Physics - Chapter-2 = Motion

Rest and motion

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

Example

The chairs of the dining table are at rest unless and until they are moved, and flower base, table, and the blackboard in the class room are all at the position of rest. ex- Tools lying on the floor, bench in the park, Books on the table.

Motion

A body is to be in motion if it changes its position with respect to its immediate surroundings and with respect to time

Example

The blades of a rotating fan, the hands of a working wall clock, a moving car, a spinning top and satellites are all in motion. Rest and motion are relative terms. A body seems to be at rest with respect to one object, but may appear to be in motion with respect to some other object.

A person on a railway platform is at rest with respect to another person on the same platform, but is in motion with reference to a person looking at him from a train crossing that platform. Similarly, a passenger sitting in the train will appear at rest to another passenger on the same train. ex- sea surfing, High speed train, snow boarding.

Rest and motion are relative

An object can be in motion relative to one set of objects while at rest relative to some other set of objects. Thus, rest and motion are relative terms.

This can be understood by following examples.

examples = These two states i.e. (rest and motion) are relative, relative means they are related to each other, because all the observation about an object in rest and motion depend upon frame in which we are doing observation, these states varies according to frame of reference.

Person sitting in a bus is in rest according to his fellow passengers, inside the bus, but he is in motion according to the person standing on bus station observing the moving bus. So, this is just the matter of reference in which we are observing.

Types of motion

Various objects can have different types of motion. They can be classified into translatory motion, rotatory motion, oscillatory motion, vibratory motion, periodic motion, non periodic motion, uniform motion and non-uniform motion.

Translatory motion

The motion in which all the particles of a body move through the same distance in the same time is called translatory motion. This is further classified into.

a. Rectillinor motion
b. Curvilinor motion

Examples of Translatory motion :-

A traigl moving on a track, a parade, coins tossed in the air are all in rectilinear motion.

a. Rectilinear motion

If a body moves along a straight line path, it is said to be in rectilinear motion

Examples for Rectilinear motion

- An athelete running on a straight path;
- A freely falling apple.

b. Curvilinear motion

If a body moves along a curved path, it is said to be in curvilinear motion.

Examples for curvilinear motion

- A car running on a curved road
- A stone thrown at an eagle

Ratatory motion

The motion in which a body moves about a fixed axis without changing the radius of its motion is called ratatory motion.

Date
Page

Examples for Ratatory Motion

- Potter's wheel
- A ceiling fan

Circular Motion

Circular motion is the movement of a body along a circular path. It is a special type of curvilinear motion. It is the motion of an object that moves at a fixed distance from a fixed point. Here all, objects rotate in circular motion. So, circular motion is motion in which the body traverses a circular path.

Examples for circular circular motion The hands of a clock, a merry-go-round, the blades of a fan, the wheel of a moving vehicle, satellites, a spinning top, are all good examples of circular motion.

Oscillatory motion

The ~~two~~ to-and-fro or back and forth motion described by an object as a whole along the same path, without any change in the shape of the object is called oscillatory motion.

Examples for Oscillatory motion

- The pendulum of a clock.
- The child on a swing.

Vibratory motion

This is a kind of oscillatory motion in which the moving object undergoes change in shape or size. In this motion the body does not move as a whole.

Examples for vibratory motion

- The streched membrane of a drum
- The plucked string of a guitar.

Periodic motion

Periodic motion is the motion that repeats itself at regular intervals of time. Every object executing uniform circular motion can be said to be executing periodic motion. Examples for periodic motion

- Earth revolving around the sun.
- Needle a a sewing machine running at constant speed.
- The motion of the pendulum in a pendulum clock, the motion of swinging cradle and the motion of the needle in a sewing machine are some examples of periodic motion.

Non-Periodic motion

A repetitive motion which repeats itself at irregular intervals of time is called non-periodic motion. It cannot repeat itself at regular intervals of time. The different types of motion we observe in our daily ~~life~~ need not be periodic.

Examples of bodies undergoing non-periodic motion :

i) A footballer running on a field ;

ii) tides in a sea.

Multiple motion

Sometimes an object can display combinations of different types of motion.

Example

A moving car which moves straight on the road displays rectilinear motion but at the same time the wheels of the car which are moving in circles display circular motion. So a moving car displays both rectilinear and circular motion.

In a sewing machine, the needle is in periodic motion where as the wheels of the sewing machine are in circular motion. So a moving car displays sewing machine displays circular and periodic motions.

Scalar and vector quantities

A phy-sical quantity which has only magnitude but no specific direction is called a scalar quantity.
Examples: length, distance, area, mass, time, energy, etc.
A physical quantity which has both magnitude and direction is called a vector quantity.
Example- displacement, velocity, acceleration, force, weight, etc.

Speed

- The distance travelled by a body per unit time is called the speed of the body.

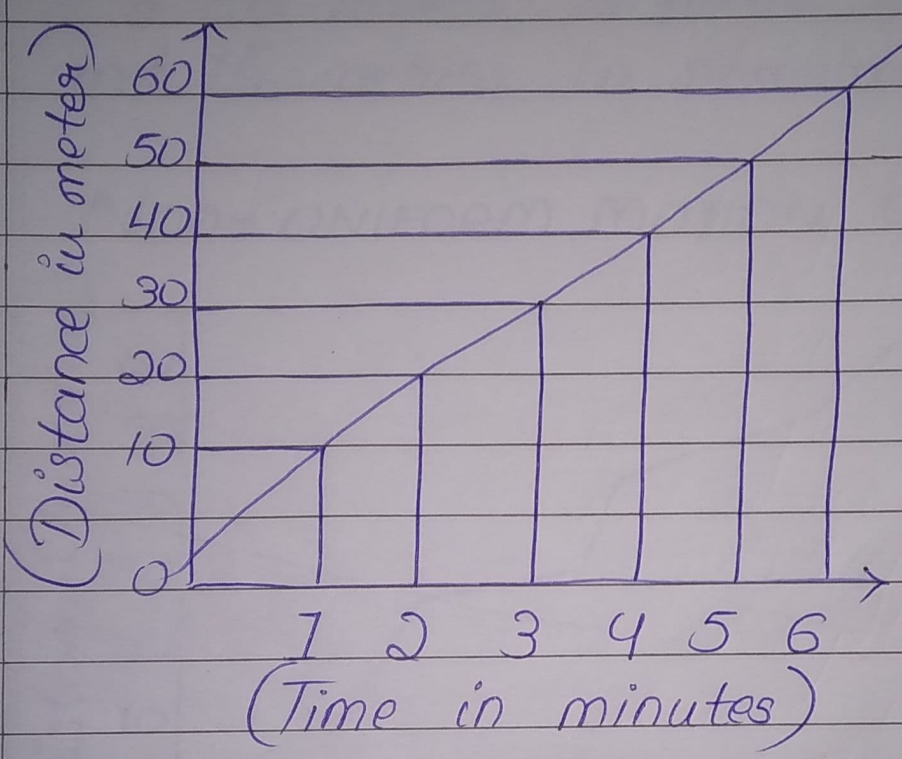
- Speed is a scalar quantity.
- The S.I. unit of speed is m/s.
- Speed = Distance travelled / Time taken

Uniform motion: A body is said to have a uniform motion if it covers equal distances in equal intervals of time. This uniform motion is defined as the motion of an object in which the object travels in a straight line and its velocity remains constant along that line as it covers equal distances in equal intervals of time, irrespective of the duration of the time.

Example of uniform motion

- If the speed of a car is 10m/s, it means that the car covers 10m in 1 sec The speed is constant in every second.
- Movement of blades of a ceiling fan.

UNIFORM MOTION GRAPH



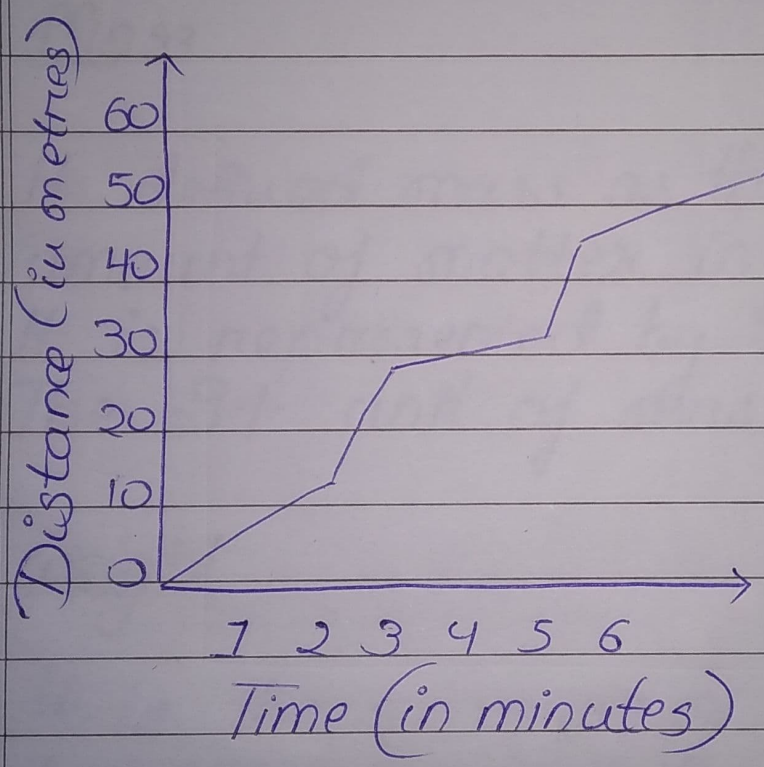
Non Uniform motion: A body is said to have a non uniform motion if it covers unequal distances in equal intervals of time.

This non uniform motion is defined as the motion of an object in which the object travels with varied speed and it does not cover same distance in equal time intervals, irrespective of the time interval duration.

Example of non-uniform motion —

- If a car covers 10 metre in first two sec, and 15 metres in next two seconds.

NON-UNIFORM MOTION GRAPH



Average speed -

- It is defined as the total path length travelled divided by the total time interval during which the motion has taken place.

In general average speed formula is:

- Average speed = Total Distance / Total time

Mass and weight

Mass

It defined mass as the measure of the amount of matter in a body.
It is represented by the symbol (m).
The S.I. unit of mass is kilogram (kg)

weight

It is the measure of the force of gravity acting on a body.
It is represented by the symbol (W)
The formula for weight is given by:
$W = mg$
As weight is a force its S.I. unit is also the same as that of force, SI unit of weight is newton (N).

Date
Page

Mass :-

* Mass can never be zero.
* Mass is scalar quantity. It has magnitude.
* Mass is commonly measured in kilograms and grams.
* Mass doesn't change according to location.
* The mass may be measured using an ordinary balance.

Weight :-

* Weight can be zero. As in space if no gravity acts upon an object, it's weight becomes zero.

* Weight is a vector quantity. It has magnitude and is directed toward the centre of the earth or other gravity well.

* Weight is commonly measured in Newtons.

* Weight is varies according to location.

* Weight is measured using a spring balance.

Test yourself

A. Objective questions

I. a) ⇒ False

b) ⇒ False

c) ⇒ True

d) ⇒ True

e) ⇒ False

f) ⇒ False

g) ⇒ True

h) ⇒ False

2. a) at rest

b) straight line

c) 2 second

d) $36\ Kh^{-1} = 10\ m\ s^{-1}$

e) average speed

f) 36 Kg

g) spring balance

Example of motion

1) Soldiers in a march past on a straight road → Rectilinear motion.

2) The movement of our chest while breathing → Vibratory motion.

3) Hand of an athelete in a race → Oscillatory motion.

4. Pedal of a bicycle in a motion → Circular motion

5. Motion of earth around the sun → Circular motion

6. Motion of a swing = Oscillatory motion

7. Motion of a pendulum → Oscillatory motion.

8. A stone falling from a certain height → rectilinear motion.

9. A plucked string of a sitar → vibratory motion.

10. A car moving on a straight → circular motion.

11. Motion of a train in a straight bridge → Curvilinear motion

12. Motion of a spinning wheel → Rotatory motion.

13. The movement of wheel of a bicycle → Translatory motion.

3. Match the following :-

a) iii) revolution of earth around the sun.

b) v) motion of pendulum of a clock.

c) iv) motion of wire of a guitar.

d) i) A running fan.

e) ii) A car moving in a market.

4. a) 1) a body at rest

b) 2) oscillatory motion

c) 2) rectilinear motion

d) 2) linear

e) 1) uniform

1) 24 Km h / 1 sec

2) 500 N