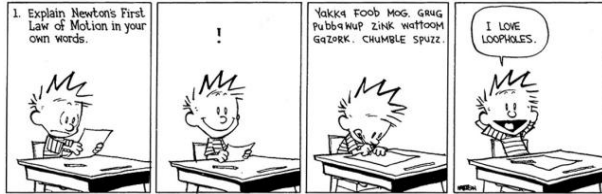


6.3 Newton's 2nd Law

LEARNING TARGETS

6.1 I can define, explain, and apply Newton's first and second laws to solve problems.

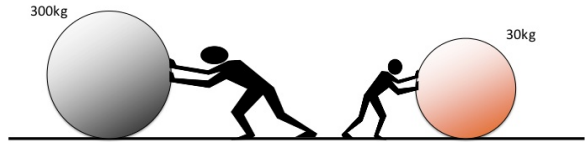


Newton's First Law of Motion: Inertia

An **object** will **not change its motion** unless **acted on** by an **unbalanced force**.

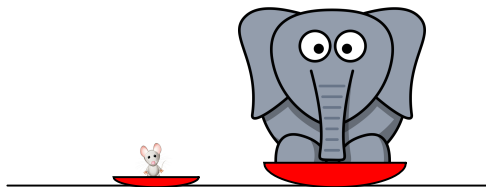
- if it is at rest, it will stay at rest
- if it is in motion, it will remain at the same velocity

Objects with a **greater mass** have **more inertia**. It takes **more force** to change their motion.



<http://www.cker.com/clipart-man-push.html>

NEWTON'S 2ND LAW



$$\frac{F}{m} = \frac{F}{M}$$

NEWTON'S 2ND LAW

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



Newton's Second Law of Motion

$F_{net} = m a$

$1 N = 1 kg \cdot \frac{m}{s^2}$

Newton

Quick Stop

11.2 m/s


A car is traveling down Virginia Lane at 25 mph and comes to a stop. Draw a free-body diagram for the car as it is stopping.

$F_{net} = F_B$

$m \cdot a = F_B$

$\vec{a} = \frac{\Delta \vec{v}}{t} = \frac{v_f - v_o}{t}$

Physics of a Car Wreck
 How much force would you feel in a 25-mph car wreck?

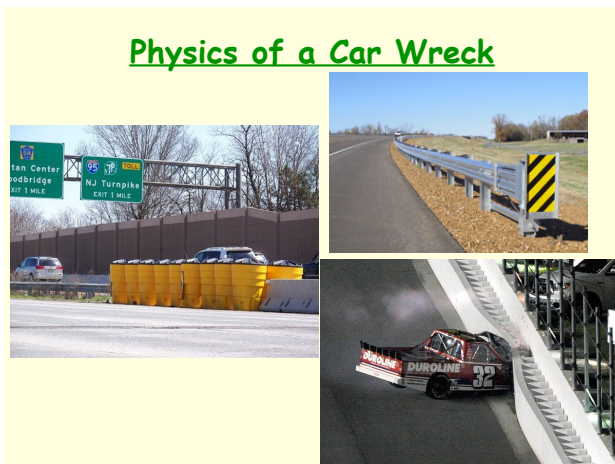
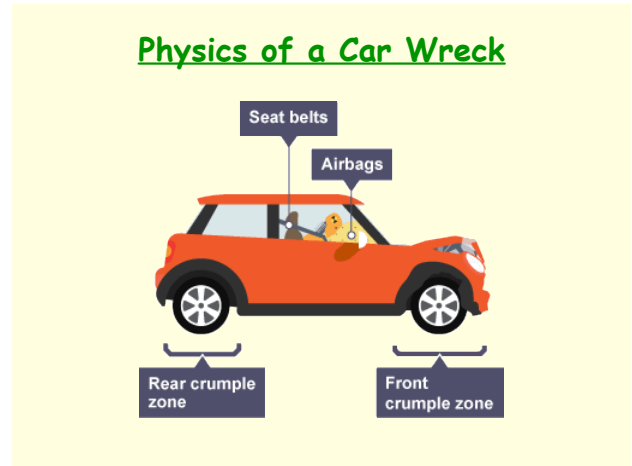


$$F = Ma$$

$$F = (65 \text{ kg}) \left(\frac{0 - 11.2 \text{ m/s}}{0.25} \right)$$

$$M = 65 \text{ kg}$$

$$F = -3640 \text{ N}$$

$$370 \text{ kg} \approx 800 \text{ lbs}$$


Foamcrete

Foamcrete is a substance designed to stop an airplane that has run off the end of a runway, without causing injury to the passengers. By crumbling, it slows the plane to a safe stop.



Foamcrete

Suppose a 747 jetliner with a mass of $1.75 \times 10^5 \text{ kg}$ and an initial speed of 26.8 m/s is slowed to a stop in 122 m . What is the magnitude of the average resistance force exerted by the Foamcrete on the plane?

$v_0 = 26.8 \text{ m/s}$
 $v_f = 0$
 $x_f = 122 \text{ m}$
 $x_0 = 0$
 $a = ?$

$v_f^2 = v_0^2 + 2ax_f$
 $\frac{-v_0^2}{2x_f} = a = -2.94 \text{ m/s}^2$

$F_{\text{net}} = F_{\text{Fc}}$
 $Ma = F_{\text{Fc}}$
 $(1.75 \times 10^5 \text{ kg})(-2.94 \text{ m/s}^2)$
 $F_{\text{Fc}} = -5.15 \times 10^5 \text{ N}$

HOMWORK
 Practice Problems
 (1-3)