Forces

A force is a push or a pull. Forces are measured in Newtons (N) after Sir Isaac Newton.

For example F_g=ma where g is the acceleration due to gravity (9.81 m/s^2 on Earth).

Normal force ('normal' is math speak for perpendicular).

F_N is a supporting force exerted by a surface at 90°.

$$F_n = F_g cos(\theta)$$

Let's do an example: A 3kg zombie head is chopped off and lands on a 30° slope. What is the normal force on the zombie head?

How would the normal force change if θ=0 or $\frac{\pi}{2}$?

Force of Friction:

F_f is the grinding together of molecules. It resists intended motion.

$$F_f = \mu F_n$$

μ (mu) is the coefficient of friction. It describes how 'sticky' a surface is. 0 would have no friction, and 1 would be all the friction. If the number was above 1 it would be glue / tape.

A 5kg zombie head is rolling down the ramp… This time we take into account friction (F_f). μ=1.5.

Elastic Force F_e:

$$F_e = k\Delta x$$

This is the force that tries to restore things that have been stretched or deformed.

k is the 'spring constant' and it is measured in N/m. High values (10,000) for stiff objects and low values (10) for stretchy objects. x is the value you stretch the object in m.

The elastic limit is how much you can stretch an object before it will not go back to how it was.

A rubber band of length .15m and a spring constant of 12 N/m experiences a force of 5.0N.
a) What is the amount it stretches?

b) What is the new length?

Last force today:

Force of Gravity F_g:

$F_g = ma$ works on Earth or very near the surface of the Earth. We want something more general…

$$F_g = \frac{Gm_1m_2}{r^2}$$

This is Newton's law of universal gravitation.
G=6.67x10^{-11} Nm^2/kg^2
r=distance from centers of mass

Calculate the F_g on you on the moon.
r_m=1.74x10^{6}m
m_m=7.35x10^{22}kg

Calculate the F_g between me, 135kg, and my coffee, .5kg.