

3.1 ACCELERATION

STANDARDS

3.1 I can interpret and analyze the motion of an object moving with constant acceleration.

Chapter In Review

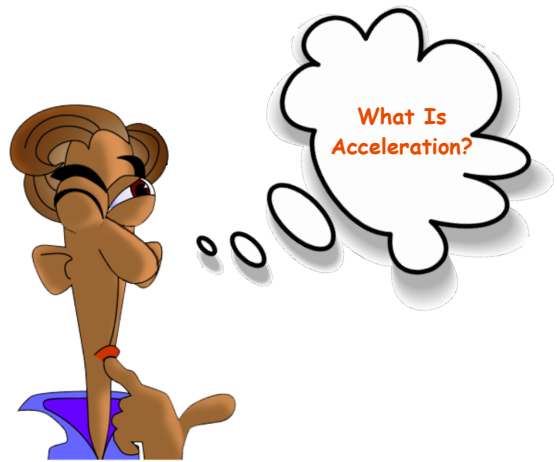
Distance = Total Length of Travel

Displacement = Change in position
 $= \Delta x = x_f - x_o$

Chapter In Review

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

Average Velocity = $\frac{\text{displacement}}{\text{time}}$



Acceleration?

Acceleration is the rate at which an object's velocity changes.

$a = \frac{\Delta v}{\text{time interval}}$

Acceleration?

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

units
 $\frac{m}{s^2}$

$\vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_f - \vec{v}_o}{t} \left(\frac{\frac{m}{s}}{s} \right)$

Tesla Roadster



Tesla Roadster

$$V_i = 0$$

$$V_f = 60 \text{ mph} = \frac{60 \text{ mi}}{\text{hr}} \times \frac{1609 \text{ m}}{1 \text{ mi}} \times \frac{1 \text{ hr}}{3600 \text{ s}} = 26.7 \frac{\text{m}}{\text{s}}$$

$$t = 1.9 \text{ s}$$

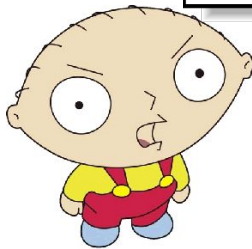
$$a = ?$$

$1 \text{ m/s} = 2.24 \text{ mph}$

$$\vec{a} = \frac{\Delta \vec{v}}{t} = \frac{V_f - V_i}{t} = \frac{26.7 \frac{\text{m}}{\text{s}} - 0}{1.9 \text{ s}}$$

$\vec{a} = 14.1 \frac{\text{m}}{\text{s}^2}$

I feel accelerated!

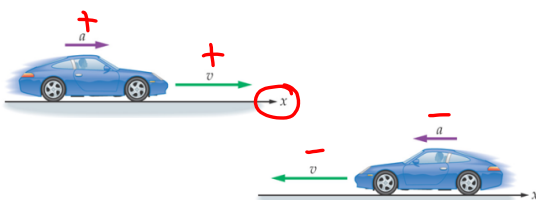


Deceleration?

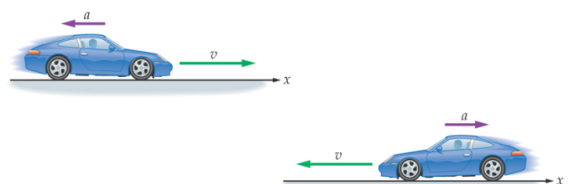
Positive Acceleration vs. Negative Acceleration



When the velocity and acceleration of an object have the same sign, the speed of the object increases.




When the velocity and acceleration of an object have opposite signs, the speed of the object decreases.



Example

You are driving down Grand Ave. at 35.0 mph. Suddenly, an unsuspecting high school student begins to cross the street, and you have to slam on your brakes to avoid a collision. If it takes you 1.50 seconds to come to a complete stop, what is your acceleration in m/s^2 ?

$V_0 = 35 \text{ mph} \times \frac{1 \text{ m/s}}{2.24 \text{ mph}} = 15.6 \text{ m/s}$
 $V_f = 0$
 $t = 1.50 \text{ s}$
 $a = ?$



$$\vec{a} = \frac{\Delta \vec{v}}{t} = \frac{V_f - V_0}{t} = \frac{0 - 15.6 \text{ m/s}}{1.5 \text{ s}}$$

$\vec{a} = -10.4 \text{ m/s}^2$

PRACTICE

Unit 3 Practice Problems (1-5)