DON BOSCO SCHOOL, KOKAR, RANCHI

CLASS VII *Motion*

Introduction to motion

- **An object is said to be in motion if it changes its position with respect to time. Eg: A car moving on a road.**
- **An object is said to be at rest if the object does not change its position with time. Eg: A person standing on the ground.**

Motion

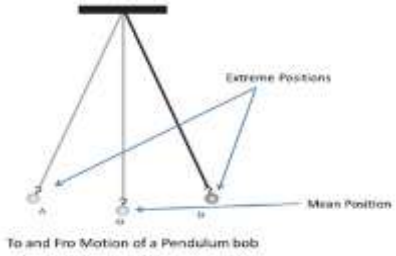
Types of Motion

1. *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 rectilinear (straight path) and curvilinear (curved path) motions.
Example: An athlete running on a straight path, a car running on a curved road.

2. *Rotatory Motion*: The motion in which a body moves about a fixed axis without changing the radius of its motion is called rotatory motion.
Example: A ceiling fan.

3. *Oscillatory Motion:* The to and fro 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.

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



To and Fro Motion of a Pendulum bob

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

Example: The plucked string of a guitar.

5. *Periodic Motion:* A repetitive motion which repeats itself at regular intervals of time is called the periodic motion.
Example: Earth revolving around the Sun.

Every object executing uniform circular motion can be said to be executing periodic motion.

6. *Non-periodic motion:* A repetitive motion which repeats itself at irregular intervals of time is called non-periodic motion.
Example: Tides in a sea.

7. *Uniform Motion:* A body is said to have a uniform motion if it covers equal distances in equal intervals of time.
Example: A train moving straight in a particular direction at constant speed.

8. *Non-uniform Motion:* A body is said to have a non-uniform motion if it covers unequal distances in equal intervals of time.
Examples:

- **A stone falling freely under gravity**
- **A car moving on a crowded road.**

Multiple Motion:
Sometimes an object can display combinations of different types of motion. For 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.

Differences between uniform and non-uniform motion:

Uniform motion	Non-uniform motion
Movement of a body along a straight line with steady speed.	**Movement of an object along a straight line with variable speed.**
Covers equal distances in equal time interval.	**Covers unequal distances in equal time interval.**
Average speed is similar to actual speed of the object.	**Average speed is different from actual speed of the object.**

Scalar and Vector Quantities

A physical 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*.

Examples: displacement, velocity, acceleration, force, weight, etc.

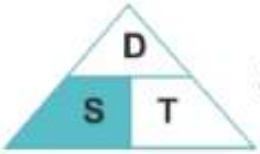
Distance

Distance is the total path covered by the object in the given interval of time.

Speed:

The distance travelled by an object in unit time is called its Speed.

Average speed - The total distance travelled by an object divided by the total time taken by the object is called its average speed



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

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total Time}}$$

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

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

MASS

Mass is a measure of the amount of matter in an object.

- **Mass** is **usually measured in grams (g) or kilograms (kg). . It is constant. The mass of a body is the quantity of matter contained in it.**
- **Mass is a scalar quantity which has only magnitude but no direction.**
- **Mass of a body always remains constant and does not change from place to place.**
- **SI unit of mass is kilogram (kg).**
- **Mass of a body can never be zero.**

Weight:

The weight of a body is the force with which the earth attracts it.

Or

Weight of a body is the force of gravity on it..

- **As weight always acts vertically downwards, therefore, weight has both magnitude and direction and thus it is a vector quantity.**
- **The weight of a body changes from place to place, depending on mass of object.**
- **The SI unit of weight is Newton.**
- **Weight of the object becomes zero if g is zero.**

NOTE:

Weight of an object on moon $= \frac{1}{6}$**th the weight of an object on the earth.**

Mass	Weight
Mass is a quantity of a matter.	Weight depends on the effect of gravity.
Mass can never be zero.	Weight can be zero
Mass does not change with respect to location.	Weight varies with respect to location due to change in gravity.
Mass is a scalar quantity. It has only magnitude.	Weight is a vector quantity. It has magnitude and direction.
Mass may be measured using an ordinary balance.	Weight is measured using a spring balance.
SI unit of mass is kilogram (kg).	SI unit of weight in Newton(N).

SOME SOLVED QUESTION

Q The distance between two stations is 240 km. A train takes 4 hours to cover this distance. Calculate the speed of the train.

Solution:

Distance between two stations = 240 kms

Total time take = 4 hrs/240 minutes

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$
$$= \frac{240}{4}$$

= 60 km/h

Q Salma takes 15 minutes from her house to reach her school on a bicycle. If the bicycle has a speed of 2 m/s, calculate the distance between her house and the school.

Solution:

Time taken by Salma to reach her school by bicycle = 15 mins= 15 x 60 = 90 s

Speed of Salma's bicycle= 2m/s

$$\text{Speed} = \frac{\text{Distance covered}}{\text{Time taken}}$$

Distance covered = speed x time taken

= 2 x 900 = 1800 m

1000m = 1 km

$$1800\ m = \frac{1}{1000} \times 1800$$

= 1.8 kms

Q .Which of the following relations is correct?

(i) Speed = Distance × Time

(ii) Speed = Distance/Time

(iii) Speed = Time/Distance

(iv) Speed = 1/Distance x Time

Solution:

Answer is (ii) Speed = Distance/Time

Q. The basic unit of speed is:

(i) km/min

(ii) m/min

(iii) km/h

(iv) m/s

Solution:

Answer is (iv) m/s

Q. A car moves with a speed of 40 km/h for 15 minutes and then with a speed of 60 km/h for the next 15 minutes. The total distance covered by the car is:

(i) 100 km (ii) 25 km (iii) 15 km (iv) 10 km

Solution:

The answer is (ii) 25 km

Calculation:

When the speed of the car is 40 km/h

Time taken = 15 min = 15/60 = 0.25 h

$$\text{Speed} = \frac{\text{Distance covered}}{\text{Time taken}}$$

Distance covered d1 = speed x time taken

= 40 x 0.25 = 10 kms

When the speed of the Car is 60 km/ h

$$\text{Speed} = \frac{\text{Distance covered}}{\text{Time taken}}$$

Distance covered d2 = speed x time taken

= 60 x 0.25= 15 kms

Total distance covered by the car = d1 + d2

= 10 + 15 = 25 Kms

Question

Express 15 m s^{-1} in km h^{-1}.

Solution

$$15\,m/s = \frac{15}{1000} \times 3600\,km/hr$$

$$\text{or}, 15\,m/s = 54\,km/hr^{-1}$$

Question

A train takes 3 hours to travel from Agra to Delhi with a uniform speed of 65 km h^{-1}. Find the distance between the two cities.

Solution
Total time taken = 3 hours
Speed of the train = 65 km/hr
Distance travelled = speed x time
= 65 x 3 = 195 km

SOLVE

Q 1. A person travels at a speed of 60 kms per hour. Then how many meters can he travel in 5 minutes?

Q2. A person covers 108 kms in 3 hours. What is his speed in meter per second?

Q.3 Write 3 difference between mass and weight.

Q.4. Define the following.

a)Motion b) uniform Motion c) Non Uniform motion d) Translatory motion

Q.5. Give an example of each types of motion

- **Rectilinear motion,**
- **Circular motion,**
- **Periodic motion and.**
- **Rotational motion**
- **Vibratory motion**