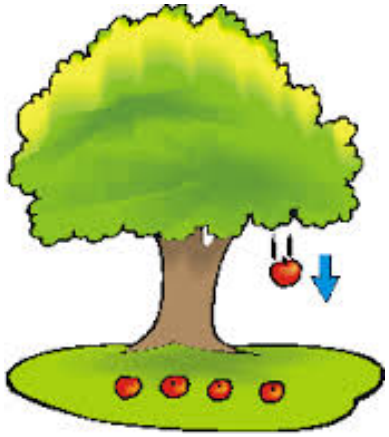
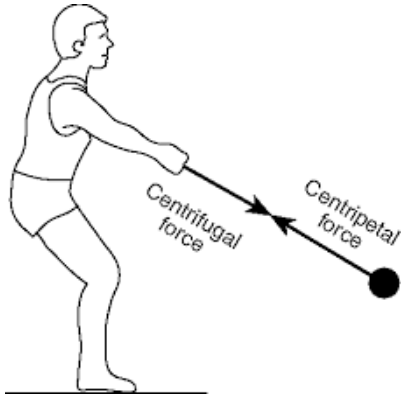
Chapter 12
Gravitation

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

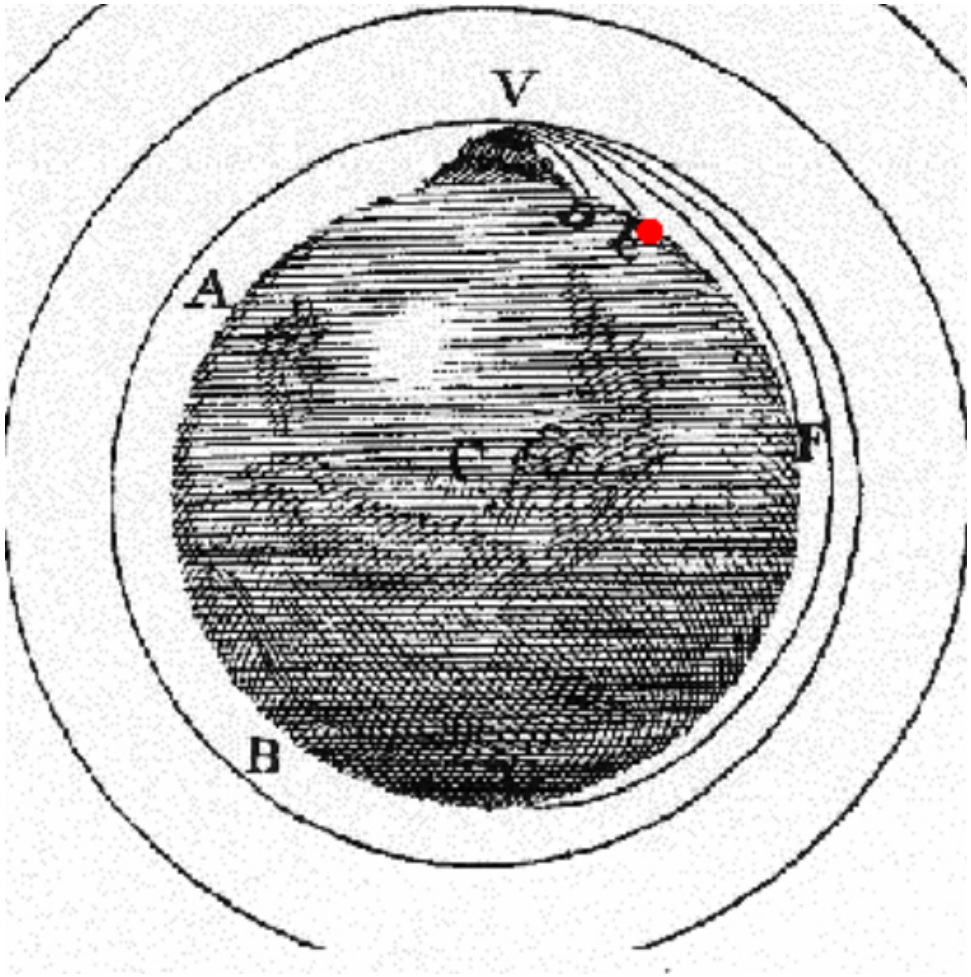


We know:



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.



http://galileoandeinstein.physics.virginia.edu/more_stuff/flashlets/NewtMtn/NewtMtn.html

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Law of Universal Gravitation

Newton's "guess"

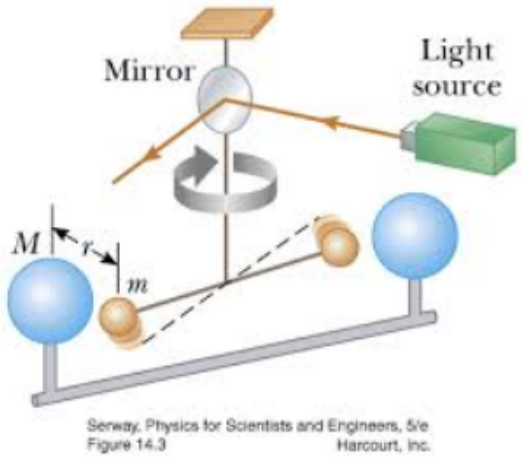
$$F = \frac{G\, m_1 m_2}{r^2}$$

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

The Cavindish Experiment

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

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



Serway, Physics for Scientists and Engineers, 5/e
Figure 14.3 Harcourt, Inc.

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 .....

Problems:

Calculate the force of gravity on a 1 kg mass at the earth's surface. Assume the mass of the earth is 6×10^{24} kg and the radius of the earth is 6.4×10^{6}m.

If you moved so that you were 6.4×10^{6}m above the surface of the earth, what would be the force of gravity on that mass?