Chapter 2

Kinematics

Define Mechanics ?

Mechanics is the branch of physics that deals with the motion of objects and the forces that change it.

How Many Type of Mechanics write its name ?

Mechanics is divided into two branches:

1.Kinematics

2. Dynamics

Define Kinematics ?

Kinematics is the study of motion of objects without referring to forces.

Define dynamics ?

Dynamics deals with forces and their effect on the motion of objects.

Differentiate between Scalars and Vectors ?

Scalar :

A scalar is that physical quantity which can be described completely by its magnitude only.

Example :When we ask a shopkeeper to give us 5 kilograms of sugar, he can fully understand how much quantity we want. It is the magnitude of mass of sugar. Mass is a scalar quantity.

Vector :

A vector is that physical quantity which needs magnitude as well as direction to describe it completely.

Example : The examples of vector quantities are displacement, velocity, acceleration, weight, force, etc. The velocity of a car moving at 90 kilometre per hour (25 m s −1) towards north can be represented by a vector. Velocity is a vector quantity because it has magnitude 25 m s −1 and direction (towards north).

How to symbol used for a vector ?

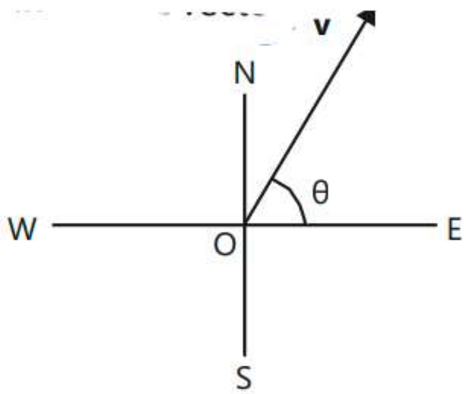
Symbol used for a vector is a bold face letter such as A, v, and etc. Since we cannot write in bold face script on paper, so a vector is written as the letter with a small arrow over it, i.e. →A, →v,→F, →d.

Write graphically mathod to Represent a Vector.

A vector can be represented graphically by drawing a straight line with an arrow head at one end. The length of line represents the magnitude of the vector quantity according to a suitable scale while the direction of arrow indicates the direction of the vector.

How to represent the direction ?

To represent the direction, two mutually perpendicular lines are required. We can draw one line to represent east-west direction and the other line to represent north-south direction as shown in Fig. The direction of a vector can be given with respect to these lines. Mostly, we use any two lines which are perpendicular to each other. Horizontal line (x x) is called x-axis and vertical line (y y) is called y-axis Fig. The point where these axes meet is known as origin. The origin is usually denoted by O. These axes are also called Parralel axis.

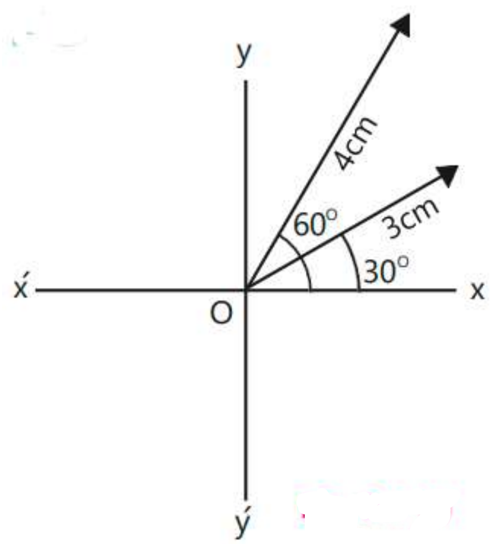


Define Resultant Vector ?

We can add two or more vectors to get a single vector. This is called as resultant vector. It has the same effect as the combined effect of all the vectors to be added. We have to determine both magnitude and direction of the resultant vector.

Write a short note on Addition of Vectors by Graphical Method ?

Let us add two vectors v1 and v2 having magnitudes of 300 N and 400 N acting at angles of 30o and 60o with x-axis. By selecting a suitable scale 100 N = 1cm, we can draw the vectors as shown in Fig.



Define head-to-tail rule ?

To add a number of vectors, redraw their representative lines such that the head of one line coincides with the tail of the other. The resultant vector is given by a single vector which is directed from the tail of the first vector to the head of the last vector.

Define Rest and Motion with example ?

If a body does not change its position with respect to its surroundings, it is said to be at rest.

Example : Suppose a motorcyclist is standing on the road. An observer sees that he is not changing his position with respect to his surroundings.If a body continuously changes its position with respect to its surroundings, it is said to be in motion.

Motion

If a body continuously changes its position with respect to its surroundings, it is said to be in motion.

Example : A person standing in the compartment of a moving train is at rest with respect to the other passengers in the compartment but he is in motion with respectto an observer standing on the platform of a railway station.

How Many Types of Motion Explain .

there are three types of motion of bodies.

1. Translatory motion

2. Rotatory motion

3. Vibratory motion

1. Translatory Motion :

If the motion of a body is such that every particle of the body moves uniformly in the same direction, it is called tanslatory motion.

For example: the motion of a train or a car is tanslatory motion .

Translatory motion can be of three types:

(i.) Linear Motion
(ii.) Random Motion
(iii.) Circular Motion

(i.) Linear Motion:

If the body moves along a straight line, it is called linear motion. A freely falling body is the example of linear motion.

(ii.) Random Motion

If the body moves along an irregular path the motion is called random motion.

Example : The motion of bee is random motion

(i.) Circular Motion

The motion of a body along a circle is called circular motion. A Ferris wheel is also an example of circular motion.

2. Rotatory Motion

If each point of a body moves around a fixed point (axis), the motion of this body is called rotatory motion.

For example: the motion of an electric fan and the drum of a washing machine dryer is rotatory motion.

3. Vibratory Motion

When a body repeats its to and fro motion about a fixed position, the motion is called vibratory motion.

The motion of a swing in a children park is vibratory motion.

Differentiate between Distance and Displacement ?

Distance:

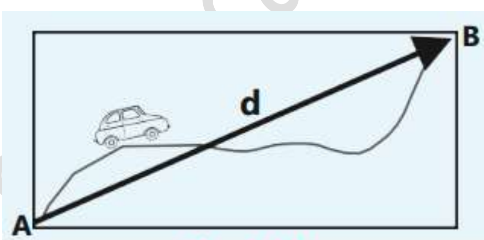
The distance is the length of actual path of the motion.

Example : Let a person be travelling from Lahore to Multan in a car. On reaching Multan, he reads the speedometer and notices that he has travelled a distance of 320 km. It is the distance travelled by that person.

Displacement:

The displacement of an object is a vector quantity whose magnitude is the shortest distance between the initial and final positions of the motion and its direction is from the initial position to the final position.

Example : Suppose a car travels from a position A to B. The curved line is the actual path followed by the car Fig. The total distance covered by the car will be equal to the length of the curved line AB. The displacement d is the straight line AB directed from A to B as indicated by the arrow head.



Define Speed and Velocity with Formula and unit ?

Speed:

The distance covered in unit time which is known as speed. If a body covers a distance S in time t, its speed v will be written as:

Speed= Distance /Time

$v = S/t$

or

$S = vt$

The speed is a scalar quantity. The SI unit of speed is $m\ s^{-1}$ or $km\ h^{-1}$.

Define instantaneous speed ?

It is obvious that speed of a vehicle does not remain constant throughout the journey. If the reading of the speedometer of the vehicle is observed, it is always changing. The speed of a vehicle that is shown by its speedometer at any instant is called instantaneous speed.

How to find average speed ?

Average speed= Total distance covered / Total time taken

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

Velocity:

The net displacement of a body in unit time is called velocity.

If a body moves from point A to B along a curved path. the displacement d is the straight line AB,

$$\text{Average velocity} = \frac{\text{Displacement}}{\text{Time}} \quad \text{or} \quad \mathbf{v}_{av} = \frac{\mathbf{d}}{t}$$

Velocity is a vector quantity. The SI unit of velocity is also m s –1 or km h–1

Uniform and Non-uniform Velocity?

Uniform Velocity:

The velocity is said to be uniform if the speed and direction of a moving body does not change.

Example :

A body moving with uniform velocity is the downward motion of a paratrooper.

Non-uniform Velocity

If the speed or direction or both of them change, it is known as variable velocity or non-uniform velocity.

Example :

A vehicle does not move in a straight line throughout its journey. It changes its speed or its direction frequently.

Define Acceleration ?

Acceleration is defined as the time rate of change of velocity.

Average acceleration= Change in velocity/Time taken

$$a_{av} = \frac{v_f - v_i}{t}$$

The SI unit of acceleration is = $m\,s^{-2}$.

Differentate between Uniform and Non-uniform Acceleration ?

Ans :

If time rate of change of velocity is constant, the acceleration is said to be uniform.

Define variable or non-uniform acceleration.

If anyone of the magnitude or direction or both of them changes it is called variable or non-uniform acceleration.

Define graph ?

A graph is a pictorial diagram in the form of a straight line or a curve which shows the relationship between two physical quantities. Usually, we draw a graph on a paper on which equally spaced horizontal and vertical lines are drawn. Generally, every 10th line is a thick line on the graph paper.

Define origin o.

The point where the two axes intersect each other is known as origin o.

What is independent and dependent variable ?

the independent quantity is taken along x-axis and dependent variable quantity along y-axis.

For example, in distance-time graph, t is independent and S is dependent variable. Therefore, t should be along x-axis and S along y-axis.

Explain Distance-Time Graph ?

1- Uniform Speed / straight line graph
2- Graph line is curved upward
3- Graph line is curved downwards

Uniform Speed / straight line graph:

Let a car be moving in a straight line on a motorway. Suppose that we measure its distance from starting point after every one minute, and record it in the table given below:

Time t (min)	0	1	2	3	4	5
Distance S (km)	0	1.2	2.4	3.6	4.8	6.0

Follow the steps given below to draw a graph on a centimetre graph paper:

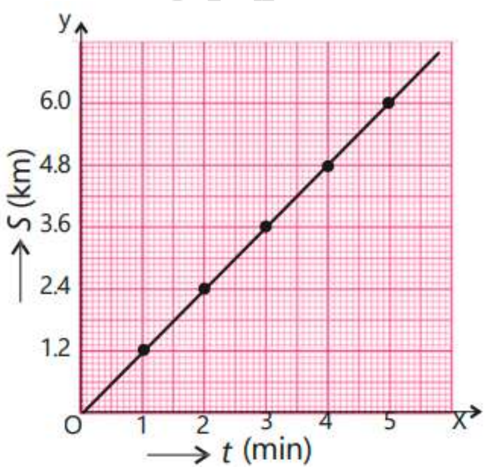
i. Take time t along x-axis and distance S along y-axis.

ii. ii. Select suitable scales (1 minute = 1 cm) along x-axis and (1.2 km =1 cm) along y-axis. The graph paper shown here is not to the scale.

iii. iii. Mark the values of each big division along x and y axes according to the scale.

iv. iv. Plot all pairs of values of time and distance by marking points on the graph paper.

v. v. Join all the plotted points to obtain a best straight line as shown in Fig. From the table, we can observe that car has covered equal distance in equal intervals of time. This shows that the car moves with uniform Speed.Therefore, a straight line graph between time and distance represents motion with uniform speed.



When Graph line is curved upward:

Now consider another journey of the car as recorded in the table given below:

Time t (min)	0	1	2	3	4	5
Distance S (km)	0	0.240	0.960	2.160	3.840	6.000

Follow the steps given below to draw a graph on a centimetre graph paper:

I. Take time t along x-axis and distance S along y-axis.

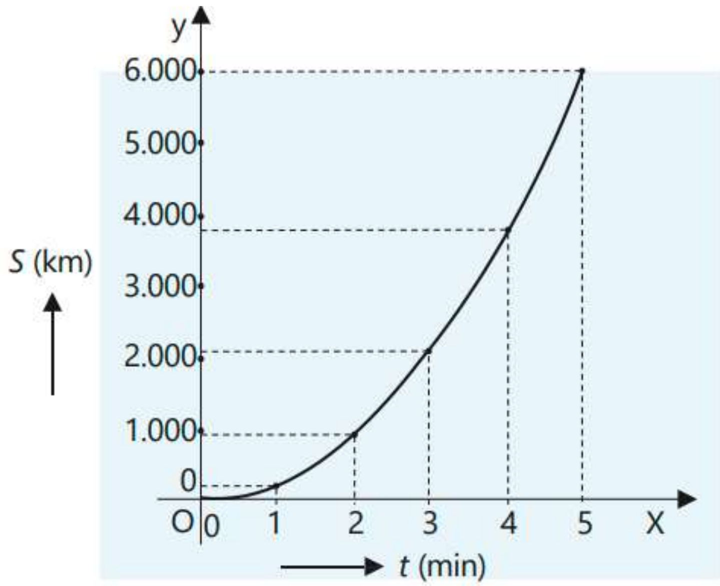
ii. Select suitable scales (1 minute = 1 cm) along x-axis and (1.000 km =1 cm) along y-axis. The graph paper shown here is not to the scale.

iii. Mark the values of each big division along x and y axes according to the scale.

iv. Plot all pairs of values of time and distance by marking points on the graph paper.

v. Join all the plotted points.

This is very obvious from the graph as shown in Fig. The graph line is curved upward. This is the case when the body (car) is moving with certain acceleration.



Graph line is curved downwards:

consider the following table:

Time t (min)	0	1	2	3	4	5
Distance S (km)	0	2.0	3.1	4.0	4.6	5.0

Follow the steps given below to draw a graph on a centimetre graph paper:

II. Take time t along x-axis and distance S along y-axis.

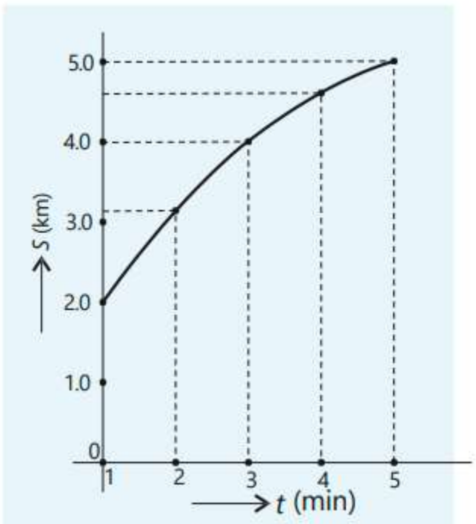
ii. Select suitable scales (1 minute = 1 cm) along x-axis and (1.0 km =1 cm) along y-axis. The graph paper shown here is not to the scale.

iii. Mark the values of each big division along x and y axes according to the scale.

iv. Plot all pairs of values of time and distance by marking points on the graph paper.

v. Join all the plotted points.

The graph line is curved downwards. This shows that distance travelled in the same interval of time goes on decreasing, so speed is decreasing. This is the case of motion with deceleration or negative acceleration as shown in Fig.



line is horizontal :

Time t (min)	0	1	2	3	4	5
Distance S (km)	1.2	1.2	1.2	1.2	1.2	1.2

Follow the steps given below to draw a graph on a centimetre graph paper:

i. Take time t along x-axis and distance S along y-axis.

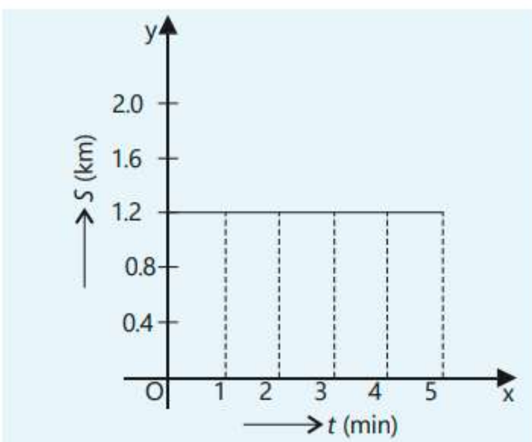
ii. Select suitable scales (1 minute = 1 cm) along x-axis and (0.4 km =1 cm) along y-axis. The graph paper shown here is not to the scale.

iii. Mark the values of each big division along x and y axes according to the scale.

iv. Plot all pairs of values of time and distance by marking points on the graph paper.

v. Join all the plotted points.

Graph line is horizontal shows that the distance covered by the car does not change with change in time. It means that the car is not moving; it is at rest.



Gradient of a Distance-Time Graph?

Gradient of the distance-Time graph is equal to the average speed of the body.

The gradient is the measure of slope of a line. Consider the distance-time graph of uniform speed again. Select any two values of time t_1 and t_2. Draw two vertical dotted lines at t_1 and t_2 on x-axis. These lines meet the graph at points P and Q. From these points draw horizontal lines to meet y-axis at S_1 and S_2 respectively . Distance covered in this time

interval is $S_2 - S_1 = S$

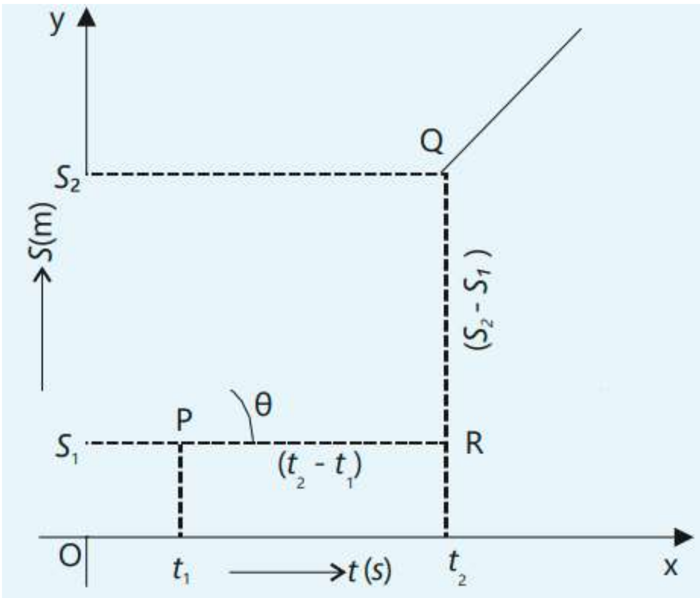
Time taken $t_2 - t_1 = t$

The slope or gradient ofthe graph is the measure oftangent θ ofthe triangle RPQ:

Slope = RQ /PR

$\tan\theta = y/x$

Commented [Ma1]:



Slope = $S_2 - S_1 / t_2 - t_1$ =S/ t

S = v , the average speed during the time interval t.

Now S/t = tan θ = slope of graph line.

Time t (s)	0	1	2	3	4	5
Speed v (m s – ¹)	0	8	16	24	32	40

Explain Speed-Time Graph with the help of exampls.

Suppose we can note the speed of the same car after every one second and record it in the table given below, we can draw the graph between speed v versus time t. This is called speed-time graph.

1. **Straight line Graph**
2. **Graph line is horizontal**

I. Straight line Graph :

Table

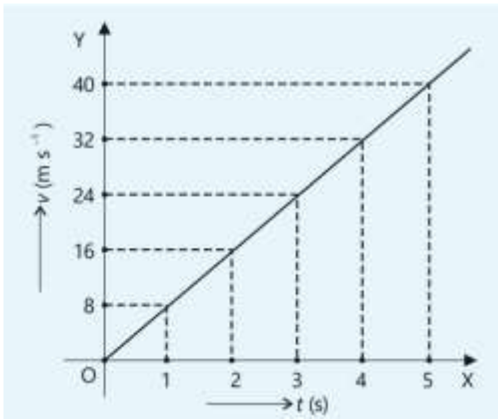
Time *t* (s)	0	1	2	3	4	5
Speed *v* ($m\ s^{-1}$)	0	8	16	24	32	40

Follow the steps given below to draw a graph on a centimetre graph paper:

I. Take t along x-axis and v along y-axis.

II. Scale can be selected as (1 s = 1 cm)(x-axis) and speed(08 m s^{-1} = 1 cm) along y-axis.

III. Shape of the graph is shown in Figure. It is a straight line rising upward. This shows that speed increases by the same amount after every one second. This is a motion with uniform acceleration. It is also evident from the table.



Now consider another case. The observations are recorded in the table given below:

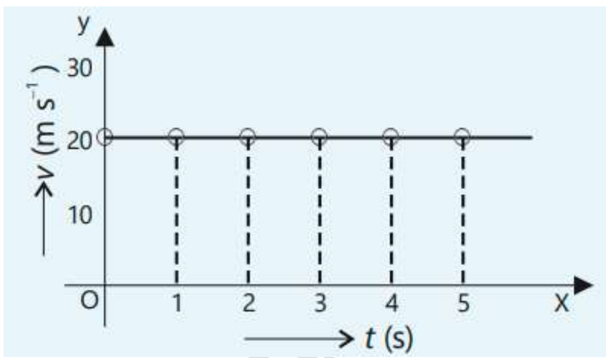
II. Graph line is horizontal :

Time t(s)	0	1	2	3	4	5
Speed v (ms^{-1})	20	20	20	20	20	20

Follow the steps given below to draw a graph on a centimetre graph paper:

1. Take t along x-axis and v along y-axis.
2. Scale can be selected as (1 s = 1 cm)(x-axis) and speed(10 m s $^{-1}$ = 1 cm) along y-axis.
3. Shape of the graph is shown in Figure.

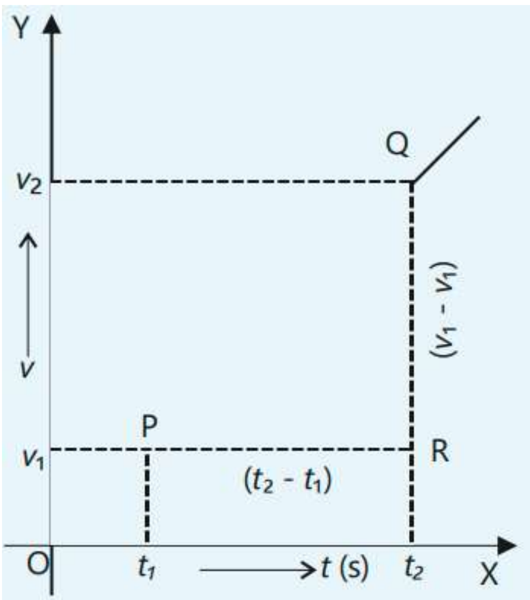
In this case, graph line is horizontal parallel to time x-axis. It shows that speed does not change with change in time. This is a motion with constant speed.



Explain Gradient of a Speed-Time Graph ?

Gradient of the speed-Time graph is equal to the average acceleration of the body.

The gradient is the measure of slope of a line. Consider the Speed-time graph of uniform speed again. Select any two values of time t1 and t2. Draw two vertical dotted lines at t1 and t2 on x-axis. These lines meet the graph at points P and Q. From these points draw horizontal lines to meet y-axis at S1 and S2 respectively as shown in Fig.



Slope = $(v_2 - v_1)/(t_2 - t_1)$

Slope = $\Delta v/t$

But $\Delta v/t = a$, the average acceleration.

This shows that when a car moves with constant acceleration, the velocity-time graph is a straight line which rises through same height for equal intervals of time.

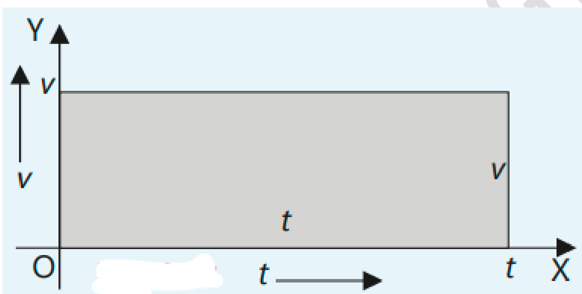
Explain Area Under Speed-Time Graph ?

Find Area Under Speed-Time Graph by rectangular ?

The area under the speed-time graph up to the time axis is numerically equal to the distance covered by the object.

The distance moved by an object can also be determined by using its speed-time graph.

For example, figure shows that the object is moving with constant speed v. For a time-interval t, the distance covered by the object as given by Eq. is v × t.



This distance can also be found by calculating the area under the speed-time graph. The area under the graph for time interval t is the area of rectangle of sides t and v. This area is shown shaded in Fig.2.23 and is equal to v × t. Thus, area under speed-time graph up to the time axis is numerically equal to the distance covered by the object in time t.

Find Area Under Speed-Time Graph by Triangle?

The area under the speed-time graph up to the time axis is numerically equal to the distance covered by the object.

Now consider another example shown in Fig. 2.24. Here, the speed of the object increases uniformly from 0 to v in time t. The average speed is given by

vav = 0 + v /2 = 1 v/2

Distance covered = average speed × time = 1/2 v × t. If we calculate the area under speed-time graph, it is equal to the area of the right-angled triangle shown shaded in Fig. 2.24. The base of the triangle is equal to t and the perpendicular is equal to v.

Area of a triangle = 1/2 (perpendicular × base)

=1/2 (v × t)

We see that this area is numerically equal to the distance covered by the object during the time interval t.

2.1 Define scalar and vector quantities.

Ans. Scalar quantity: The physical quantities which are described completely by its magnitude only called scalar quantity.

Vector quantity: Such physical quantities which can be described completely by magnitude along with direction are called vector quantity.

2.2 Give 5 examples each for scalar and vector quantities.

Ans.

Examples of scalar quantities:(i) Mass(ii) Length(iii) Time(iv) Speed(v) Work

Example of vector quantities:(i) Velocity(ii) Displacement(iii) Force(iv) Momentum(v) Torque

2.3. State head-to-tail rule for addition of vectors.

Ans. To add a number of vectors, we draw their representative line such that the head of one coincides with the tail of the other, the resultant vector is given by a single vector which is directed from the tail of the first vector to the head of the last vector.

2.4. What are distance-time graph and speed-time graph?

Ans. A distance-time graph represents how the distance covered by an object changes with time. The slope of the graph represents the speed of the object.

X-axis represents time (in second minutes) etc.

Y-axis represents distance (in meter, kilometer) etc.

Speed- time graph:

A speed-time graph represents how the speed (or velocity) by an objects changes with time.The slope of the graph represents the acceleration of the object and the area under the graph represents the distance traveled."

X-axis represents time.

Y-axis represents speed.

2.5. Falling objects near the Earth have the same constant acceleration. Does this imply that a heavier object will fall faster than a lighter object?

Ans. No, heavier object does not fall faster than a lighter object due to Earth's constant acceleration due to gravity. Near the Earth's surface all object experience the same gravitational acceleration (9.8 ms-2 ignoring air resistance.

This means that in a vacuum, both heavy and light object will fall at the same rate and hit the ground simultaneously if dropped from the same height.

2.6. The vector quantities are sometimes written in scalar notation (not bold face). How is the direction indicated?

Ans. When the vector quantities are written in scalar notation (not bold face), their direction is indicated by a positive or negative sign or by specifying the angle or direction explintly in words, symbols or reference frames.

2.7. A body is moving with uniform speed. Will its velocity be uniform? Give reason.

Ans. No, a body moving with uniform speed may not necessarily have a uniform velocity.

Reason: Speed is a scalar quantity which describes magnitude only while velocity is a vector quantity which includes both the magnitude (speed) and direction of motion.

2.8. Is it possible for a body to have acceleration? When moving with:(i) Constant velocity(ii) Constant speed

Ans. (i) Constant velocity:

No, a body moving with constant velocity cannot have acceleration;

Reason: Acceleration is the rate of change of velocity. If the velocity is constant (both magnitude and direction), there is no change in velocity, and hence the acceleration is zero.

(ii) Constant speed:

Yes, a body can have acceleration while moving at constant speed if its direction of motion changes.
Reason: Acceleration is a vector quantity. If the speed is constant but the direction changes, the velocity changes.

Constructed Response Questions

2.1 Distance and displacement may or may not be equal in magnitude. Explain this statement.

Ans. Distance and displacement may differ because distance is the total path traveled, while displacement is the shortest path between the start and end points, with direction. They are equal only if the motion is along a straight line in one direction.

2.2.When a bullet is fired, its velocity with which it leaves the barrel is called the muzzle velocity of the gun. The muzzle velocity of one gun with a longer barrel is lesser than that of another gun with a shorter barrel. In which gun is the acceleration of the bullet larger? Explain your answer.

Ans. The gun with the shorter barrel has a larger acceleration of the bullet.

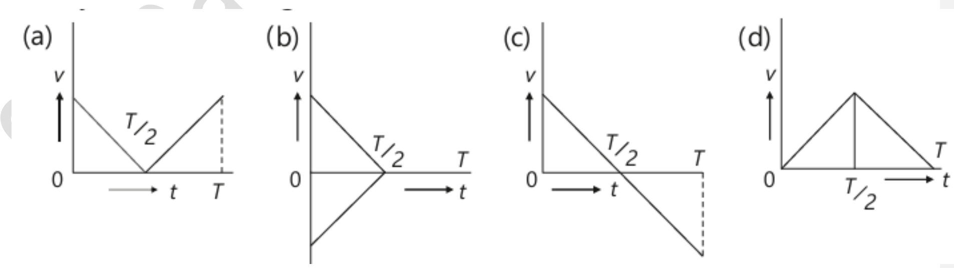
Reason: This is because the bullet in the shorter barrel achives a higher muzzle velocity. Over a shorter distance, implying a greater rate of change of velocity (acceleration) within that shorter distance, as acceleration is proportional to velocity change divided by the distance traveled.

2.3 For a complete trip, average velocity was calculated. Its value came out to be positive. Is it possible that its instantaneous velocity at any time during the trip had the negative value? Give justification of your answer.

Ans. Yes, average velocity depends on total displacement while instantaneous velocity shows the velocity at specific time.

For example : An object briefly move backward (negative velocity) but still have a positive average velocity if it moves forward overall.

2.4 A ball is thrown vertically upward with velocity v. It returns to the ground in time T. Which of the following graphs correctly represents the motion? Explain your reasoning.



Reason: Graph (a), is correct. The ball's velocity decreases linearly to zero at the highest point, then increase linearly in the opposite direction until it reaches the ground. The area under the graph represents displacement, which is zero when the ball returns to the ground.

2.6. Is it possible that the velocity of an object is zero' at an instant of time, but its acceleration is not zero? If yes, give an example of such a case.

Ans. Yes, it is possible. For example, at the highest point of a vertically thrown ball, its velocity becomes zero for an instant, but its acceleration due to gravity remains constant and non-zero (9.8 ms-2 downward).

Chapter 2

Numerical

2.1 Draw the representative lines of the following vectors:

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

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

Given Data:

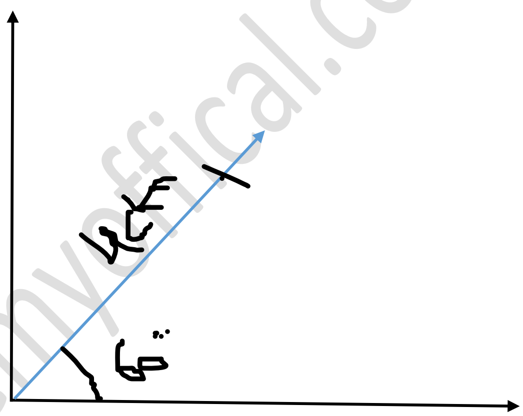
Velocity =V= 400 m s^{-1}

Angle = Ɵ= 60°

Solution :

100 m s^{-1} = 1 cm

400 m s^{-1} = 4 cm



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

Given Data :

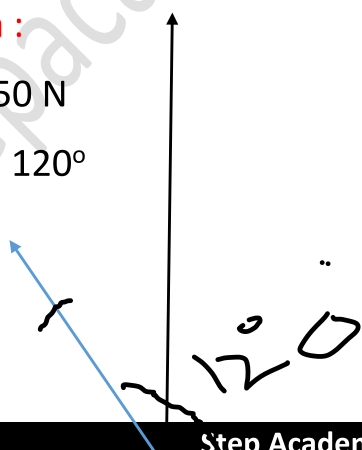
Force =F= 50 N

Angle = Ɵ= 120°

Solution :

10N=1cm

50N=5cm



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?

Given Data:

Average Speed =v= 72 km h^{-1}

Distance =d= 360 km

Time=t=?

Solution:

Speed= Distance / time

Time=Distance/speed

Time= 360/72

Time = t=5 hours

2.3

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

Given data:

Initial Velocity= v_i =o

Final Velocity= v_f =90 kmh^{-1}=90×1000m/3600sec=25ms^{-1}

Time=t=50 Sec

Average Acceleration =a=?

Solution :

a= v_f -v_i/2

a= 25-0/50

a=25/50

a=0.5 ms^{-2}

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 :

Initial Velocity=vi=5 $m\ s^{-1}$

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

Time =t=5 sec

Final Velocity=vf= ?

Solution :

Vf=vi + at

$V_f = 5 + (1.5 \times 5)$

$V_f = 5 + (7.5)$

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

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 :

Initaial Velocity = vi= 18 km h^{-1}

Vi= 18 ×1000/3600= 5 m s^{-1}

Acceleration = a = 2 m s^{-2}

Time = t= 10 sec

Distance = S= ?

Solution

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

$S = (5\times10) + 0.5\times2(10)^2$

S= 50 + 1 (100)

S= 50 + 100

S=150 m s^{-1}

2.6

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

Given Data :

Initial Velocity = vi= 54 km h^{-1}

Vi= $54\frac{1000}{3600}=\frac{54000}{3600}=15$ ms^{-1}

Final Velocity = vf= 0

Distance = S= 25m

Acceleration =a=?

Solution

$2aS=v_f^2-v_i^2$

$a=\frac{vf2-vi2}{2s}$

$a=0-(15)^2/\ 2\times25$

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

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

2.7

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

Given data :

Height = h=S= 45m

Time=t=?

Velocity=v_f=?

Now

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

$t=\sqrt{\frac{2s}{g}}$

$t=\sqrt{\frac{2\times45}{10}}$

$t=\sqrt{9}$

t=3 sec

$v_f=gt$

$v_f = 10 \times 3$

$v_f = 30 ms^{-1}$

2.8

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

Sol:

Distance=s=10Km=$10 \times 1000 = 10000m$

Average Velocity=V=20 ms^{-1}

$t_1 = \frac{\text{Distance}}{\text{Average Velocity}}$

$t_1 = \frac{10000}{20}$

t_1=500sec

Average velocity=4 m s^{-1}

Distance=S=0.8 km=$0.8 \times 1000 = 800m$

$t_2 = \frac{\text{Distance}}{\text{Average Velocity}}$

$t_2=\frac{800}{4}$

t_2=200sec

Total time= $t_{1+}\ t_{2=}$500+200=700Sec

Total Distance=10000+800=10800m

Average Velocity $=\frac{\text{Total distance}}{\text{total time}}$

Average Velocity $=\frac{10800}{700}$=15.4ms^{-1}

2.9

A ball is dropped from the top of a 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.

Sol:

Time=t=5 Sec

Height=h=s=?

S=$\frac{1}{2}gt2$

S=0.5(10$\times$ (5)2)

S=0.5(10$\times$ 25)

$S=0.5(250)$

$S=125m$

Velocity=vf=?

$V_f=gt$

$V_f=10\times 5$

$V_f=50ms^{-1}$

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?

Sol:

Time=t=3 sec

Initial Velocity=vi=?

Vf=vi+at "a=g"

Final velocity=vf=0

0=vi+10(3)

Vi=-30ms-1

Height=h=S=?

2as=vf^2-vi^2

S=$\frac{vf2-vi2}{2a}$

S=$\frac{0-(-30)2}{2(10)}$

S=$\frac{-900}{20}$

S=45m

Total height = 1+45=46m