

## Gravitation:

Newton's law of Universal Gravitation:

Every mass exerts a force of attraction on every other mass. The force is proportional to the product of the masses and inversely proportional to the square of the separation between them.

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

# Cavendish's Experiment

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# 55. Tom has a mass 70. kilograms. Sally has a mass of 50 kg. They are standing 20 m apart. Find the magnitude of the gravitational attractive force between them.

1. Two objects are exerting a gravitational force of attraction on each other. This is the only force acting. If the mass of one of the objects were to double, what would happen to the magnitude of the gravitational force?

2. Two objects are exerting a gravitational force on each other. If the distance between the objects is doubled, what would happen to the magnitude of the gravitational force?

3. Two objects are exerting a gravitational force of attraction on each other. If the mass of one of the objects were to double and the distance between them were to triple, what would happen to the magnitude of the force of gravity between them?

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# 49. Suppose that yesterday your body had a mass of 68 kilograms. This morning you stepped on the scale and found that you had gained weight.

(1) What happened to your mass?

- (a) Increased
- (b) Decreased
- (c) remained constant

(2) What happened to the ratio of your weight to your mass?

- (a) Increased
- (b) Decreased
- (c) remained constant

If a satellite is in orbit, what variables determine the speed at which it must travel?



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# 64.

Two spheres are placed so their centers are 2.6 m apart. The force between the two spheres is

$2.75 \times 10^{-12}$  N. What is the mass of each sphere if one sphere is twice the mass of the other?

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#102. Carolyn wants to know how much her brother weighs. ... he steps on a scale in an elevator while the elevator is accelerating upward at  $1.74 \text{ m/s}^2$  and the scale reads  $716 \text{ N}$ . What is his usual weight?

## Kepler's Laws of Planetary Motion

1. The planets move in ellipses with the sun at one focus.
2. The radius vector sweeps out equal areas in equal times.
3. The square of the ratio of the periods of any two planets revolving around the sun is equal to the cube of the ratio of their average distances from the sun.

# Newton's Mountain

[http://galileo.phys.virginia.edu/classes/109N/more\\_stuff/Applets/newt/newtmtn.html](http://galileo.phys.virginia.edu/classes/109N/more_stuff/Applets/newt/newtmtn.html)