9. Motion and Types of Motion

Observe and discuss.

9.1 : Objects in motion

In our day-to-day life, we see many moving objects. Moving objects are said to be objects in motion. Discuss which objects in the above pictures are in motion. What differences are seen in their motion?

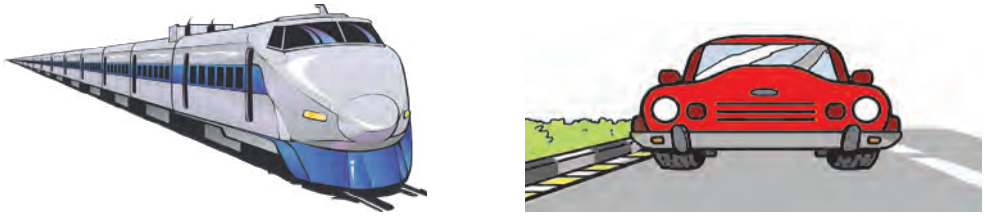
Motion

While waiting for a bus at a bus-stop, other vehicles appear to be in a state of motion. On the other hand, when you are in motion yourself, a still object appears to be moving. For example, the trees are seen to run backward while you are travelling in a train. If an object is seen by an observer to change its place continuously, the object is said to be in motion. Change of place of an object is called displacement. An object in motion continuously undergoes displacement.

9.2 : Backward motion of object

The continuous displacement of an object is called motion.

Types of motion

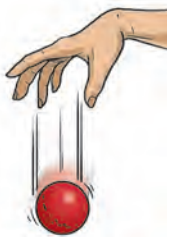


9.3 : Linear motion

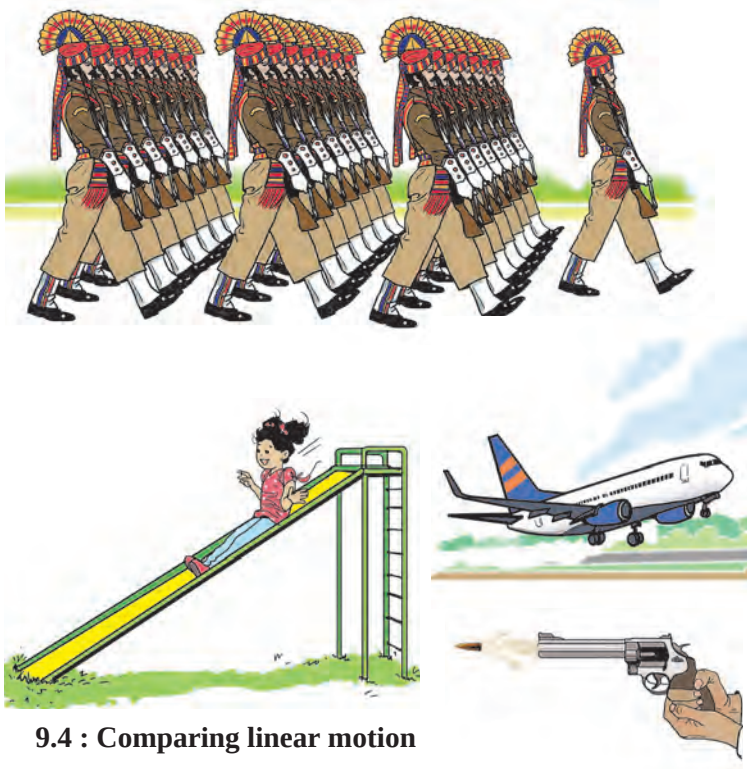
1. Linear motion

A train or a moving vehicle on a road may travel in a straight line or in the same direction. This motion of an object is called linear motion. An object in linear motion shows displacement along a straight line.

If you stand on a chair and release a ball from your hand, it falls to the floor. What do you conclude from this?



Compare the motion of soldiers on parade and a girl coming down a slide.



9.4 : Comparing linear motion

The motion of soldiers in a parade is the same. During that period, not even a slight difference is seen. However, the motion of the girl coming down the slide does not appear to be uniform. The girl comes down faster and faster. The speed of her motion goes on increasing continuously.

The motion of the marching soldiers is 'uniform linear motion', because in this motion no change is seen. On the other hand, the motion of the girl coming down the slide is 'non-uniform linear motion'.

These are the two main types of linear motion.

Uniform linear motion

When the distance traversed by an object along a straight line in unit time is continuously the same, the motion is called uniform linear motion.

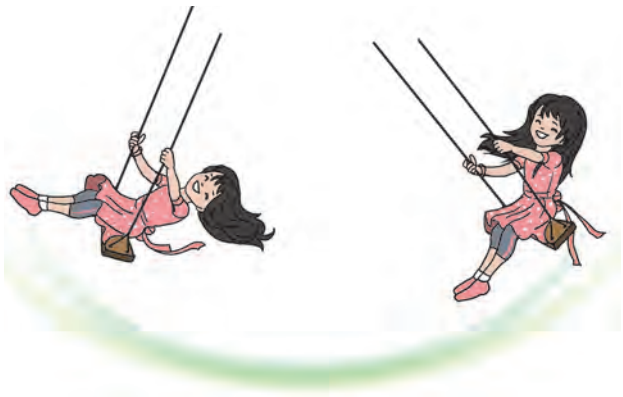
Non-uniform linear motion

When the distance traversed by an object along a straight line in unit time keeps on changing, the motion is called non-uniform linear motion.

2. Non-linear motion : The motion of an object that does not move in a straight line is called 'non-linear motion'. Non-linear motion may be of the following types.

Can you tell ?

What kind of movement does a swing in a park show ?

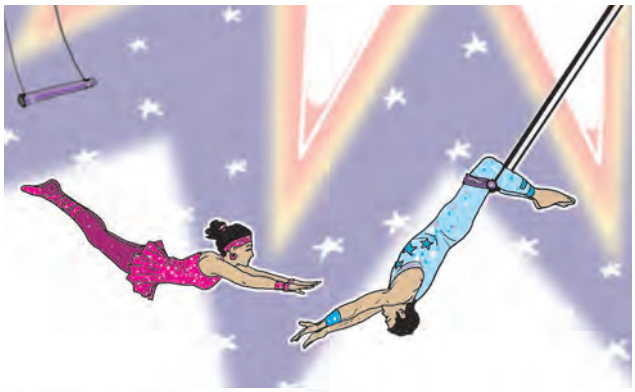


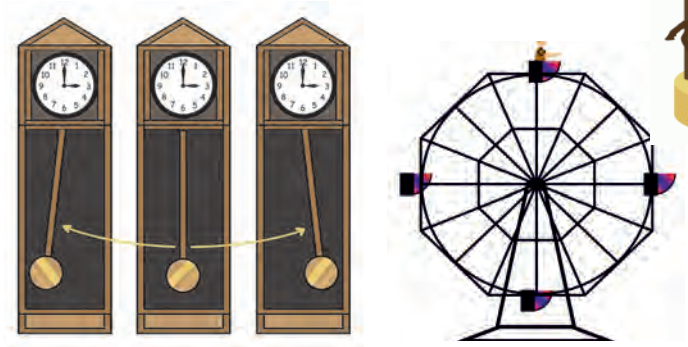
9.5 : Oscillatory motion

The swing always comes back from one end to the other end. It takes about the same time for each swing or oscillation. This movement of a swing is called **oscillatory motion**. Similarly, the movement of the pendulum of a clock, the wings of a bird, the needle of a sewing machine, the vibrating diaphragm of a *tabla* or drum are also examples of oscillatory motion.

The motion of a body that is oscillating, i.e., swinging back and forth, is called oscillatory motion.

Observe and discuss.





Use your brain power!

In which musical instruments can you see oscillatory motion?

9.6 : Examples of non-linear motion

The hands of a clock move in a circular manner. Similarly, a fan, a giant wheel, and a merry-go-round complete each round along a circular route. In our day-to-day life we come across many examples of objects that trace a circular path.

Which other examples of circular motion can you give?

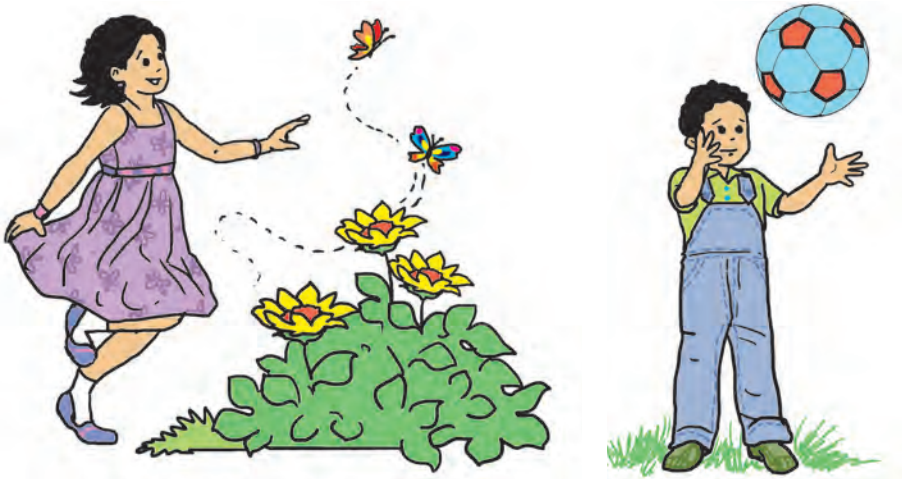
We see from these examples of oscillatory motion and circular motion that some objects complete one round or one oscillation in a fixed period of time. For example, the minute hand of a clock completes one round in exactly 60 minutes every time, while a merry-go-round also completes every round in the same period of time. Such motion is called **periodic motion**.

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

The motion of an object which passes through a certain point again and again after a fixed period is called periodic motion.

Use your brain power!

Which types of motion are seen when a girl rides a bicycle as shown here?



9.7 : Children playing in a garden

Can you tell ?

While chasing a butterfly in a garden, do you run along a definite path or in the same direction all the time ? Not really.

A butterfly constantly flits from one flower to another. There is no definite direction to its motion. Such motion is called **random motion**.

The motion that changes its direction and speed continually is called random motion.

The motion of the players in a game of football is also of this type. The motion of a crawling baby or a wandering animal is also random motion.

Speed

A bus covers the distance of about two hundred kilometres from Solapur to Pune in five hours. How much distance does the bus cover in one hour ?

While solving this example, we take the ratio of the distance traversed and the time required to traverse that distance.

From this ratio, we come to know the distance traversed by the bus in one unit of time.

The distance traversed by an object in unit time is called the speed of that object.

$$\text{Speed} = \frac{\text{Distance traversed}}{\text{Time required for traversing the distance}}$$

Unit of speed : kilometre/hour, metre/second

Always remember...

A moving object may not have only one type of motion.

What we have learnt–

- Objects in motion are those that change their position continuously.
- The various types of motion are linear, uniform linear, non-uniform linear, oscillatory, circular, periodic and random motion.
- The distance traversed by an object in unit time is called its speed.
- The time required to traverse a certain distance depends on the speed of the object.

Exercise

1. Identify the types of motion.

(a) Movement of the earth around the sun : ……..... .
(b) Movement of a ceiling fan : ……..
(c) A meteor falling from the sky : ……..... .
(d) A rocket launched from the ground : ……..
(e) A fish swimming in water : ……..
(f) The plucked string of a sitar : …….

2. Fill in the blanks.

(a) If a ball is released from the terrace of a building, it comes down in ……..... motion. On the other hand, it reaches the ground in ……..... motion if it is thrown with force away from the terrace in a direction parallel to the terrace.
(b) The motion of an aeroplane on the runway before take-off is……..... .
(c) The kite looking for its prey flies with ..... motion in the sky.
(d) Children sitting in a rotating giant wheel have ……..... motion, while those sitting in a merry-go-round have a ……..... motion.

(Linear, non-linear, circular, uniform linear, non-uniform linear, uniform circular, non-uniform circular, random)

3. How are we different ?

(a) Oscillatory motion and linear motion.
(b) Linear motion and random motion.
(c) Random motion and oscillatory motion.

4. Explain in your own words, giving one example each.

(a) Linear motion
(b) Oscillatory motion
(c) Circular motion
(d) Random motion
(e) Periodic motion

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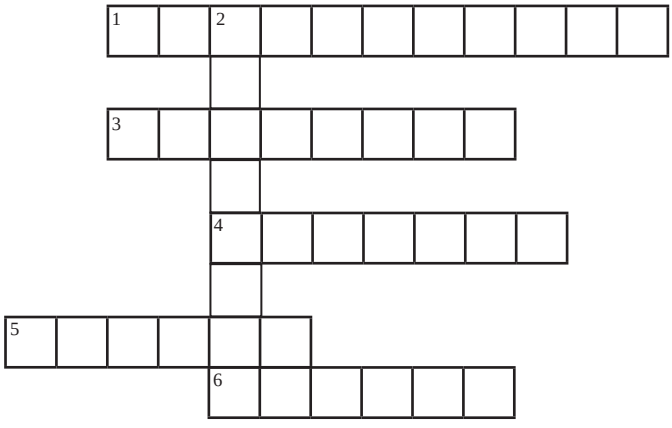
5 Answer the following questions in your own words.

(a) Which types of motion are seen in birds flying in the sky ?
(b) Write in detail about your experience of various types of motion while riding a bicycle on a road.

6. Complete the puzzle using words for types of motion :

(1) a spring is stretched and one end is released
(2) a minute hand
(3) a see saw
(4-5) children in a march past
(6) a stone rolling down a hillside.



Activity :

- Make a list of various moving objects in the environment, and discuss the types of motion seen in them.