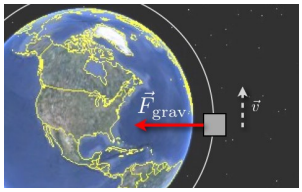
Universal Gravitation

Objectives

Identify factors that affect the amount of gravitational force between 2 objects.

Calculate the gravitational force between 2 objects.

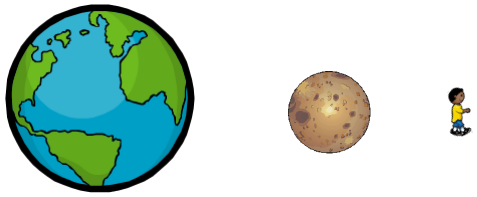


Universal Gravitation

Newton

everything that has mass also has gravity

Gravity - attractive force ....pulls two objects together



How much gravitational force?

1 kg 1 kg

1 m

F_g = ?

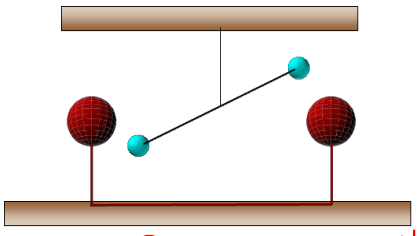
$F_g = \frac{m_1 m_2}{d^2}$

1 N ???

too much!
Missing G constant

Cavendish Apparatus

1798



G constant = 6.67×10^{-11}

Force of gravity

Longhand:

Force of gravity = Gravitational constant x $\frac{Mass_1 \times Mass_2}{(Distance)^2}$

Shorthand:

$F_g = G \times \frac{m_1 \times m_2}{D^2}$

Picture:

M. Yasuda 2002

Calculating Gravitational Force

$F_g = \frac{G m_1 m_2}{d^2}$

1 kg 1 kg

1 m

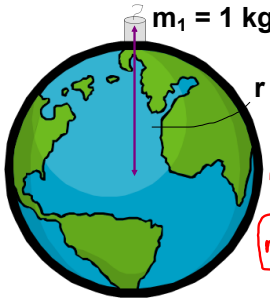
F_g = ?

6.67×10^{-11} N

or

.00000000006 67 N

"Weighing the Earth"



$m_1 = 1$ kg $F_g = 9.8$ N

$r \approx 6.4 \times 10^6$ m

$m_2 = ?$ (Earth)

$F_g = \frac{G m_1 m_2}{d^2}$

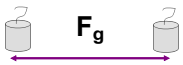
$9.8 N = \frac{6.67 \times 10^{-11} \cdot 1 kg \cdot (m_2)}{(6.4 \times 10^6)^2}$

$m_2 = 5.9 \times 10^{24}$ kg

Inverse Square Law

$F_g = \frac{G m_1 m_2}{d^2}$

greater effect



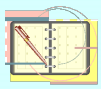
F_g

1 m

2 m 1/4 amt of F_g

3 m 1/9 amt. of F_g

Assignments . . .



- Begin Chapter 11 Homework #1 - 6