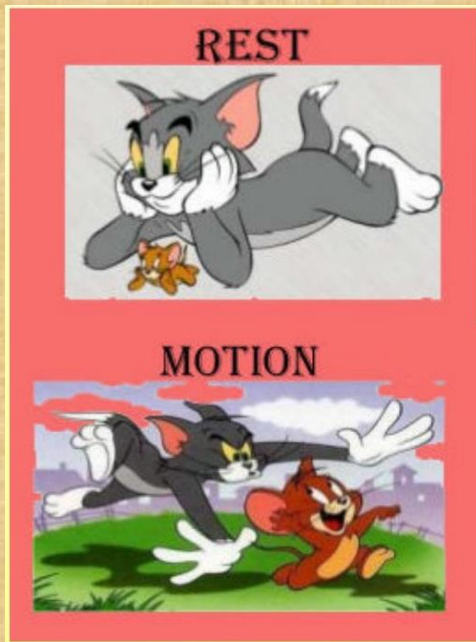


Chapter 04

Motion and Time

Motion and Rest:

In our life, motion is a common experience and daily we see many things moving around. We also see things without any movement. We have two states of objects to learn about. Rest and Motion are the two states of objects.



Motion:

A body said to be in motion if it changes its position with respect to its surroundings.

Ex: A car running on the road is in motion with respect to the trees on the roadside. Blades of a rotating fan, a flying bird, a walking man, a moving train, a sailing ship, blood flowing in veins and arteries are some of the examples of motion.

EXAMPLES FOR THE STATE OF MOTION



Sea Surfing



High Speed Train



Snowboarding

Hence, the position of a body with respect to its surroundings changes with time and the body said to be in motion.

Rest:

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

Ex: A book lying on a table will not change its position if it is not disturbed. It is in a state of rest.

Blackboard in a classroom, benches in the park all are examples of state of rest.

EXAMPLES FOR THE STATE OF REST



Tools lying on the floor



Bench in the Park



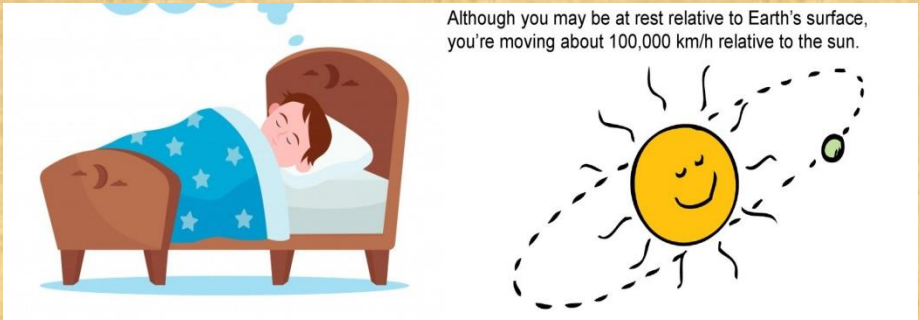
Books on the table

Therefore, when the position of a body with respect to its surroundings does not change with time, the body said to be at rest.

Rest and Motion are relative:

A body can be at rest and motion at the same time.

Ex: You are lying on your bed in bedroom. All the objects inside the room appear to be in rest. The room is on earth and earth itself is always in motion by revolving around the sun. Thus along with earth, you and your room are also revolving around the sun. In relation to the sun, you and objects in your room said to be in motion.



Thus, a body in motion with respect to a set of objects can appear at state of rest at the same time with respect to another set of objects. This way the body can be at rest or in motion at the same time. It is an observer, and surroundings decide whether a given object is at rest or in motion.

Uniform Motion and Non-uniform motion:

- A body said to have a uniform motion if it covers equal distances in equal intervals of time.

Ex: A boy walking on a straight road at constant speed.

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

Ex: A car moving in a crowded road.

Types of Motion:

Various objects can have different types of motion. Few objects move up and down, few move in straight path and few move in 'to' and 'fro'. Depending on the path taken by object, they are classified.

Translatory Motion:

The motion in which all the particles of a body move through the same distance in same time is translatory motion.

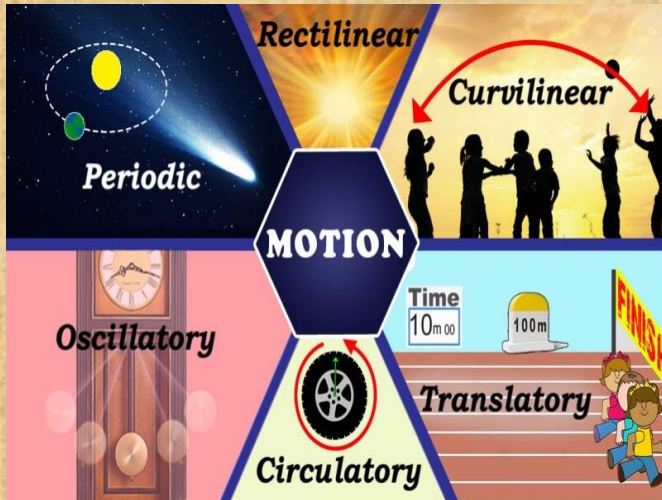
Ex: Coins tossed in the air.

- If a body in translatory motion moves along a straight line, then the motion is **rectilinear motion**.

Ex: An athlete running on a straight path.

b) If a body in translatory motion moves along a curved path then the motion is **curvilinear motion**.

Ex: A car running on a curved road.



Types of motion

Rotatory Motion:

The motion of all particles of a moving body, follow a circular path with respect to a fixed center or axis of rotation is rotatory motion. **Circular motion** is a special type of rotatory motion.

Ex: The blades of a fan, wheel of a moving vehicle, potter’s wheel.

Oscillatory Motion:

The ‘to’ and ‘fro’ or back and forth motion of an object about a fixed point along the same path is called oscillatory motion.

Ex: The pendulum of a clock, a child on a swing.

These, are the different types of motion we generally come across in our daily life.

Slow and Fast Motion:

On road, we see different vehicles with different speeds. Few vehicles move fast and few vehicles move slow.

How can we decide one object is moving faster or slower than the other object?

An object that takes long time to cover a certain distance, said to be slow and an object that takes short time to cover the same distance is said to be fast.

Hence, the distance travelled by an object in a given interval of time can help us decide which one is faster and which one is slower.

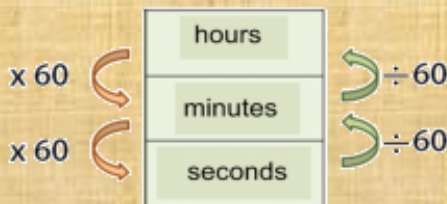
Time:

You may say time is what a clock reads! Right.

They are just one of many possible instruments of time measurement.

Time is a calculable measure of motion with respect to before and afterness.

The measurement of time involves different units. Like seconds, minutes, hours, days, month, year are the units used to measure time in our life. The smaller basic unit is second.



1000 milliseconds	1 second
60 seconds	1 minute
60 minutes	1 hour
24 hours	1 day
7 days	1 week
28-31 days	1 month
365 or 366 days	1 year
12 months	1 year
10 years	1 decade
100 years	1 century
1000 years	1 millennium

Units of time:

In the beginning, people used sundials and hourglass to keep track of time. Now a day we use clocks and watch to measure the time accurately.

Today clocks do not just tell us the time of the day, they are also used as timers in ovens, in stopwatches, in various athletic events etc.

Speed:

The distance covered per unit time is speed. Speed tells us how fast or slow an object moves.

Speed, described as the distance travelled by an object divided with the time taken to cover that distance.

$$\text{Speed} = \text{Distance}/\text{Time}$$

$$S = \frac{d}{t}$$

Average speed Distance traveled

Total time

In vehicles to measure the speed, speedometers are used and to measure the distance covered, odometers are used.

$$\text{Average speed (v)} = \frac{\text{Distance travelled (s)}}{\text{Time taken (t)}}$$



Fig. Speedometer and Odometer

To express the speed of an object we consider its average speed. Average speed is defined as the uniform speed given by the ratio of total distance travelled by an object to the total time taken by an object.

Average speed =

Total distance travelled/Total time taken to travel the distance.

SI unit of speed is meters per second or m/sec.

Commonly used unit of speed is kilometer per hour (kmph or km/h).

$$1 \text{ km / h} = 5/18 \text{ m/s}$$

Do you know how we got this?

$$1 \text{ km} = 1000 \text{ m}$$

$$1 \text{ h} = 3600\text{s}$$

$$1 \text{ km} / \text{h} = 1000 \text{ m} / 3600\text{s} = 5/18 \text{ m/s}$$

If we travel 1 km in 1 hour, it means we travelled 5 meters in 18 seconds.

Summary:

- Motion is a common phenomenon of object changing its position.
- Rest and motion are two states of objects.
- An object said to be in motion if it changes its position. It said to be in rest if it does not changes its position with respect to time.
- Rest and motion are relative.
- Mainly there are three types of motion namely translatory motion, rotatory motion and oscillatory motion.
- Slow and fast motion explained with the help of speed and time.
- The basic unit of time is second. Time expressed in units like seconds, minute and hour.
- Time is measured with the help of instruments like digital clocks, stopwatches etc.
- The distance covered per unit time is speed.
- Speedometer, help us to know the speed of a vehicle.
- S.I unit of speed is meters per second or m/sec.
- Commonly used unit of speed is kilometer per hour (kmph or km/h).

GLOSSARY:

- **Average Speed** – Total distance travelled by an object in a particular interval of time.
- **Axis of Rotation** – A straight line through all the fixed points of a rotating rigid body around which all other points of the body move in circles.
- **Motion** – A phenomenon of moving or changing position.
- **Oscillatory Motion** - Moving 'to' and 'fro' or back and forth.
- **Rest** – No movement or change in the position of an object.
- **Rotatory Motion** – A body moves about a fixed axis without changing the radius of its motion.
- **Speed** – Rate at which the object covers the distance.
- **Translatory motion** – The motion in which all the points of a body move in the same direction.

