

Physics - 9th Class
Ch#2 Kinematics

①

Numerical

2.1:- Draw the representative line of the following vectors.

- (a) A velocity of 400 m s^{-1} making an angle of 60° with x-axis.

Solution:-

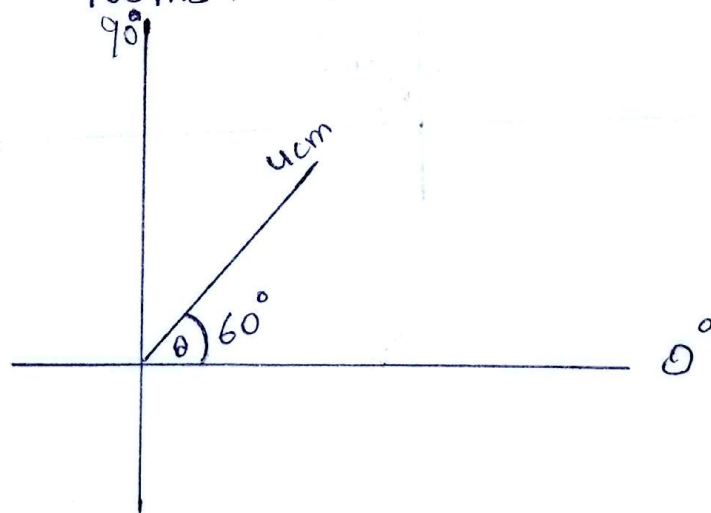
$$\text{Velocity} = v = 400 \text{ m s}^{-1}$$

$$\text{Angle} = \theta = 60^\circ$$

Let:-

$$100 \text{ m s}^{-1} = 1 \text{ cm}$$

$$\text{So } 400 \text{ m s}^{-1} = 4 \text{ cm}$$



②

(b) A Force of 50N, making an angle of 120° with x-axis.

Solution:-

$$\text{Force} = F = 50\text{N}$$

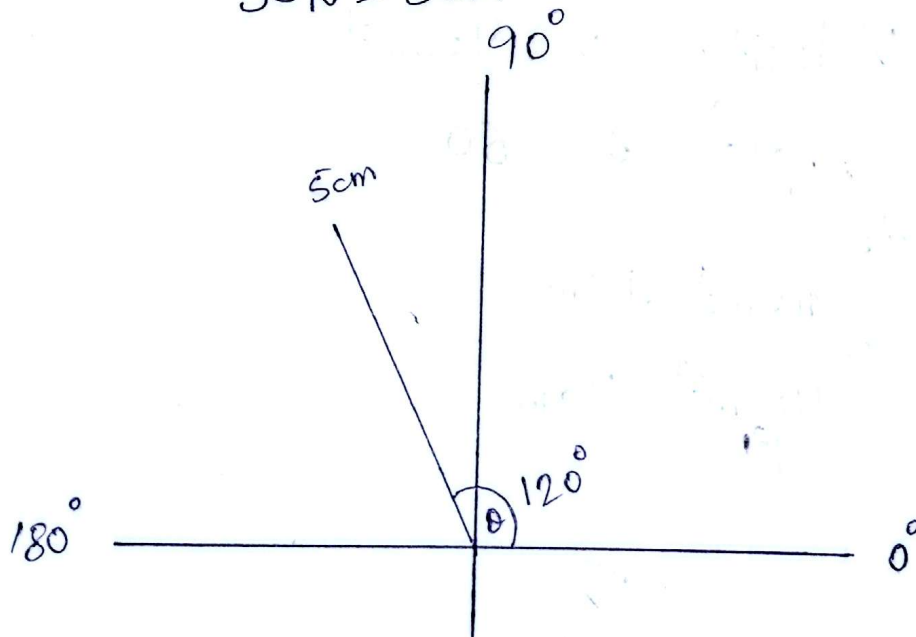
$$\text{Angle} = \theta = 120^\circ$$

Let:-

$$10\text{N} = 1\text{cm}$$

So,

$$50\text{N} = 5\text{cm}$$



3

2.2:- A car is moving with an average speed of 72 km h^{-1} . How much time will it take to cover a distance of 360 km ?

Solution:-

Given Data:-

Average speed = $V_{av} = 72 \text{ km h}^{-1}$

Distance = $S = 360 \text{ km}$

To find:-

Time = $t = ?$

Solve:-

$$V_{av} = \frac{S}{t}$$

By putting value

$$72 = \frac{360}{t}$$

$$t = \frac{360}{72}$$

$$\boxed{t = 5 \text{ h}}$$

Result:-

It take 5 h to cover 360 km .

(4)

2.3:- A truck starts from rest. It reaches a velocity of 90 kmh^{-1} in 50 seconds. Find its average acceleration.

Give Data:-

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

$$V_f = 90 \text{ kmh}^{-1}$$

$$V_f = \frac{90 \times 1000}{3600}$$

$$\therefore K = \frac{10^3}{10} = 1000$$

$$V_f = 25 \text{ ms}^{-1}$$

$$t = 50 \text{ s}$$

To Find:-

$$a_{av} = ?$$

Solution:-

$$V_f = V_i + at$$

$$25 = 0 + a(50)$$

$$a = \frac{25}{50}$$

$$a = 0.5 \text{ ms}^{-2}$$

Result:-

its average acceleration is 0.5 ms^{-2}

(5)

2.4:- A car passes a green traffic signal while moving with a velocity of 5 m s^{-1} . It then accelerates to 1.5 m s^{-2} . What is the velocity of car after 5 seconds?

Given Data:-

$$v_i = 5 \text{ m s}^{-1}$$

$$a = 1.5 \text{ m s}^{-2}$$

$$t = 5 \text{ s}$$

To Find:-

$$v_f = ?$$

Solution:-

$$v_f = v_i + at$$

$$v_f = 5 + (1.5)(5)$$

$$v_f = 5 + 7.5$$

$$\boxed{v_f = 12.5 \text{ m s}^{-1}}$$

Result:-

After 5 second its velocity will be 12.5 m s^{-1} .

⑥

2.5:- A motorcycle initially travelling at 18 km h^{-1} accelerates at constant rate of 2 m s^{-2} . How far will the motorcycle go in 10 seconds?

Given Data:-

$$v_i = 18 \text{ km h}^{-1}$$
$$= \frac{18 \times 1000}{3600}$$

$$v_i = 5 \text{ m s}^{-1}$$

$$a = 2 \text{ m s}^{-2}$$

$$t = 10 \text{ s}$$

To Find:-

$$S = ?$$

Solution:-

$$S = v_i t + \frac{1}{2} a t^2$$

$$S = (5)(10) + \frac{1}{2}(2)(10)^2$$

$$S = 50 + 100$$

$$\boxed{S = 150 \text{ m}}$$

Result:-

It cover 150m
in 10 seconds

(7)

2.6:- A wagon is moving on the road with a velocity of 54 kmh^{-1} . Brakes are applied suddenly. The wagon covers a distance of 25 m before stopping. Determine the acceleration of the wagon.

Given Data:-

$$v_i = 54 \text{ kmh}^{-1}$$

$$= \frac{54 \times 1000}{3600} \text{ ms}^{-1}$$

$$v_i = 15 \text{ ms}^{-1}$$

$$s = 25 \text{ m}$$

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

To Find:-

$$a = ?$$

Solution:-

$$2as = v_f^2 - v_i^2$$

$$2a(25) = (0)^2 - (15)^2$$

$$50a = -225$$

$$a = \frac{-225}{50}$$

$$a = -4.5 \text{ ms}^{-2}$$

Result:-

Acceleration of the wagon is -4.5 ms^{-2}

⑧

2.7:- A stone is dropped from a height of 45m. How long will it take to reach the ground? What will be its velocity just before hitting the ground?

Given Data:-

$$S = 45\text{m}$$

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

$$g = 10\text{ms}^{-2}$$

To Find:-

$$V_f = ?$$

$$t = ?$$

Solution:-

To find V_f we use 3rd equation

$$2gS = V_f^2 - V_i^2$$

$$2(10)(45) = V_f^2 - 0^2$$

$$900 = V_f^2$$

Taking $\sqrt{\quad}$ on b/s.

$$\sqrt{V_f^2} = \sqrt{900}$$

$$\boxed{V_f = 30\text{ms}^{-1}}$$

Now,

To find Time t we use 1st equation. 9

$$V_f = V_i + gt$$

$$30 = 0 + 10t$$

$$30 = 10t$$

$$t = \frac{30}{10}$$

$$\boxed{t = 3 \text{ se}}$$

2.8:- A car travels 10km with an average velocity of 20 m s^{-1} . Then it travels in the same direction through a diversion at an average velocity of 4 m s^{-1} for the next 0.8km. Determine the average velocity of car for the total journey.

Given Data:-

$$S_1 = 10 \text{ km} = 10,000 \text{ m}$$

$$V_1 = 20 \text{ m s}^{-1}$$

$$S_2 = 0.8 \text{ km} = 800 \text{ m}$$

$$V_2 = 4 \text{ m s}^{-1}$$

(10)

To find:-

$$V_{av} = ?$$

Solution:-

$$V_{av} = \frac{S_1 + S_2}{t_1 + t_2} = \frac{S}{t}$$

First find time t_1 and t_2

$$t_1 = \frac{S_1}{V_1}$$

$$t_1 = \frac{10,000}{20} = 500 \text{ s}$$

$$t_2 = \frac{S_2}{V_2}$$

$$t_2 = \frac{800}{4} = 200 \text{ s}$$

Now,

$$V_{av} = \frac{10000 + 800}{500 + 200}$$
$$= \frac{10,800}{700}$$

$$V_{av} = 15.4 \text{ m s}^{-1}$$

Result:-

Velocity of car is 15.4 m s^{-1} before hitting the ground.

2.9:- A ball is dropped from the top of a (11) tower. The ball reaches the ground in 5 seconds. Find the height of the tower and the velocity of the ball with which it strikes the ground.

Given Data:-

$$v_i = 0 \text{ m s}^{-1}$$

$$t = 5 \text{ s}$$

$$g = 10 \text{ m s}^{-2}$$

To find:-

$$h = s = ?$$

$$v_f = ?$$

Solution:-

To find v_f we use 1st equation

$$v_f = v_i + g t$$

$$= 0 + 10(5)$$

$$\boxed{v_f = 50 \text{ m s}^{-1}}$$

To find s we use 2nd equation

$$s = v_i t + \frac{1}{2} g t^2$$

$$= (0)(5) + \frac{1}{2} (10)(5)^2$$

$$= 5(25)$$

$$s = 125$$

So,

$$\boxed{h = 125 \text{ m}}$$

(12)

2.10:- A cricket ball is hit so that it travels straight up in the air. An observer notes that it took 3 seconds to reach the highest point. What was the initial velocity of the ball? If the ball was hit 1 m above the ground, how high did it rise from the ground?

Given Data:-

$$t = 3 \text{ s}$$

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

$$g = -10 \text{ ms}^{-2}$$

To find:-

$$h = S = ?$$

$$V_i = ?$$

Solution:-

To find V_i we use 1st equation

$$V_f = V_i + gt$$

$$0 = V_i + (-10)(3)$$

$$-V_i = -30$$

$$\boxed{V_i = 30 \text{ ms}^{-1}}$$

To find S we use 2nd equation

$$S = V_i t + \frac{1}{2} g t^2$$

$$= (30)(3) + \frac{1}{2} (-10)(3)^2$$

$$= 90 - 5(9)$$

$$= 90 - 45$$

$$\boxed{S = 45 \text{ m}}$$

So, $h = 45 + 1 = 46 \text{ m}$