3.1 acceleration

**Standards**

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

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**Chapter In Review**

Distance = Total Length of Travel

Displacement = Change in position
= \( \Delta x = x_f - x_o \)

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**Average Speed** = \( \frac{\text{distance}}{\text{time}} \)

**Average Velocity** = \( \frac{\text{displacement}}{\text{time}} \)

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**What Is Acceleration?**

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

\[
\alpha = \frac{\Delta \vec{v}}{\text{time interval}}
\]

Units: \( \text{m/s}^2 \)

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

\[
\alpha = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_f - \vec{v}_o}{t} \quad \text{(m/s)}
\]
3.1 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**.

**Tesla Roadster**

\[
\begin{align*}
V_f &= 0 \\
V_i &= 60 \text{ mph} \\
t &= 1.95 \\
V &= \text{?}
\end{align*}
\]

\[
\vec{a} = \frac{\Delta V}{t} = \frac{V_f - V_i}{t} = \frac{0 - 26.7 \text{ mph}}{1.95} \\
\vec{a} \approx 14.1 \text{ m/s}^2
\]
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/s²?

\[ V_i = 35 \text{ mph} \times \frac{1 \text{ m/s}}{2.24 \text{ mph}} = 15.6 \text{ m/s} \]

\[ V_f = 0 \]

\[ t = 1.50 \text{ s} \]

\[ a = \frac{V_f - V_i}{t} = \frac{0 - 15.6}{1.5} \approx -10.4 \text{ m/s}^2 \]

PRACTICE

Unit 3 Practice Problems

(1-4)