Chapter 12
Gravitation

What makes things fall down?
What keeps the moon in orbit around the earth?
What keeps the earth in orbit around the sun?

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We know:

Centripetal force is needed to keep a thing moving in a circle.

Centripetal force is proportional to the mass and is directed toward the center of the circle.

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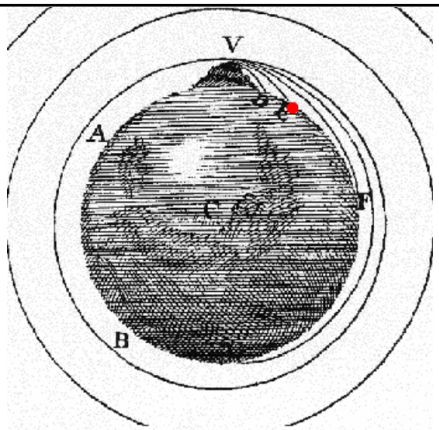

http://galileo.phys.virginia.edu/classes/109N/more_stuff/Applets/newt/newtmtn.html

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Newton's "guess"

$$F = \frac{G m_1 m_2}{r^2}$$

But we need to find the value of G which is called the Universal Gravitational Constant!

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The Cavindish Experiment

100 years after Newton's discovery, Henry Cavindish measured G.

$G = 6.67 \times 10^{-11}\ N\ m^2/kg^2$

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Inverse Square Law

If the distance doubles, the force.....

If the distance halves, the force .....

If the distance tripples, the force .....

If the distance is 1/3, the force .....

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What is the magnitude of the force of gravity on a 1 kilogram mass on the surface of the earth?
Mass of earth = 6 $x10^{24}$ kg.
Radius of earth = 6.4 $x10^{6}$ m.

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Which will take more fuel: a rocket going from the earth to the moon or from the moon to the earth?

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If the gravitational force of the sun on the planets suddenly disappeared, what would happen to the paths of the planets?

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Problems:

Calculate the force of gravity on a 1 kg mass at the earth's surface. Assume the mass of the earth is 6 $x10^{24}$ kg and the radius of the earth is 6.4 $x10^{6}$m.

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