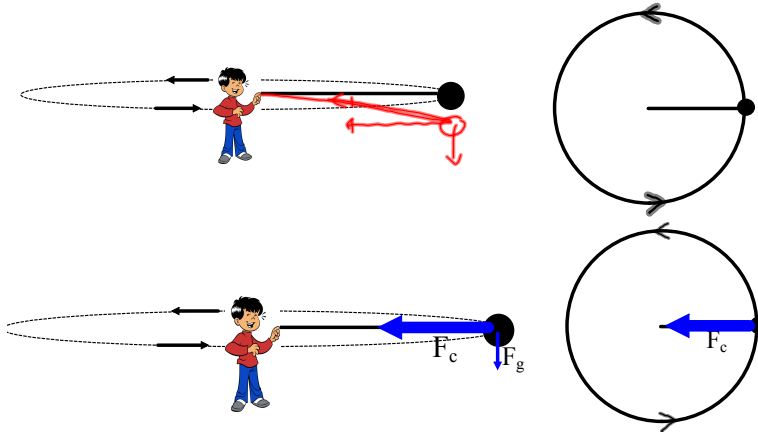


Uniform Circular Motion

An object travelling in a circular path at a constant speed



Spinning things

<http://www.youtube.com/watch?v=qkbyIfGgOiY&mode=related&search=>

Spinning wine glasses

<http://www.youtube.com/watch?v=c59V0RUiaEM>

Round-up

<http://www.youtube.com/watch?v=JWyo1kMITWs>

g force

centrifuge

<http://www.youtube.com/watch?v=EXQKI-28zn0>



Moonraker scene

[On DVD](#)

2001 Space Odyssey

[On DVD](#)

Stratosphere Rollercoaster

<http://www.youtube.com/watch?v=P3Zr-76tgnY>

<http://www.youtube.com/watch?v=TAgqpkk1NtA&mode=related&search=>

Centripetal Force is the force that causes circular motion.

It acts toward the center of the circle.

It may be one force or the resultant of 2 or more forces ΣF_c

$$F_c = \frac{mv^2}{r} \quad \frac{\text{kg (m/s)}^2}{\text{m}} = \frac{\text{kg m}^2/\text{s}^2}{\text{m}} = \text{kg m/s}^2 =$$

Recall Newton's 2nd Law

$$F = ma$$

It follows that

$$a_c = \frac{v^2}{r}$$

a_c = the centripetal acceleration (always toward the center of the circle)

Newton's Law of Gravitational Attraction

gravity is the result of the attraction between any two objects that have mass.

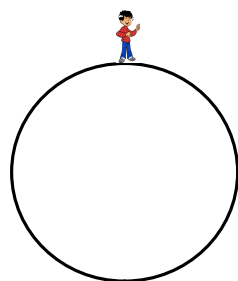
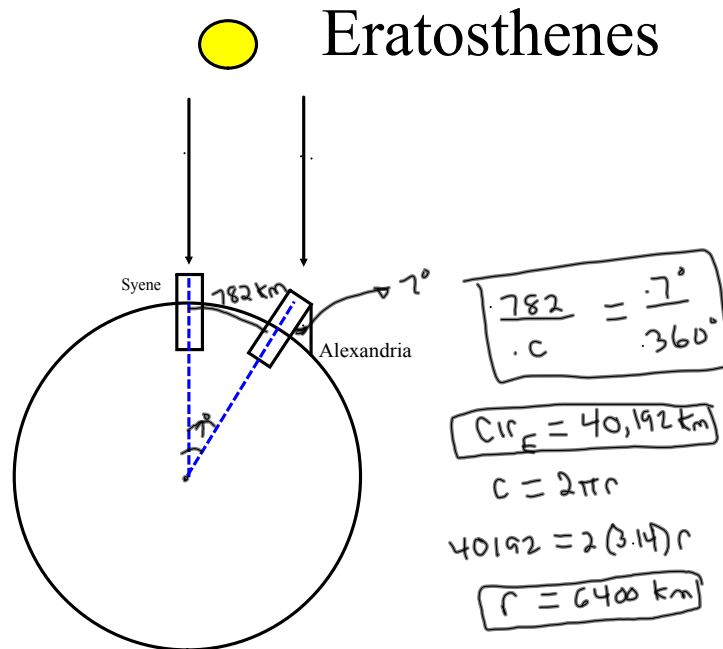
the force of attraction is proportional to the product of the masses and inversely proportional to the square of the distance between their centers of gravity.

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

G = the universal gravitational constant

$$G = 6.7 \cdot 10^{-11} \text{ Nm}^2 / \text{kg}^2$$

Mass of the Earth



$$F_g = \frac{Gm_1m_2}{d^2} \quad F_g = ma_g$$

$$F_g = \frac{Gm_1m_2}{d^2} \quad F_g = ma_g$$

$$\frac{Gm_E}{d^2} = a_g$$

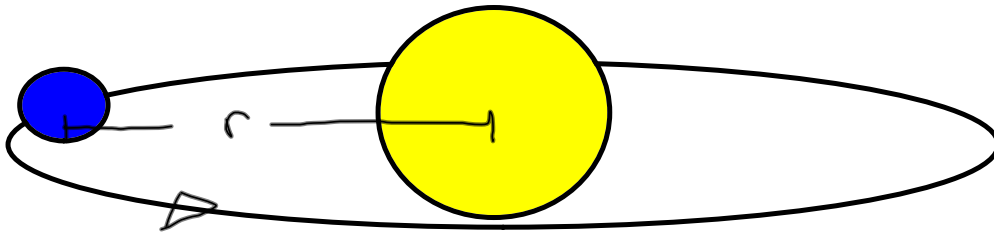
$$\frac{(6.7 \cdot 10^{-11}) m_E}{(6.4 \cdot 10^6)^2} = 9.8$$

$$m_E = \frac{(9.8)(6.4 \cdot 10^6)^2}{6.7 \cdot 10^{-11}}$$

$$m_E = 6.0 \cdot 10^{24} \text{ kg}$$

Mass of The Sun

$$r = 150,000,000 \text{ km}$$



$$F_c = \frac{mv^2}{r} \quad F_g = \frac{Gm_s m_{\text{planet}}}{d^2}$$

$$\frac{v^2}{r} = \frac{Gm_s}{r^2}$$

$$v^2 = \frac{Gm_s}{r}$$

$$v = \frac{2\pi r}{t}$$

$$m_s = \frac{v^2 r}{G}$$

$$v = \frac{2(3.14)(1.5 \cdot 10^{11})}{(1)(365)(24)(3600)}$$

$$m_s = \frac{(3 \cdot 10^4)^2 (1.5 \cdot 10^{11})}{6.7 \cdot 10^{-11}}$$

$$v = 3.0 \cdot 10^4 \text{ m/s}$$

$$m_s = 2 \cdot 10^{30} \text{ kg}$$