Velocity (Notes)

Translational Motion

the motion of objects that move without rotating

Mechanics the study of why and how objects move

Kinematics how objects move

Dynamics why objects move

Vector

has magnitude (a number representing how big it is) and direction

Scalar has magnitude only

Position

separation between an object and a reference point; "where you are"

Distance

how far you have traveled; "odometer reading;" the magnitude of the change in position; scalar quantity; symbol is d and SI unit is m (for meters)

Displacement

how far you have gone in a certain direction; distance with direction; how far you are from your starting point; "as the crow flies;" vector quantity; symbol is d or x and SI unit is m (for meters); the change in position of an object

Displacement = change in position = original position minus initial position



Displacement does not always equal the distance traveled! Displacement describes the direction of motion of the object. We will call the displacement of an object moving to the right positive and that of an object moving to the left negative.Directions in physics can be assigned positive and negative signs. For now, let right and up be positive and left and down be negative.

Speed

distance (how far you have gone) traveled in a given amount of time; scalar quantity; symbol is vandSI unit is m/s (for meters per second)

Velocity

displacement (how far you have gone in a certain direction) per time interval; vector quantity; symbol is v and SI unit is m/s (for meters per second) In physics, definitions can be expressed mathematically. The definition for speed (and velocity) can be expressed as:

$$v = \underline{d}$$
 or $d = v t$

Instantaneous velocity (or speed)

velocity (or speed) at that instant of time, or, it can be defined as the average velocity (or speed) over an infinitesimally short time interval (average speed and velocity are always the same value)

Frame of reference

gives location of an object relative to a reference point. Any measurement of position, distance, or speed must be made with respect to a frame of reference.

Average velocity

total displacement divided by total time vav=(displacement)/(elapsed time) vav = (change in position)/(change in time) = displacement/time = x / t The average velocity of an object is positive if the sign of the displacement is positive and negative if the sign of the displacement is negative.

Average speed

total distance divided by total time, or, the distance traveled along a path divided by the time it takes to travel this distance v_{av} =(distance traveled)/(elapsed time)