

## Unit One: Force and Motion

### Lesson 1

### Motion in One Direction

**Motion:** It is the change of an object's location as time passes according to the location of another object.

**There are two main types of motion:**

- a- Translational Motion (along a straight line).
- b- Periodic Motion (along a curved path).

**\* Speed:**

It is the distance covered by object in one second (per unit time).

OR: is change of distance with change time.

OR: is the rate of change of distance.

Unit: m/s or km/h.

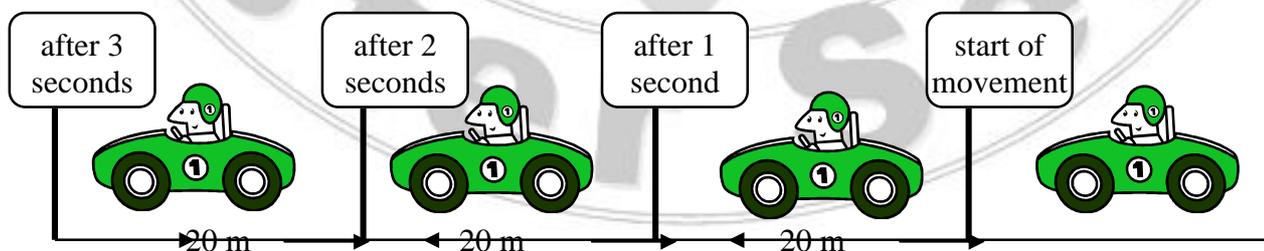
$$V = \frac{\Delta d}{\Delta t}$$

To convert Km/h to m/s (Multiply 5/18)

**Types of speed:**

**1- Uniform (regular) speed:**

The object covers equal distances at equal periods (interval) of time.



A car moved at a regular speed.

$$V = \frac{\Delta d}{\Delta t} \quad \text{for regular speed only.}$$

## 2- Non-uniform (variable) (Irregular) speed:

The object covers equal distances at unequal periods (interval) of time.

OR: The object covers unequal distances at equal periods (interval) of time.]

### - Average speed ( $\bar{V}$ )

It is the total distance that a moving object covers divided by the total time taken to cover this distance.

$$\text{Average speed: } \bar{V} = \frac{\text{Total distance moved (D)}}{\text{total time (T)}} = \frac{d}{T}$$

\* In case of moving at regular speed, the average speed equals the fixed uniform speed.

This means that  $V = \bar{V}$  and this represents the regular motion.

\* In case of moving at irregular speed, we calculate the average speed.

### Relative Speed:

\* If there is a person standing on the side of the road, and he observes the speed of the moving car (this person is called observer).

\* Therefore measuring speeds depend on the position of the observer who determines the magnitude of this speed.

\* This means that:

Relative speed: is the speed of moving object relative to the observer.

\* We conclude that:

The value of the car's speed relative to the observer standing on the ground differs from the value of the car's speed relative to an observer in another moving car.

## Home Work

### I) Complete the following statements:

1. The.....is defined as the speed of moving object relative to the observer.
  2. The total distance that a moving object covers divided by the total time taken to cover this distance is known as .....
  3. The uniform speed of a car is 90 km/ hour so, its speed equals ..... m/s.
  4. When the average speed of an object equals the uniform speed in this case the motion represents ..... motion.
  5. The relative speed of moving object depends on .....
- 

### II) Write the scientific term:

1. The distance that a moving object covers within a unit time. [.....]
  2. The speed in which the object moves to cover equal distances at equal periods of time. [.....]
  3. The speed of moving object relative to the observer. [.....]
  4. The change in the position of a body by time relative to the position of another body. [.....]
  5. The simplest type of motion. [.....]
- 

### III) Put (✓) or (×) then correct what is wrong:

1. When a moving object covers equal distances at equal periods of time so it moves with uniform acceleration ( )
2. A car moves with regular speed covers 500 meters in 20 sec. its speed is 200m/s. ( )
3. Average speed is the speed of a moving object relative to the observer ( )
4. Measuring the relative speed for a moving car depends on the presence of speedometer, which determines the speed value. ( )
5. The relative speed of two moving bodies in the same direction equals the sum of their speed. ( )

**IV) Give reasons for:**

1. The moving car seems stable to an observer moves with the same speed and direction.

.....

2. The uniform speed of a car can't be obtained practically.

.....

3. The motion of the trains can be considered as a motion in one direction.

.....

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**V) Define each of the following:**

(1) Speed.

.....

(2) Irregular speed.

.....

(3) Average speed.

.....

(4) Relative speed.

.....

(5) Motion.

.....

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**VI) Problem:**

A runner covered a distance of 100 meters to the north in 30 seconds, then 50 meters to the east in 10 seconds, then 100 meters to the south in 15 seconds, and then he came back again to the starting point in 5 seconds. Calculate.

1. The total distance covered by the runner.

.....

2. The average speed of the runner.

.....

## Lesson 2

### Graphic Representation of Moving in Straight Line

\* **Acceleration:** is the speed of object in one second (per unit time).

OR: is change of speed with change time. OR: is the rate of change of speed.

**Note:** If body moves from rest  $V_1 = 0$  a body stops  $V_2 = 0$

$$* \text{Acceleration (a)} = \frac{\text{Change in speed } (\Delta V)}{\text{Time } (\Delta t) \text{ in which change occurs}}$$

$$\text{Acceleration (a)} = \frac{\text{Final speed (V}_2\text{)} - \text{initial speed (V}_1\text{)}}{\text{Time } (\Delta t)}$$

$$* \text{ Acceleration units} = \frac{\text{Speed units}}{\text{Time unit}} = \frac{\text{m/s}}{\text{s}} = \text{m/s}^2$$

#### Types of acceleration:

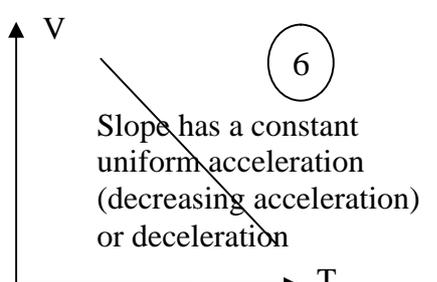
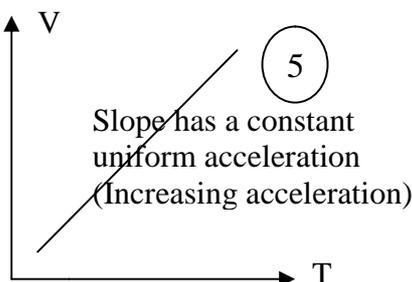
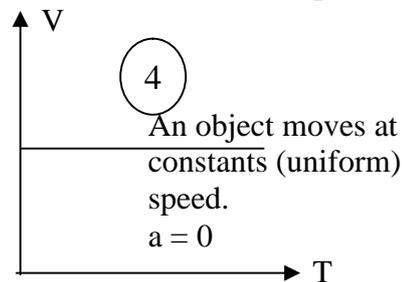
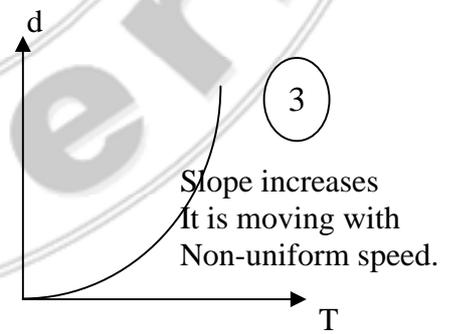
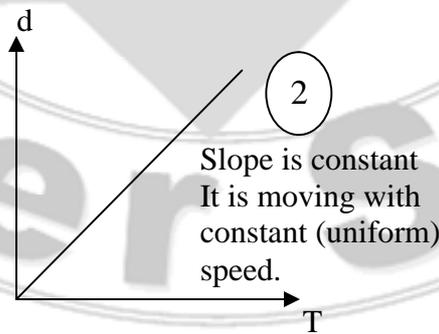
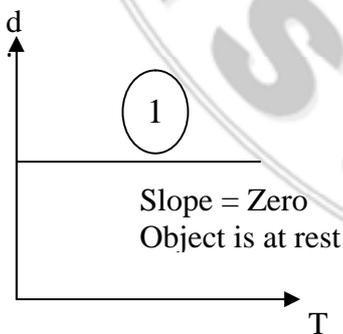
**Uniform acceleration:** It is acceleration of object when moves by equal speeds in equal periods of time. (Increasing and decreasing acceleration).

Increasing acceleration when  $(V_2 > V_1)$

Decreasing acceleration when  $(V_2 < V_1)$

$a = 0$  when uniform speed  $(V_2 = V_1)$

\* Graphics can possibly represent the relation between distance or speed on x-axis and time in a moving car on y-axis.



## Home Work

### I) Complete:

1. The value of change of an object's speed in one second is .....
  2. When an object moves with decelerating motion this means that it's ..... speed is greater than its .....speed.
  3. For a car moves with regular speed, the ratio  $d / t$  is .....
  4. The ratio between the final speed and initial speed for an object moves with accelerating motion is .....one.
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### II) Write the scientific term:

1. The graph for a regular motion at uniform speed that is represented by a straight line parallel to the (x) axis. [.....]
  2. The change of the object's speed by equal values through equal periods of time. [.....]
  3. The graph for a regular motion at uniform speed which is represented by a straight line passes through - the origin point. [.....]
- 

### III) What's the difference between:

1. Speed - acceleration (Definition - measuring unit)  
.....
  2. The graphical relation (distance - time) and the graphical relation (speed - time) for regular motion in a straight line at constant speed.  
.....
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### IV) Problems:

- 1- A racing car starts moving from the rest. Then its speed increased to 900 m/s through 5 second. Calculate the acceleration of the moving car.  
.....
- 2- A car moves at speed 100 km / h if the driver reduces its speed by a rate of 2km / h<sup>2</sup>. Calculate the car's speed after half hour.

## Lesson 3

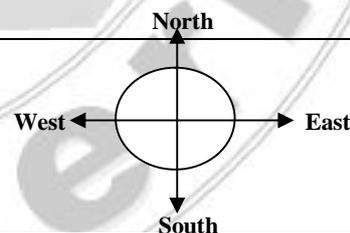
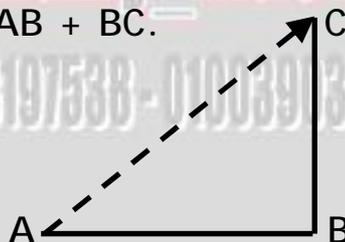
### Physical quantities: (Scalars and Vectors)

1- Physical quantities are classified into two types:

Points	Scalar physical quantity	Vector physical quantity
Definition	It has a magnitude only.	It has a magnitude & direction.
Examples:	Mass (kg), length & distance (m), time(s), speed (m/s).	Force (Newton), acceleration & gravitational acceleration (m/s <sup>2</sup> ) displacement (m), velocity (m/s).

2- Distance and displacement:

Points	Distance	Displacement
Definition	It is the actual (real) path between two positions.	The length of the shortest straight line between two positions. OR: distance in a constant direction.
Scalar or vector	Scalar quantity, which has a magnitude only.	Vector which has a magnitude & direction.
Example	Distance (d) = AB + BC.	Displacement (d) = AC.
Unit	Meter.	Meter.



3- Speed and velocity:

Points	Speed	Velocity
Definition	Distance covered by object in one second.	Displacement covered by object in one second.
Type	Scalar.	Vector.
Units	m/s or Km/h	
Law	velocity = $\frac{\text{Distance}}{\text{Time}}$	velocity = $\frac{\text{Displacement}}{\text{Time}}$

## Home Work

### I) Complete the following:

1. The ..... is a vector quantity while .....is a scalar quantity.
  2. .... is the distance in a constant direction and is a vector quantity.
  3. Average velocity =.....
- 

### II) What's the difference between :

- Distance and displacement (Definition only).

.....

- Scalar quantity and vector quantity (Definition and Examples).

.....

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### III) What is meant by?

1. The displacement of an object is 60 meters in east direction.

.....

2. The average velocity of a moving car is 80 km / h.

.....

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### IV) When dose the following cases happen:

1. The displacement covered by a moving body equals zero.

.....

2. The distance and displacement of a moving object are equal.

.....

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### V) Problems:

1. A tennis ball falls from a height of 30 m. then it rebounds from the ground to upward a distance of 6 m. find the distance covered by the ball and the displacement .

.....

2. If a body starts its motion from point (a) covered 20 meters northward till point (b) within 20 seconds, then 50meters eastward till point ( c ) within 10 seconds then 20 meters southward till point (d) within 5 seconds calculate the average velocity .

.....  
.....

3. A body moves in a circular path, starting from the point A to B to C to D and returns back to the start point (A) if the circumference of the path is 200 meters and the body covered the distance (ABC) within 10 seconds. Then it covered the distance (CDA) within 20seconds calculate:

1) The total distance the body moved.

.....

2) The average speed of the body.

.....

3) The displacement.

.....

4) The average velocity of the body.

.....

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**VI) Give reasons for:**

1. Velocity and acceleration are vector quantities. While distance and length are scalar quantities.

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2. Pilots take in consideration the velocity of the wind.

.....

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**VII) Write the scientific term:**

1. The length of shortest straight line between primary position and final position. [.....]

2. The rate of change of displacement. [.....]

3. The vector quantity, which is measured in  $m/s^2$ . [.....]

## Technology of Unit (1)

1- The predator (cheetah) is one of the fastest animals as it is possible that its speed reaches 27 m/s.

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2- If the sun is 149000,000 kilometers away from the Earth and if the speed of light is 300,000 Km/s,

To calculate the time that light takes to reach from the sun to the Earth.

$$\text{Time} = \frac{\text{Total distance moved}}{\text{Light speed}} = \frac{149000000}{300000} = 496.67\text{s} = 8.3 \text{ minutes.}$$

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3- Plane flies in the reverse direction of the wind.

1- Increase wind resistance.

2- Increase compensation of fuel.

3- Increase time taken to complete trip.

Ø Pilots take into consideration the directing velocity of the wind. (G.R)

- To calculate the amount of fuel necessary to complete the trip.

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4- Speedometer:

It is a device used to detect the speed of car or plane.