



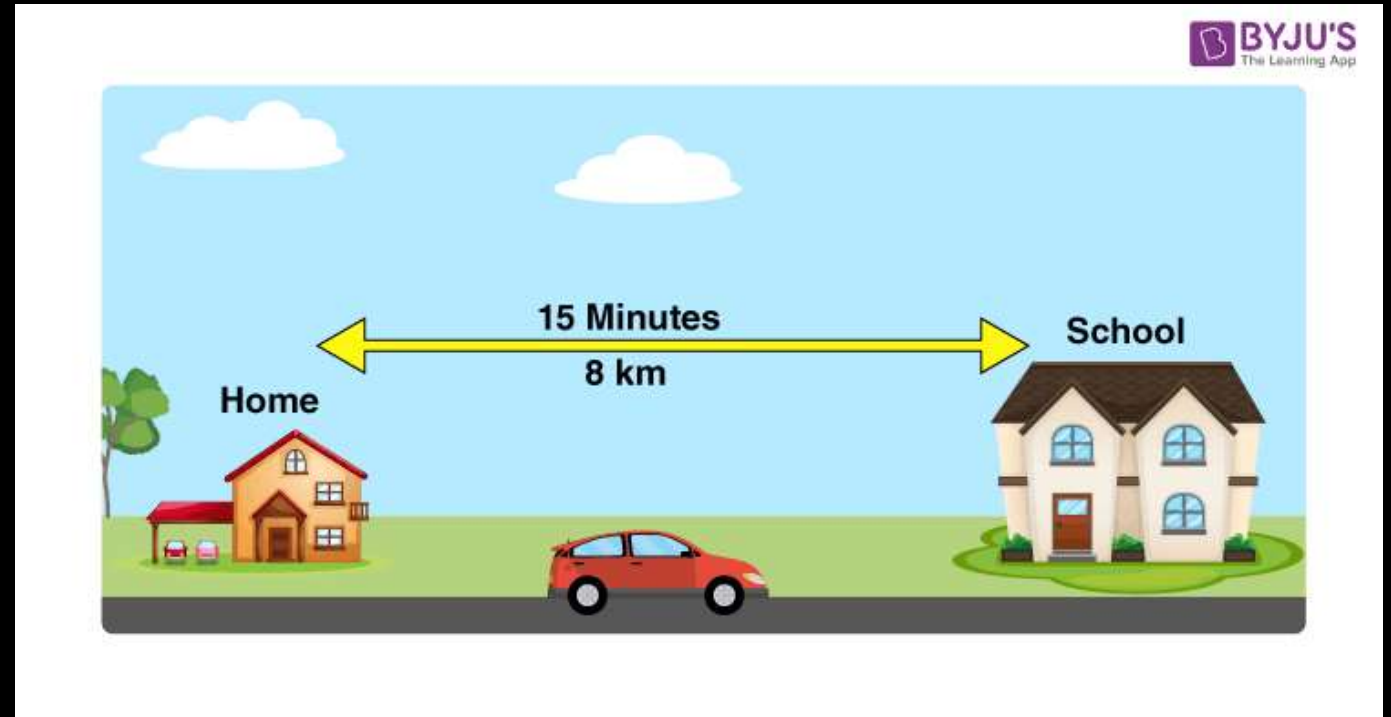
VELOCITY

VELOCITY

- defined as the rate of change of the object's position with respect to a frame of reference and time. It might sound complicated but velocity is basically speeding in a specific direction. It is a vector quantity, which means we need both magnitude (speed) and direction to define velocity.
- Can be solve using the formula:
 - Average velocity = $\frac{\textit{displacement}}{\textit{time}}$

EXAMPLE:

Jewel goes to school in her dad's car every morning. Her school is 8 km from her home, and she takes 15 mins to travel, but when she looks at the speedometer on the dashboard of the car, it shows a different reading all the time. So, now how would she know her velocity?



- For convenience, we have considered the car to move in a straight line, and we will convert all the units of time to hours. Therefore, 15 mins = $15/60 = 0.25$ hours.

Average velocity, $v = d/t$

$$v = 8 \text{ km}/0.25 \text{ hrs}$$

$$v = 32 \text{ km/h}$$

Now we see that even though the car may vary its speed, if it covers the same amount of distance in the same amount of time, every time its average velocity will remain the same.

SAMPLE PROBLEM:

1. George walks to a friend's house. He walks 750 meters North, then realizes he walked too far. He turns around and walks 250 meters South. The entire walk takes him 13 seconds. what was George's velocity in meters per second? (hint: draw a picture to find his displacement)
2. A man walks 7 km in 2 hours and 2 km in 1 hour in the same direction. What is the man's average velocity for the whole journey?
3. A man walks 7 km East in 2 hours and then 2.5 km West in 1 hour.
 - a. What is the man's average speed for the whole journey?
 - b. What is the man's average velocity for the whole journey?

EXERCISES!!!

1. You start walking from a point on a circular field of radius 0.5 km and 1 hour later you are at the same point.
 - a) What is your average speed for the whole journey?
 - b) What is your average velocity for the whole journey?
2. John drove South 120 km at 60 km/h and then East 150 km at 50 km/h. Determine
 - a) the average speed for the whole journey?
 - b) the magnitude of the average velocity for the whole journey?



ACCELERATION

ACCELERATION

- change in velocity in a particular time interval.
- It is a vector quantity, is defines as;

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time interval}}$$

$$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$$

HOW DO YOU KNOW IF A BODY IS ACCELERATING?

- Three things to consider in order for you to determine if a body is accelerating; **the speed, the direction, and both speed and direction.**
- Since velocity involves speed and direction, a body is accelerating if it has –
 1. Constant speed but changing direction,
 2. Constant direction but changing speed, and
 3. Both changing speed and changing direction.
- For instance: a car is travelling north at a speed of 30 km/h, then turns right at a corner while maintaining its speed. The speed of the car is uniform at 30 km/h but the velocity changes because its direction changes from north to east.

EXAMPLE: a car increases its velocity from 50 m/s to 80 m/s in 2.0 s maintaining its direction/ what is its acceleration?

• **GIVEN:**

$$v_f = 50 \text{ m/s}$$

$$v_i = 80 \text{ m/s}$$

$$\Delta t = 2.0 \text{ s}$$

• **SOLUTION:**

(assume that the direction of motion is positive)

$$\bar{a} = \frac{v_f - v_i}{\Delta t}$$

$$\bar{a} = \frac{80 \text{ m/s} - 50 \text{ m/s}}{2 \text{ s}}$$

$$\bar{a} = \frac{30 \text{ m/s}}{2.0 \text{ s}}$$

$$\bar{a} = 15 \text{ m/s}^2$$

• **ANSWER:**

The car's acceleration is 15 m/s² in the positive direction.

EXAMPLE: approaching a street with heavy traffic, a jeep slows down and reduces its velocity from 90 km/h to 10 km/h in 10 seconds. Calculate the acceleration of the jeepney.

• **GIVEN:**

$$v_f = 10 \text{ km/h or } 2.778 \text{ m/s}$$

$$v_i = 90 \text{ km/h or } 25 \text{ m/s}$$

$$\Delta t = 10 \text{ s}$$

• **SOLUTION:**

$$\bar{a} = \frac{v_f - v_i}{\Delta t}$$

$$\bar{a} = \frac{2.778 \text{ m/s} - 25 \text{ m/s}}{10 \text{ s}}$$

$$\bar{a} = \frac{-22.22 \text{ m/s}}{10 \text{ s}}$$

$$\bar{a} = 0.2778 \text{ m/s}^2$$

• **ANSWER:**

The jeepney's acceleration is 0.2778 m/s^2 .