1. An Object is launched at a Velocity of 40 m/s in a direction making an angle of 50° upward with the horizontal.

Q1. What is the maximum height reached by the Object?

Q2. What is the Objects total flight time (between launch and touching the ground)?

Q3. What is the Objects horizontal range (maximum x above ground)?

Q1. Given that,

Velocity, $V_0 = 40$ m/s

angle, $\theta = 50°$

let, Maximum height, H

We know that, $g = 9.8$

We know that, $H = \dfrac{V_0^2 \sin^2\theta}{2g}$

$= \dfrac{(40)^2 \times (\sin 50)^2}{2 \times 9.8}$

$= 47.91$

Q2. Given that,

$V_0 = 40$ m/s

$\theta = 50°$

$g = 9.8$

let, total flight time, T

We know that, $T = \dfrac{2 V_0 \sin\theta}{g}$

$= \dfrac{2 \times 40 \times \sin 50}{9.8}$

$= 6.26$ s

Q3. Given that,

$$V_0 = 40 \, ms^{-1}$$

angle, $\theta = 50°$

let, horizontal Range, R

We know that,

$$R = \frac{V_0^2 \sin 2\theta}{g}$$

$$= \frac{(40)^2 \times \sin 2 \cdot 50}{9 \cdot 8}$$

$$= 160 \cdot 79$$

2. A ball kicked horizontally with a speed of 10 m/s from a height of 5m. How long does it take for the ball to hit the ground?

Given that,

$$h = 5m$$
$$g = 9 \cdot 8$$

We know, $h = V_0 t + \frac{1}{2} g t^2$

$$\Rightarrow 2h = 0 + g t^2$$

$$\Rightarrow g t^2 = 2h$$

$$\Rightarrow t^2 = \frac{2h}{g}$$

$$\Rightarrow t^2 = \frac{2 \times 5}{9 \cdot 8}$$

$$\Rightarrow \sqrt{t^2} = \sqrt{1 \cdot 03}$$

$$\therefore t = 1 \cdot 015$$

3. If a stone is thrown vertically upward with a velocity of 15 m/s, how high will it go before it starts coming back down?

Given that,

   initial velocity, $U = 15$ m/s

   final velocity, $V = 0$ m/s

We know that,

$$V^2 = U^2 + 2gh$$

$$\Rightarrow 0^2 = 15^2 + 2 \times (-9.8) \times h$$

$$\Rightarrow 0 = 225 - 19.6\,h$$

$$\Rightarrow 19.6\,h = 225$$

$$\Rightarrow h = \frac{225}{19.6}$$

$$\therefore h = 11.47 \text{ m}$$

4. An object is launched at angle 30 degrees to the horizontal with an initial speed of 20 m/s. Calculate the time it takes for the object to reach its maximum height.

Given that,
  angle, $\theta = 30°$
  Initial Velocity, $V_0 = 20$ m/s

We know that,
$$t = \frac{V_0 \sin \theta}{g}$$

$$= \frac{20 \times \sin 30°}{9.8}$$

$$= 1.035$$

5. A fielder throws a ball with an initial velocity of 30 m/s at an angle of 45 degrees to the horizontal. Calculate the horizontal and vertical components of the initial velocity?

Given that,
  angle, $\theta = 45°$
  Initial Velocity, $V_0 = 30$ m/s

We know that,
  the horizontal Component is $= V_0 \cos \theta$
  $$= 30 \cos 45$$
  $$= 21.22$$

  the vertical Component is $= V_0 \sin \theta$
  $$= 30 \sin 45$$
  $$= 21.22$$

6. If an object is dropped from a height of 50 meter, how long will it take reach the ground?

Given that,

$$h = 50 \text{ meter}$$
$$g = 9.8$$

We know,

$$h = v_0 t + \tfrac{1}{2} g t^2$$

$$\Rightarrow 2h = 0 + g t^2$$

$$\Rightarrow t^2 = \frac{2h}{g}$$

$$\Rightarrow t^2 = \frac{2 \times 50}{9.8}$$

$$\Rightarrow \sqrt{t^2} = \sqrt{10.205}$$

$$\therefore t = 3.2$$

7. A stone is thrown horizontally off a cliff with a speed of 15 m/s. Calculate the time it takes for the stone to reach the ground, neglecting air resistence.

8. A soccer player kicks a ball at an angle of 60 degrees to the horizontal with an initial speed of 25 m/s. Calculate the vertical velocity after 5 seconds.

Given that,

angle, $\theta = 60°$

Initial velocity $= 25 \, ms^{-1}$

We know that,

$$V = U_0 \sin\theta - gt$$

$$= 25 \sin 60 - 9.8 \times 5$$

$$= 21.65 - 49$$

$$= -27.35 \, ms^{-1}$$

The negative sign indicates that the final velocity is directed downward.

9. A paper airplane is launched horizontally from a height of 2m with a velocity 5 m/s. How long does it take for the airplane to hit the ground.

Given that,

maximum height $= 2m$

initial velocity $= 0 \, m/s$

We know that,

$$h = V_0 t + \frac{1}{2} gt^2$$

$$\Rightarrow 2 = 0 + \frac{1}{2} \times 9.8 \times t^2$$

$$\Rightarrow 2 \times 2 = 9.8 \, t^2$$

$$\Rightarrow 9.8 \, t^2 = 2 \times 2$$

$$\Rightarrow t^2 = \frac{2 \times 2}{9.8}$$

$$\Rightarrow \sqrt{t^2} = \sqrt{\frac{4}{9.8}}$$

$$\therefore t = 0.635 \, s$$

10. An object falls freely from rest. Calculate its velocity after 3 seconds.

Given that,
$$t = 3 s$$
$$g = 9.8$$

We know that,

Velocity, $V = u + gt$
$$= 0 + 9.8 \times 3$$
$$= 29.4 \ m/s$$

11. A car accelerates from 20 m/s to 40 m/s in 4 seconds. Find its acceleration.

Given that, initial velocity, $U = 20 \ m/s$

final velocity, $V = 40 \ m/s$
$$t = 4 s$$

We know that,

acceleration, $a = \dfrac{V - u}{t}$
$$= \dfrac{40 - 20}{4}$$
$$= 5 \ m/s$$