

Good afternoon,  
our objectives...

To **identify** some physics concepts used in describing motion.  
To **classify** these physics concepts.  
To **relate** them to each other using  
concept maps

Good afternoon, last Tuesday, we were able to...  
complete a concept map showing the **relationships** among various kinematic concepts :  
distance (x)    • displacement  
speed (v)      • velocity

## Fundamental Concepts in Mechanics

➤ **Distance**  
SI unit : meter, m



➤ **Time**  
SI unit : second, s



➤ **Mass**  
SI unit : kilogram, kg



## Distance vs. Displacement

**Distance** (scalar)– total length of path, be it straight or not.

**Displacement** (vector)– shortest path from initial point to final point.

## Speed and Velocity

**Speed** – (scalar) a measure of how fast something is moving

$$= \frac{\text{distance}}{\text{time}}$$

**Average speed** – whole distance covered divided by the total time

$$= \frac{\text{total distance covered}}{\text{time interval}}$$

**Instantaneous speed** – speed that something has at any one instant

**Velocity** – (vector) speed and the direction of motion

$$= \frac{\Delta x}{\Delta t}$$

**Average velocity** – displacement divided by the total time

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

change in displacement over change in time

**Instantaneous velocity** – velocity at any specific instant of time

Units : m/s , km/hr, ft/s

## Review

1. Your position indicates exactly where you are located.

*Displacement vs Distance*

2. Your **VELOCITY** measures how quickly your position changes.

*Velocity vs Speed*

3. Your **ACCELERATION** measures how quickly your velocity changes.

## Review

4. In order for you to accelerate, something must exert a **NET FORCE** on you.

5. The more mass you have, the more **INERTIA** you have, and the less acceleration you experience for a given force.

## Newton's 2<sup>ND</sup> LAW OF MOTION

$$\begin{aligned} \bullet \quad \vec{a} &\propto \vec{F}_{net} \\ \bullet \quad \vec{a} &\propto \frac{1}{m} \end{aligned}$$

$$\vec{F}_{net} = m\vec{a}$$

Unit:

- Newton (N)
- kg-m/s<sup>2</sup>

## Newton's 1<sup>st</sup> LAW OF MOTION

### Law of Inertia

If the velocity of an object is constant,

$$\text{then, } \Sigma F = 0 \text{ or } F_{\text{net}} = 0$$

If  $\Sigma F = 0$  or  $F_{\text{net}} = 0$ ,

then the velocity of an object is constant.

## Newton's 3<sup>rd</sup> LAW OF MOTION

### FORCES COME IN PAIRS !

For a force  $\vec{F}_{AB}$ , there is another force  $\vec{F}_{BA}$ , where

$$\vec{F}_{AB} = - \vec{F}_{BA}$$