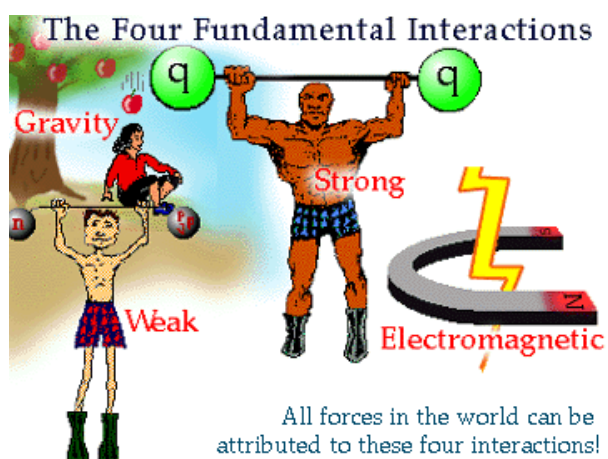


Forces...

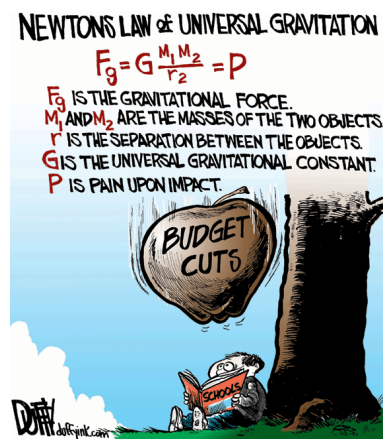
What forces are out there?



Universal Gravitation...aka GRAVITY !

- Every object attracts and is attracted to every other object in the universe.

$$F_g = \frac{G m_1 m_2}{r^2} \quad G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$$



http://www.youtube.com/watch?v=p_o4aY7xkXg
Minute Physics...Gravity

1. What is the force of attraction (gravity) between (kg) and (kg)? They are cm apart.

2. What is the force of gravity between 2 cars?

3. What is the force of gravity between a 63kg student and the earth?!

mass of earth= 5.98×10^{24} kg

radius of earth= 6.37×10^6 m

so $F_g = mg$ * where $g = 9.8 \text{N/kg}$

* when one of the masses is the earth

* also called weight

Points to remember...

1. There are always 2 equal and opposite (in direction) forces present.

2. F is only noticeable when at least one of the objects is massive.

(The whole earth only exerts 9.8 N on a 1kg mass.)

3. Inverse Square Law

What happens if the masses double?

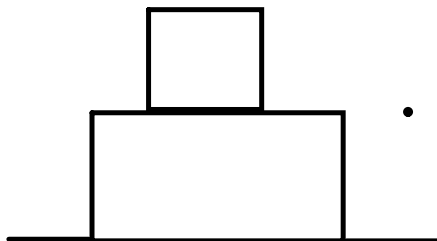
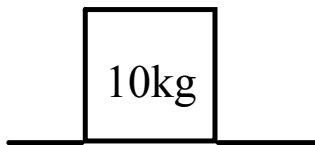
... if one mass triples?

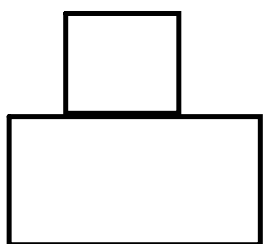
...if the distance doubles?

Normal Force

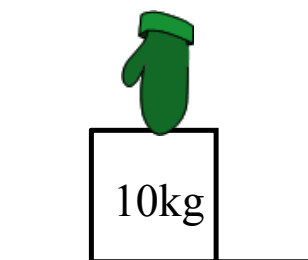
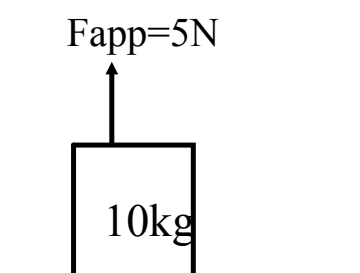
...a supporting force provided by a solid surface

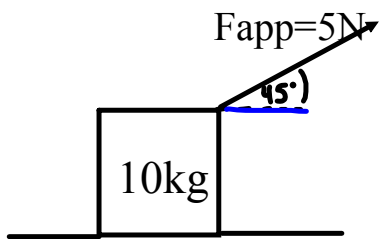
...always perpendicular to the surface





* $F_{net,y} = 0$ or *ups = downs*









The force of friction...

...always acts opposite to the direction of the object's motion.

$$F_f = \mu_k \times F_N$$





bld042282 fotosearch.com

Find the force of friction on the lawn mower.

$$M = 27 \text{ Kg}$$

$$\mu = 0.2$$

$$F_{\text{app}} = 230 \text{ N}$$





Find the friction acting on the sled .

$$\mu_k = 0.1.$$

$$m = 7500 \text{ kg}$$

$$F_{\text{app}} = 25000\text{N} [35^\circ \text{N of E}]$$