2.2 Acceleration

Objectives

- **Describe** motion in terms of changing velocity.
- **Compare** graphical representations of accelerated and nonaccelerated motions.
- **Apply** kinematic equations to **calculate** distance, time, or velocity under conditions of constant acceleration.

Deconstructing a Sentence

- Slows down = Accel and Velocity in opposite directions
- Speeds up = Accel and Velocity in same direction
- Starts from rest = Initial velocity is ZERO
- Stops = Final velocity is ZERO

Changes in V

- **Acceleration** is the rate at which velocity changes of time
- Acceleration has direction and magnitude because it is a **vector**
- An object accelerates if it…
  - Changes speed
  - Changes direction

Acceleration

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

- Solve for final velocity $\Delta t a + v_i = v_f$
- Solve for initial velocity $v_f - \Delta t a = v_i$

Math

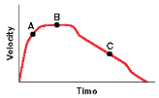
- Velocity Equations is: $v = \frac{d}{t}$
- Acceleration equations is: $a = \frac{v_f - v_i}{\Delta t}$
- Combine them to get: $a = \frac{\frac{d}{t_f} - \frac{d}{t_i}}{\Delta t}$

Assignments

- Sample Problem B

Acceleration

- Consider a train moving to the right, so that the displacement and the velocity are positive.
- The slope of the velocity-time graph is the average acceleration.
  - When the velocity in the positive direction is increasing, the **acceleration is positive**, as at **A.**
  - When the velocity is constant, there is **no acceleration**, as at **B.**
  - When the velocity in the positive direction is decreasing, the **acceleration is negative,** as at **C.**



Visual Concept

Accel (cont)

v_i	a	Motion
+	+	speeding up
−	−	speeding up
+	−	slowing down
−	+	slowing down
− or +	0	constant velocity
0	− or +	speeding up from rest
0	0	remaining at rest

Demo

- Tiles and walking
- Constant Clapping/Beeping
- Constant
- Increasing
- Decreasing

Questions

- Pg 46 – Conceptual Challenge #2 and #3
- Pg 47 – Fig 2.4
  - Create a line graph of something moving with a constant acceleration of 3 m/s^2 .
    - Graph velocity vs. time
      - What do you notice?

Equations for Constantly Accelerated Straight-Line Motion

Form to use when accelerating object has an initial velocity	Form to use when accelerating object starts from rest
$\Delta x = \frac{1}{2}(v_i + v_f)\Delta t$	$\Delta x = \frac{1}{2}v_f \Delta t$
$v_f = v_i + a\Delta t$	$v_f = a\Delta t$
$\Delta x = v_i \Delta t + \frac{1}{2}a(\Delta t)^2$	$\Delta x = \frac{1}{2}a(\Delta t)^2$
$v_f^2 = v_i^2 + 2a\Delta x$	$v_f^2 = 2a\Delta x$

Assignment

- Supp Prob B, C, D, E
- Q: 5,
- *Practice problems on pgs 49, 51, 54*
- *Packet 2A – 2E*
  - *Odds*