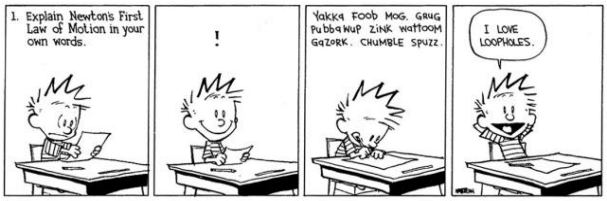
6.3 Newton's 2nd Law

LEARNING TARGETS

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

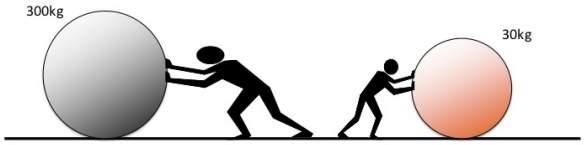


Newton's First Law of Motion: Inertia

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*

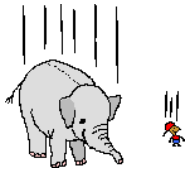
Objects with a **greater mass** have **more inertia**.
It takes **more force** to change their motion.



http://www.clker.com/clipart-man-push.html

NEWTON'S 2ND LAW

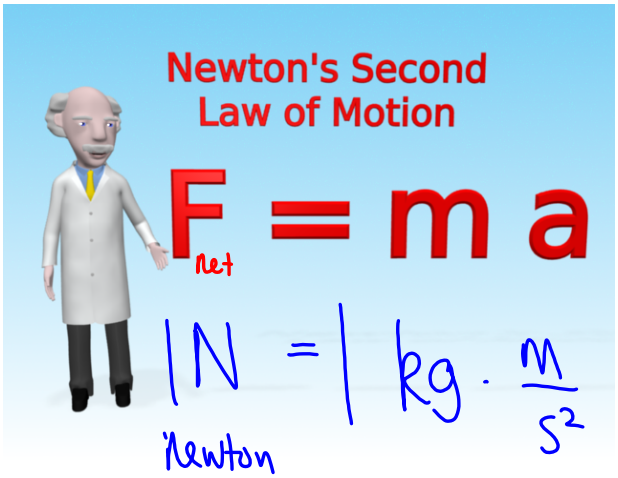
Free Fall Experiment



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

NEWTON'S 2ND LAW

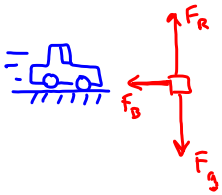
$$\vec{a} = \frac{\sum \vec{F}}{m} = \frac{\vec{F}_{net}}{m}$$



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.



$\Sigma F = F_{net} = F_B$

$ma = F_B$

$m = 65\ kg$

$$\vec{a} = \frac{\Delta V}{t} = \frac{V_f - V_0}{t}$$

Physics of a Car Wreck

How much force would you feel in a 25-mph car wreck?

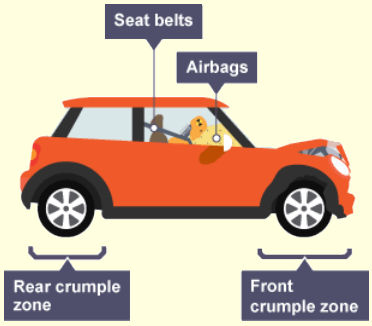
$F = ma$

$F = (65\,kg)\left(\frac{0 - 11.2\,m/s}{0.2\,s}\right)$

$F = -3640\,N$

$370\,kg \approx 800\,lbs$

Physics of a Car Wreck



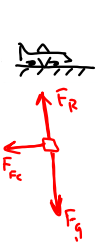
Physics of a Car Wreck

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 1.75×10^5 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?



$V_f = 0$

$V_0 = -26.8\,m/s$

$V_f^2 = V_0^2 + 2a(x_f - x_0)$

$x_f = 122\,m$

$x_0 = 0$

$a = ?$

$\frac{-V_0^2}{2x_f} = a = -2.94\,m/s^2$

$F_{net} = F_{Fc}$

$ma = F_{Fc} = (1.75 \times 10^5\,kg)(-2.94\,m/s^2)$

$F_{Fc} = -5.15 \times 10^5\,N$ ∴

HOMEWORK

Practice Problems (1-3)