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### Rest and Motion

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### Motion is Relative

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While sitting in the moving train, the distance of the platform from the compartment is changing as time passes. So, the platform is moving with respect to the compartment. Also, the compartment is moving with respect to the platform.

### Types of Motion

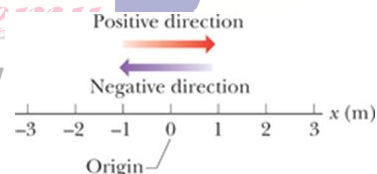
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5. Rolling motion: type of motion that combines rotation and translation of an object with respect to the surface. For example, the wheels of a moving cycle.

### Position of a Particle along a Straight Line

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Position of Particle: 'The position of a particle moving along a straight line is described by a quantity 'x'. The numerical value of 'x', together with the unit, gives the distance of the particle from the Origin, and the sign of 'x' denote whether the particle is in the positive direction or in the negative direction.'



### Vector and Scalar Quantity

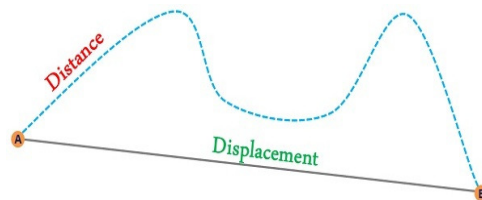
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If the mass of an object is 2kg, the mass is represented by the number 2 along with the unit 'kg'.

Physical quantities with which we can associate only magnitude i.e. numbers as well as direction are called Vector Quantities. For e.g., weight, displacement, velocity etc.

### Distance Traversed and Displacement

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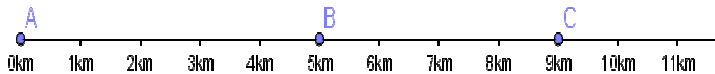




the direction in which the body travels. It is a scalar quantity. Its SI unit is Metre. The displacement is the change in the position of the object when it moves from a given position to another position. It gives the shortest path measured in the direction from the initial position to the final position of the object. It's a vector quantity. Its SI unit is metre.

### Exercise 1

Q1. In the adjoin figure, find the distance and displacement if the boy starts form 'A' goes to 'B' and then goes to 'C', then travels back to point 'B'.



Q2. A man leaves his house at 5:30 am for a morning walk and returns at 6: 15 am. Find his displacement in this time. (45 min)

Q3. The position of a particle going along a straight line is  $x = 50$  m at 10:30 am and  $x = 55$  m at 10:35 am. Find the displacement between 10:30 and 10: 35 am. (5m)

Q4. Jogger jogs along one length and breadth of a rectangular park. If the dimensions of park are 15m X 120 m, then find the distance travelled and displacement of the jogger. (270 m, 30/41 m)

Q5. A body moves in a circular path of radius 20cm. If it completes two and half revolution along the circular path, then find distance and displacement of the body.

Q6. What is the displacement of a satellite when it makes a complete round along its circular path?

### Uniform and Non Uniform Motion

A body is said to have a uniform motion, if it travels equal distances in equal intervals of time, no matter how small these intervals may be. The distance travelled by an object in uniform motion increases linearly. For e.g., if a car moving along a straight line covers equal distances in equal intervals of time, it is said to be in uniform motion.

A body is said to have a non-uniform motion, if it travels unequal distances in equal intervals of time, then no matter how small these intervals may be. For e.g., a car moving through a crowded market has non-uniform motion.

### Speed of an Object

The speed of an object is equal to the distance travelled by it in a short time interval divided by the time interval. We can also say that, speed is the distance covered per unit time. Its SI unit is metre/second or m/s.

$$\text{Speed (v)} = \text{Distance (s)} / \text{Time (t)}$$

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### Average Speed

Average speed of an object in a time interval is equal to the total distance travelled divided by the total time taken.

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**Exercise 2**

Q1. Mr X is standing on one corner of a swimming pool of dimensions 30m x 40m. He moves to the opposite's corner walking around the edge of swimming pool.

a) What are his displacement and the distance covered by him?

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Q2. Convert 72 km/hr into m/sec. (20m/sec)

Q3. A car covers 30km at a uniform speed of 60 km/hr and next 30 km at a uniform speed of 40km/hr. Find the total time taken. (1hr 15 min)

Q4. A bus between Kerala and Goa passes the 100km, 160 km, 220 km points at 10:30 am, 11:30 am and 1:30 pm. Find the average speed of the bus during each of the following:

a) 10:30 am to 11:30am (60km/h)

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Q5. Convert 15 m/sec into km/hr. (54 km/hr)

Q6. The average speed of a bicycle, an athlete and a car are 18 km/hr, 7m/ sec and 2 km/ min respectively. Which of the three is the fastest and which is the slowest. (car is fastest and bicycle is slowest)

Q7. An object travels 14 m in 4sec and then another 16 m in 2 sec. What is the average speed of an object? (5m /sec)

Q8. A car travels 100 km in 2 hours and then 150 km in 4 hours. What is the average speed of the car? (41.67 km/hr)

Q9. If the first 100 km of a 500 km journey is covered at a speed of 50 km/hr and the rest of the journey is covered at a speed of 40 km/hr. What is the average speed during the entire journey?

**Velocity**

The velocity of an object is a quantity that gives the speed of an object as well as its direction of motion. Velocity has magnitude as well as direction. It is a vector quantity. Is the speed or the direction of the motion of an object is changed, its velocity changes. The velocity '5 km/hr, North' is different from the velocity '7km/hr, North'.

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Average velocity is defined as the ratio of total displacement of the object to the total time taken. It is expressed as:

Average Velocity ( $v_{AB}$ ) = Total Displacement / Total time taken

Average Velocity ( $v_{AB}$ ) = [Initial Velocity (u) + Final Velocity (v)] / 2





### Difference Between Speed and Velocity

	<u>Speed</u>	<u>Velocity</u>
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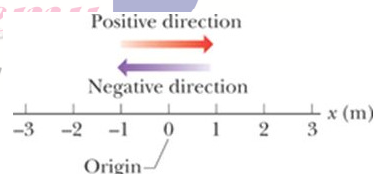
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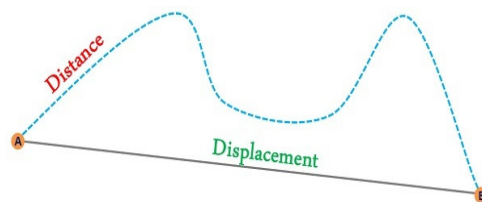
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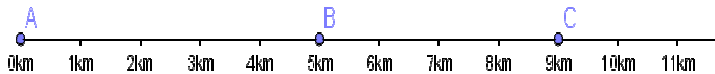




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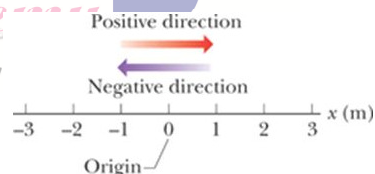
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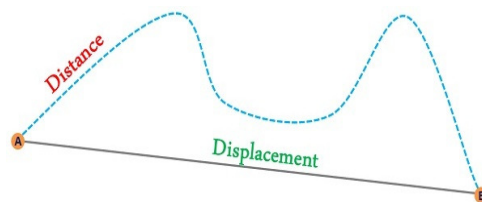
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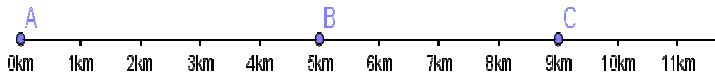




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Average velocity is defined as the ratio of total displacement of the object to the total time taken. It is expressed as:

Average Velocity ( $v_{AB}$ ) = Total Displacement / Total time taken

Average Velocity ( $v_{AB}$ ) = [Initial Velocity (u) + Final Velocity (v)] / 2





### Difference Between Speed and Velocity

	<u>Speed</u>	<u>Velocity</u>
1	It is the distance covered by the body per unit time.	It is the displacement of the body per unit time.
2	It is a Scalar Quantity	It is a Vector Quantity
3	The average speed of a moving body can never be zero.	The average velocity of a moving body can be zero. (when displacement = 0)
4	Speed of a body can never be negative	Velocity of a body can never be negative, positive or zero.

Q1. A body travels one third of a distance with a velocity of 25 m/s and the remaining distance with a velocity of 40 m/s. Calculate Average velocity. (Hint: Take total time to be T) (35m/sec)

Q2. A body travels with a uniform speed of 30 m/s for 600 m and then it travels with a uniform speed of 25 m/s for the next 1000 m. What is the average speed of the body? (80/3 m/sec)

Q3. A racing car is running on a circular track of radius 49 m with a speed of 22 m/s. What displacement of the car from the starting point, after 14 s from the start of the journey?

Q4. A car moved from Kishan Garh to Ram Garh covering a distance of 200 km on a straight road with a uniform speed of 50km/hr. It immediately returned from Ram Garh and covered the distance in 8 source speed of 50 km/hr. What is the average velocity and average speed of the car at the journey?

Q5. A car was moving at a speed of 25 m/s when brakes were applied and it was brought to a speed of 10 m/s. What is the change in speed?

Q6. Fill in the blanks:

1. 1GF = \_\_\_\_\_ F

4. 1PF = \_\_\_\_\_ F

7. 1NM = \_\_\_\_\_ M

2. 1MA = \_\_\_\_\_ A

5. 1KG = \_\_\_\_\_ G.

8. 1DG = \_\_\_\_\_ G.

3. 1MM = \_\_\_\_\_ M.

6. 1US = \_\_\_\_\_ S.

Q7. Change from one unit to another unit:

(i) 18 km/hr to m/s

(ii) 25 m/s to km/hr

(iii) 72 km/hr to m/s

(iv) 36 km/hr to dm/min

