

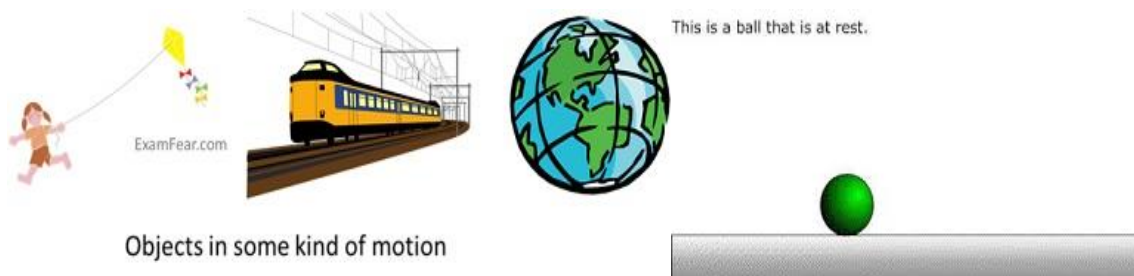
Chapter- 10

Motion and Measurement of Distances

MOTION AND REST

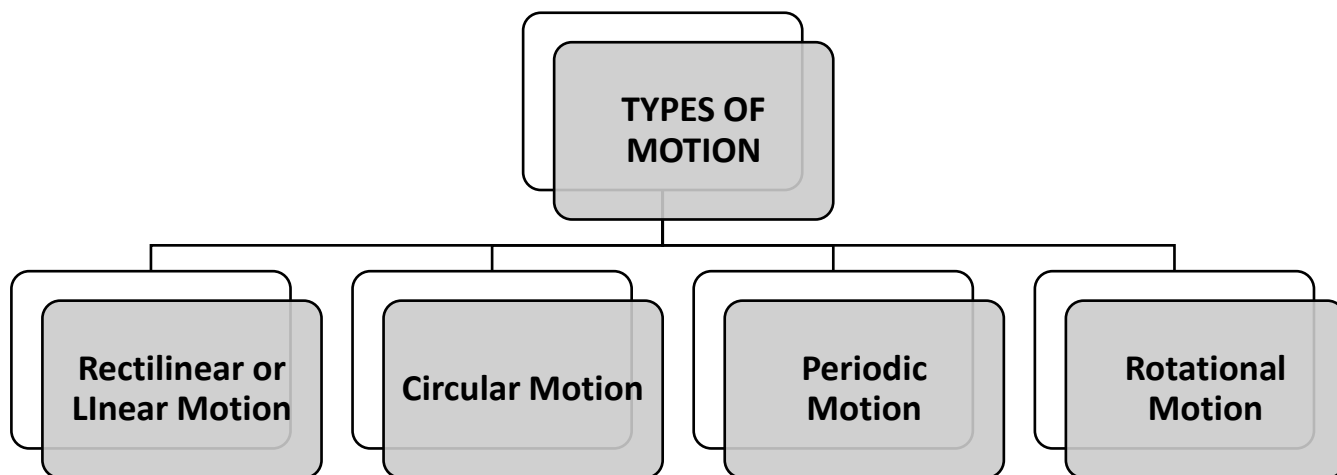
Rest- A body is said to be at rest when it remains at the same position with respect to its surroundings. Example- a man sitting on a chair

Motion- A body is said to be in motion if it is changing its position with respect to its surroundings and time. Example- a car moving on the road



TYPES OF MOTION

The motion of all the objects is not of the same type. Different objects show different types of motion.



a.Rectilinear motion- Motion in a straight line is called rectilinear motion.

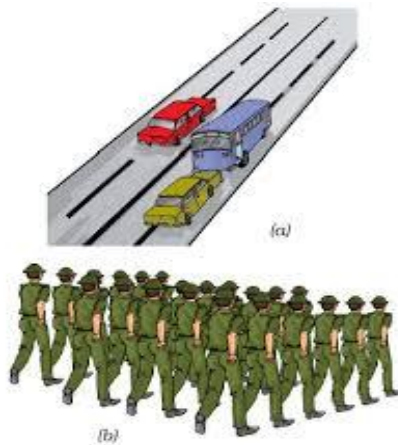
OR

When an object moves along a straight line, it is said to be in rectilinear motion.

Examples-

(i) When a bullet is fired from a gun

- (ii) Light travels in a straight line
- (iii) March past of soldiers in parade
- (iv) Motion of a striker on the carom board



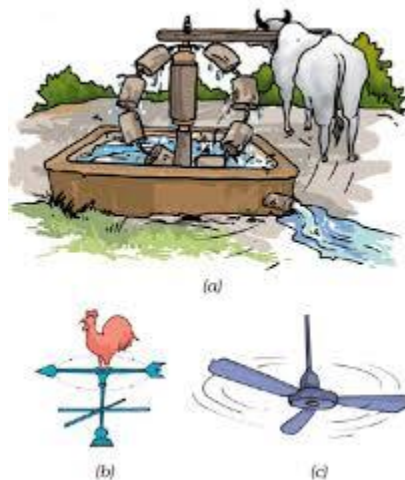
b. Circular Motion- When an object moves along a circular path, it is called circular motion.

OR

The motion in which an object moves at a fixed distance from a fixed point.

Examples-

- (i) Hands of a clock
- (ii) Wheels of vehicles
- (iii) A child sitting on merry-go-round
- (iv) Blades of a moving fan



c. Periodic Motion- The motion which repeats itself after regular intervals of time, is called periodic motion.

Examples-

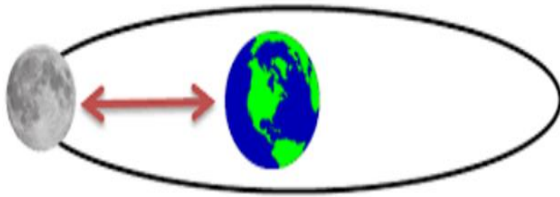
- (i) motion of pendulum
- (ii) child on a swing
- (iii) rotation of earth
- (iv) revolution of earth around the sun
- (v) strings of guitar



d. Rotational Motion- When an object turns or spins about a fixed axis, it is called rotational motion.

Examples-

- (i) a spinning top
- (ii) rotation of earth
- (iii) turning of blades
- (iv) turning of potter's wheel
- (v) turning of windmill
- (vi) turning of a wheel



Objects having more than one type of motion

(i) The case of a bicycle- A bicycle moving on a straight road has two types of motion- rotational motion and rectilinear motion.

(ii) The case of a sewing machine- The sewing machine exhibits three types of motion i.e. rotational motion, rectilinear motion and periodic motion.

The Story of Transport

Transport is a means to carry people and goods from one place to another.

Examples-

Land transport- car, train, and bike

Water transport – ships, boats

Air transport- Aeroplane, rockets



Distances- The length of space between two points or two places is called distance.

Example- The distance between Delhi and Agra is 200 Km.

Measurement- The process of comparing an unknown quantity with some known quantity. The fixed unknown quantity is called a **UNIT**.

Standard Units of Measurement- A unit of measurement which has fixed value and which does not change from person to person or place to place is called a standard unit of measurement.

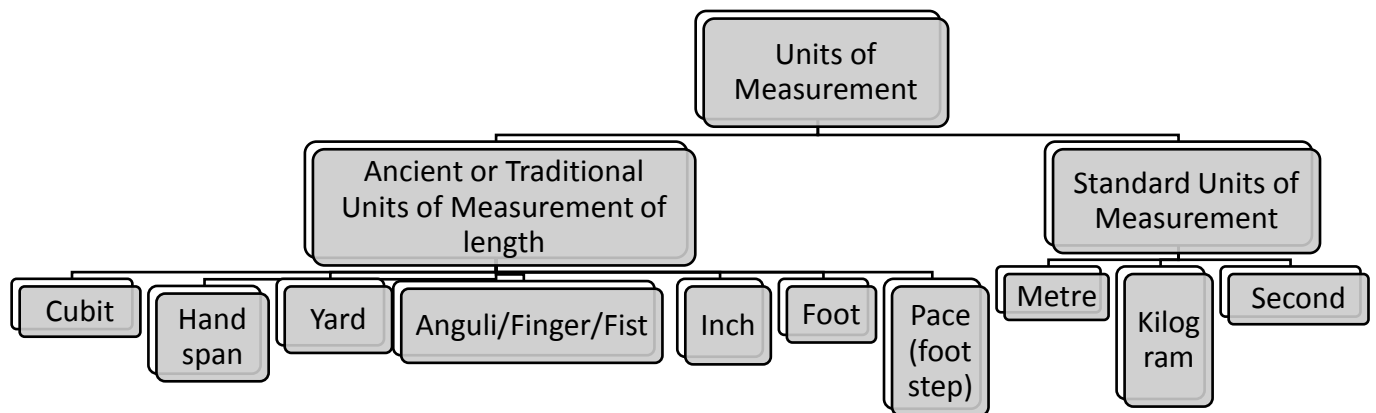
SI Unit- International System of Units (Systeme Internationale De Unites: in French)

Example- **Metre** is the SI Unit of **length**.

Need to develop a uniform system of measurement

In ancient times, people used length of a foot, length of finger, the distance of a step as units of measurement. This caused confusion and hence a uniform system of measurement was developed.

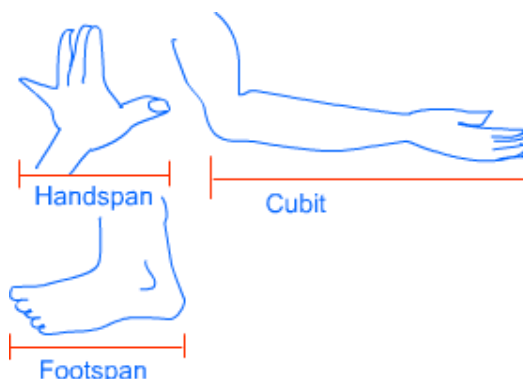
A fist or a foot step cannot be used as a standard unit of length because they are not accurate as every individual's body is not of the same size.



UNITS OF MEASUREMENT

I. Ancient Units of Measurement

1. **Cubit**- A cubit as the length from the elbow to the middle finger tip was used in ancient Egypt and was also accepted as a unit of length in other parts of the world.
2. **Hand Span**- The distance between the tip of stretched thumb and little finger in an expanded palm is called a span.
3. **Yard**- The distance between the end of outstretched arm and the chin is called a yard.
4. **Anguli/finger/fist**
5. **Inch**
6. **Foot** (length of an adult person's barefoot)
7. **Pace** (foot step)



II. Standard Units of Measurement

France created a standard unit of measurement called Metric System. For the sake of uniformity, General Conference of Weights and Measures recommended a basic set of units accepted by scientists all over the world called International System of Units (S.I. Units).

SI units of Fundamental Quantities

Fundamental quantity	SI unit	Unit symbol
Length	Metre	m
Mass	Kilogram	kg
Time	Second	s

CONVERSION TABLE

10 mm = 1cm
100 cm = 1m
1000 m = 1Km
1 m = 1000 mm

EXTENDED LEARNING

1. People of the Indus Valley Civilization measured lengths with great accuracy. Archaeologists have unearthed a piece of ivory with markings on it, like a scale.
2. An Odometer is a device used for indicating distance travelled by an automobile.

3. **Precautions to be taken while using a scale-**

1. Place the scale in contact with the object along its length.
2. In case the ends of the scale are broken, then we should avoid taking measurement from the zero mark of the scale.
3. Correct position of eye is also important i.e. while observing the reading on a scale we should look directly in line with the reading.

4. **Measuring Length of a given line using a scale-**

Steps:

1. Place the scale along the edge of the line, with the zero mark aligned with the edge of the line.
2. The reading on the scale at the other end of the object gives the measure of the length of the line.



The length of line AB is 4.8 cm.

5. **Measuring a straight line using a damaged scale**

Steps:

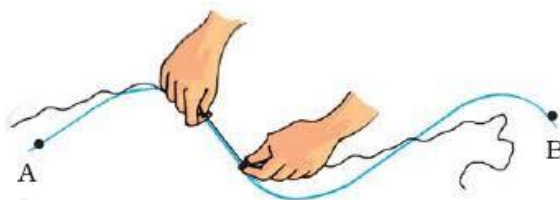
1. Place the ruler such that any clearly visible mark coincides with one end of the line.
2. Note the readings on the ruler at the other end of the line.
3. The difference of readings observed against both the ends gives the length of line.

6. **Measuring the length of a curved line**

Materials Required- a thread or a string, scale

Steps-

1. Make a knot on one of the ends of the thread, i.e. the starting point of the thread.
2. Place the knotted end of the thread at the starting point of the curved line.
3. Stretch the thread along the curved line of the object holding it steady with your fingers and thumb.
4. Keep stretching along the curved line until you reach the end.
5. Make a mark on the thread when it reaches the other end.
6. Place the thread along the scale and measure the length between the knot and the marked point.



NCERT SOLUTIONS

1. Give two examples each of modes of transport used on land, water and air.

Ans: (i) Land—Bus, truck, train. (ii) Water—Ship, boat. (iii) Air—Aeroplane, Helicopter.

2. Fill in the blanks:

(i) One metre is _____

(ii) Five kilometre is _____

(iii) Motion of a child on a swing is _____ .

(iv) Motion of the needle of a sewing machine is _____ .

(v) Motion of wheel of a bicycle is _____ .

Ans:(i) 100 (ii) 5000 (iii) periodic (oscillatory) motion (iv) periodic oscillatory (v) circular.

3. Why can a pace or a footstep not be used as a standard unit of length?

Ans: Because a pace or a footstep of each and every person is not equal.

4. Arrange the following lengths in their increasing magnitude :

1 metre, 1 centimetre, 1 kilometre, 1 millimetre.

Ans: Ascending order of length:

1 millimetre < 1 centimetre < 1 metre < 1 kilometre

5. The height of a person is 1.65 m. Express it in cm and mm.

Ans:

(a) 1.65 m, as one metre = 100 cm

= 1.65 × 100 cm = 165 cm

(b) 165 × 10 mm = 1650 mm.

6. The distance between Radha's home and her school is 3250 m. Express this distance in km.

Ans.The distance between Radha's home and her school is 3250 m.

1 km = 1000 m

i.e., 1 m = $\frac{1}{1000}$ km

3250 m = $\frac{1}{1000} \times 3250 = 3.25$ km

7. While measuring the length of a knitting needle, the reading of the scale at one end is 3.0 cm and at the other end is 33.1 cm. What is the length of the needle?

Ans.The reading of the scale at one end is 3 cm and at the other end is 33.1 cm.

Therefore, the length of the knitting needle is given by subtracting both the readings, i.e., (33.1 - 3.0) cm = 30.1 cm.

8. Write the similarities and the differences between the motion of a bicycle and a ceiling fan that has been switched on.

Ans. Similarities between the motion of a bicycle and a ceiling fan:

(i) The ceiling fan and the wheels of a bicycle are fixed at a point.

(ii) Both have rotational motion about their respective fixed points.

Difference between the motion of a bicycle and a ceiling fan:

The wheels of a bicycle show rectilinear motion in addition to the rotational motion, while the ceiling fan shows only rotational motion.

9. Why can you not use an elastic measuring tape to measure distance? What would be some of the problems you would meet in telling someone about a distance you measured with an elastic tape?

Ans. An elastic measuring tape is stretchable. It cannot be used to measure distance because the length of the tape may change on stretching. As a result, the measured length would not be correct.

If we measure a certain distance twice using an elastic tape, then we may get different values for the same length each time. This is because elastic tapes are stretchable.

10. Give two examples of periodic motion.

Ans. Examples of periodic motion:

(i) Motion of a pendulum

The bob of a pendulum repeats its motion regularly after fixed intervals of time. This motion is called periodic motion.

(ii) Motion of a boy sitting on a swing

The motion of a swing repeats itself after regular intervals of time. Hence, a boy sitting on a swing has periodic motion.

Assignment

Q1. Trains A and B running parallel to each other at equal speed. State whether a person in Train A will be in a state of rest or motion with respect to-

- a. the another person in Train A
- b. a person in Train B
- c. a bridge over which the trains are running

Q2. If end of a ruler is broken then starts the reading from 1.2 cm. The final reading of a pencil is 7.6 cm. What will be the actual reading of the pencil?

Q3. Length of the book is 15 cm. What will be the final reading on the ruler if the ruler reads 2.2 cm?

Q4. All circular motions are usually periodic but all periodic motions are not usually circular. Why?

Q5. If you are given an elastic measuring tape, will you be able to accurately measure the length and width of a cricket pitch with it? Justify your answer.

Q6. What is the similarity and difference between the motion of a car which is slowing down and the ceiling fan moving with the same speed?

Q7. Is the motion of moon around the Earth periodic? Give reasons for your answer.

Q8. Answer the following-

- (i) Is your house at rest or in motion? Explain briefly.
- (ii) When is a body said to be in motion with respect to an observer? Give one example.
- (iii) Is it possible for a body to appear to be at rest to one observer and appear to be in motion to another at the same time? Give examples.

Q9. Why cannot a sundial be used to measure time throughout the day?

Q10. Mention two precautions you will take while measuring a line with the help of a ruler.

