac{u^2}{-2a}$$

$$= \frac{14.79^2}{-2 \times -9.81}$$

$$= 11.15 \text{ m}$$

Time of flight =  $2 \times$  time to fall as motion symmetrical

$$s = -11.15 \text{ m}$$

$$u = 0 \text{ ms}^{-1}$$

$$v = ?$$

$$a = -9.81$$

$$t = ?$$

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

$$\text{as } u = 0$$

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

$$\therefore t = \sqrt{\frac{2s}{a}} = \sqrt{\frac{-11.15 \times 2}{-9.81}} = 1.508 \text{ s}$$

$$\therefore \text{time of flight} = 2 \times 1.508 = \underline{3.02 \text{ s}}$$

OR Assume flight is symmetrical so for whole flight

$$s = 0$$

$$u = +14.79$$

$$v = -14.79$$

$$a = -9.81$$

$$t = ?$$

$$v = u + at$$

$$\therefore t = \frac{v - u}{a} = \frac{-14.79 - 14.79}{-9.81} = \underline{3.02 \text{ s}}$$

OR For whole flight

$$S = 0$$

$$U = 14.79 \text{ ms}^{-1}$$

$$v = x$$

$$a = -9.81$$

$$t = ?$$

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

$$0 = 14.79t + \frac{1}{2}(-9.81)t^2$$

$$\text{or } 0 = -4.905t^2 + 14.79t$$

which is a quadratic

$$a = -4.905$$

$$b = 14.79$$

$$c = 0$$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

since  $c = 0$

$$t = \frac{-b \pm b}{2a} = \frac{-14.79 \pm 14.79}{-9.81}$$

$$= 0 \text{ s} \quad \text{or} \quad \frac{3.02 \text{ s}}{\text{End of flight}}$$

Start of flight

Range =  $V_H \times t$  as motion is constant velocity

$$= 31.72 \times 3.02 = \underline{95.6 \text{ m}}$$