Short Questions

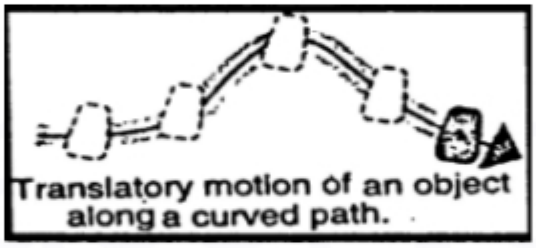
2.2 Explain translator motion and give examples of various types of translator motion.

Ans: Translatory motion:

In translation motion, a body moves along a line without any rotation. The line may be straight or curved.

Examples:

Riders moving in Ferris wheel are also in translational motion. Their motion is in circle without rotation.



Types of Translatory motion:

Translatory motion can be divided in to linear motion, circular motion and random motion**.**

i. Linear motion:

Straight line motion of a body is called linear motion.

Examples:

The motion of objects such as a car moving on a straight and level road is linear motion.

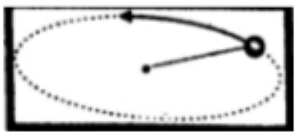
Airplanes flying straight in air and objects falling vertically down are also the examples of linear motion.

ii. Circular motion:

The motion of an object in a circular path is called circular motion.

Examples:

A stone tied at the end of a string can be made to whirl. The stone moves in a circle and thus has circular motion.



Toy train moving on a circular track. A bicycle or a car moving along a circular track possess circular motion.

Motion of the earth around the sun and motion of the moon around the earth are also the examples of circular motion.

iii. Random Motion:

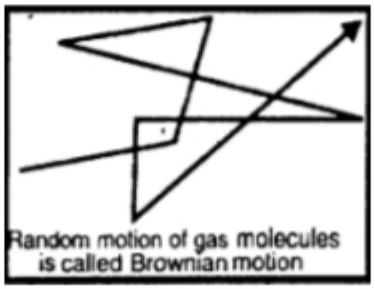
The disordered or irregular motion of an object is called random motion.

Examples:

The motion of insects and birds are irregular. Thus, motion of insects and birds is a random motion.

The motion of dust or smoke particles in the air is also random motion.

The Brownian motion of a gas or liquid molecules along a zigzag path such as shown in the figure is also an example of random motion.



2.3 Differentiate between the following:

(i) Rest and motion

(ii) Circular motion and rotatory motion

(iii) Distance and displacement

(iv) Speed and velocity

(v) Linear and random motion

(vi) Scalers and Vectors

Ans:

(i) Difference between Rest and motion:

Rest:

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

Motion:

A body is said to be at rest, if it changes its position with respect to its surroundings**.**

The state of rest or motion of a body is relative. For example, a passenger sitting in a moving bus is at rest because he/she is not changing his/her position with respect to the other passengers or objects in the bus but to an observer outside the bus the passengers the objects inside the bus are in motion

(ii) Difference between Circular and rotatory motion:

Circular motion:

Any turning as if on axis is rotatory motion. Any rotatory motion where the radius of gyration, length and axis of rotation are fixed is circular motion. And that is the difference. Circular motion is just a special case of rotatory motion.

That is, there is no fixed axis and radius restriction for rotatory motion. But there is for circular motion.

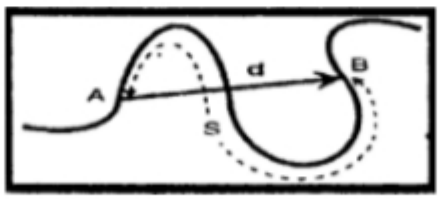
For example, all planets have rotatory motion around their suns but most of the orbits are elliptical. Therefore, rotation axis and radius of gyration vary as they trek around. So, most, if not all, planets do not have circular motion.

Note:

Gyration length:

A length that represents the distance in a rotating system between the point about which it is rotating and the point to and from which the transfer of energy has the maximum effect.

(iii) Difference between distance and displacement:

Distance	**Displacement**
Length of the path between two points is called distance between those points.	Displacement is the shortest distance between two points which has magnitude and direction
Distance is a scaler quantity	Displacement is a vector quantity
Distance is denoted by "S". S=vt Its unit is meters (m).	Displacement is denoted by "d". d=vt Its SI unit is meter (m).
 Distance(S) dotted lines, Displacement(d) dark lines from point A to B.	

(iv) Differentiate between speed and velocity

Speed	Velocity
The distance covered by an object in unit time is called speed. $speed = \frac{Distance\ covered}{Time\ taken}$ Distance=speed x time Or S=vt	The rate of displacement of a body is called velocity. $Velocity = \frac{displacement}{Time\ taken}$ V=d/t or d=vt
Speed is a scaler quantity.	Velocity is a vector quantity.
SI unit of speed is ms^{-1}	SI unit of velocity is same as speed

(v) Difference between linear and random motion

i- Linear motion:

Straight line motion of a body is called linear motion.

Examples:

The motion of objects such as a car moving on a straight and level road is linear motion.

Airplanes flying straight in air and objects falling vertically down are also the examples of linear motion.

i- Random Motion:

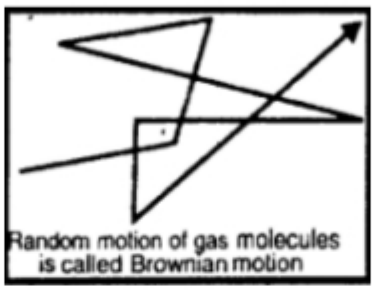
The disordered or irregular motion of an object is called random motion.

Examples:

The motion of insects and birds are irregular. Thus, motion of insects and birds is a random motion.

The motion of dust or smoke particles in the air is also random motion.

The Brownian motion of a gas or liquid molecules along a zigzag path such as shown in the figure is also an example of random motion.



(vi) Difference between scalers and vectors:

Scalers	**Vectors**
A scaler quantity is described completely by its magnitude only.	A vector quantity is described by its magnitude and direction.
Examples Examples of scaler are mass, length, time, speed, volume, work, energy, density, power, charge, pressure, area, temperature.	**Examples** Examples of vector are velocity, displacement, force, momentum, torque, weight, electrical potential etc.

2.4 Define the terms Speed, velocity and acceleration

Ans:

Speed:

The distance covered by an object in unit time is called speed.

$$speed = \frac{Distance\ covered}{Time\ taken}$$

v=S/t

Velocity:

The rate of displacement of a body is called velocity.

$$velocity = \frac{Displacement}{Time\ taken}$$

V=d/t

Acceleration:

Acceleration is defined as the rate of change of velocity of a body

$$acceleration = \frac{change\ of\ velocity}{Time\ taken}$$

$$acceleration = \frac{final\ velocity - initial\ velocity}{Time\ taken}$$

$$a = \frac{vf - vi}{t}$$

Unit of acceleration:

SI unit of acceleration is meter per second square.

2.5 Can a body moving at a constant speed have acceleration?

Ans:

Yes, when a body is moving with constant speed, the body can have acceleration if its direction changes. For example, if the body is moving along a circle with constant speed, it will have acceleration due to the change of direction at every instant.

2.6 How do riders in a Ferris wheel possess Translatory motion but not circular motion?

Ans:

Riders in a Ferris wheel possess Translatory motion because their motion is in a circle without rotation.

2.7 Sketch a distance-time graph from the body starting from rest. How will you determine the speed of the body from this graph?

Ans:

Distance-time graph for a body starting at rest:

When a body starting from rest then distance-time graph is a straight line. Its slope gives the speed of the object.

Speed of a body from graph:

Consider two points A and B on the graph

Speed of the object=slope of line AB

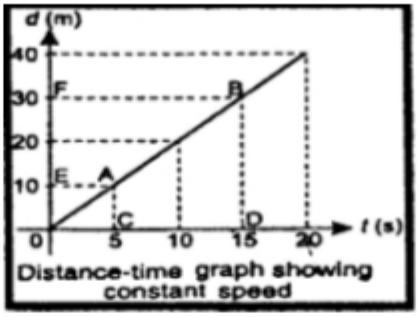
= Distance EF/Time CD=2

$$= \frac{Distance\ EF}{Time\ \ CD}$$

$$= \frac{20m}{10s}$$

=2m/s

The speed found from the graph is 2m/s



Distance-time graph showing constant speed

2.8 What would be the shape of a speed-time graph of a body moving with variable speed?

Ans:

Object moving with variable speed:

When an object does not cover equal distances in equal intervals of time then its speed is not constant. In this case, the distance-time graph is not a straight line.

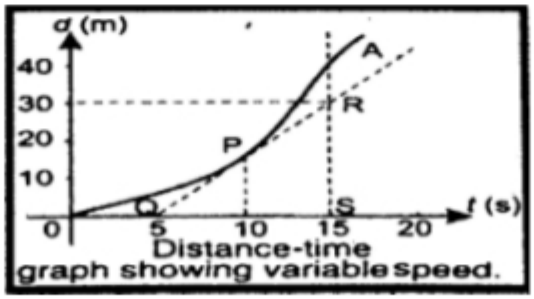
The slope of the curve at any point can be found from the slope of the tangent at that point. For example,

$$\text{slope of tangent at P} = \frac{RS}{QS}$$

$$= \frac{30m}{10s}$$

$$= 3\text{m/s}$$

Thus, the speed of the object at P is 3m/s.



Distance-time graph showing variable speed.

The speed is higher at instants when slope is greater, speed is zero at instants when slope is horizontal.

2.9 Which of the following can be obtained from speed-time graph of a body?

(i) Initial speed

(ii) Final speed

(iii) Distance covered in time t

(iv) Acceleration of motion

Ans:

All the above factors can be obtained from speed time graph.

2.10 How can vectors quantities can be represented graphically?

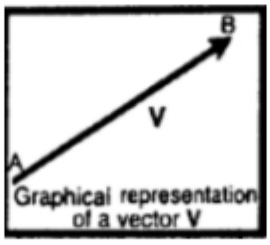
Ans:

Symbolic Representation of a vector:

To differentiate a vector from a scaler quantity, we generally use bold letters to represents vectors quantities such as **F, a, d** or a bar or an arrow over the symbols such as $\overline{F}, \overline{a}, \overline{d}$ or $\vec{F}, \vec{a}, \vec{d}$

Graphical Representation of a vector:

A straight line is drawn with an arrow head at one end. The length of a line, according to some suitable scale, represents the magnitude and the arrow head gives the direction of the vector.



Graphical representation of a vector V

2.11 Why vector quantities cannot be added or subtracted like scaler quantities?

Ans:

The scaler quantities obey the rules of arithmetic and ordinary algebra because scaler quantities have no directions, so vectors obey special rules of vector algebra therefore vectors are added by head to tail rule (vector algebra)

2.12 How are vector quantities important to us in our daily life?

Ans:

We use vectors in almost every activity of life. A vector is a quantity that has both direction and magnitude.

Examples of everyday activities that involve vectors include:

(i) Breathing (your diaphragm muscles exerts a force that has magnitude and direction)

(ii) Walking (you walk at a velocity pf around 7 km/h in the direction of the bathroom)

(iii) Going to school (the bus has length of about 300m and is headed towards your school)

(iv) Lunch (the displacement from your classroom to canteen is about 50m in north direction.

(v) To describe a car's velocity, you would have to state it as 80km/h south.

Vectors are important as they describe physical processes in the real world, and without understanding them, we cannot understand how real-world works. Imagine how difficult it would be for an air traffic controller if he did not understand vectors when directing planes speeds and direction.

2.13 Derive equations of motion for uniformly accelerated rectilinear motion.

Ans:

See Q36, 37 and 38 from notes.

2.14 Sketch a velocity time graph for the motion of the body. From the graph explaining each step, calculate total distance covered by the body.

Ans:

Velocity time graph:

Calculation of distance moved by an object from velocity time graph:

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

(i) If object moves at constant velocity v for time t. The distance covered by the object is v x t. the distance can also be found by calculating the area under the velocity-time graph. This area is shaded and is equal to v x t.

(ii) If the velocity of the object increases uniformly from 0 to v in time t. the magnitude of its average

$$\boldsymbol{avg.velocity} = \frac{\mathbf{0} + \boldsymbol{v}}{\mathbf{2}}$$

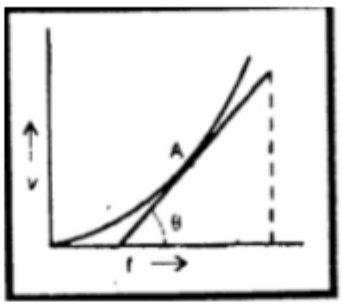
$$= \frac{v}{2}$$

Distance covered = average velocity x time= 1/2v x t

Now we calculate the area under the velocity time graph, which is equal to area of the triangle shaded in figure. Its value is equal to ½ base x height= ½ v x t

Note:

The area between the velocity time graph and the time axis is numerically equal to the distance covered by the object.



ClassNotes