

## Gravitation

Gravitation is the force of attraction between any two bodies. All the objects in the universe attract each other with a certain amount of force, but in most of the cases, the force is too weak to be observed due to the very large distance of separation.

### Example:

1. Rain falls down from the sky to the earth due to gravitational force of earth or gravity.
2. If a ball is thrown upwards, it reaches a certain height and falls downwards because of the gravity of the earth.

### Every objects in the universe attracts every other objects

Force of attraction was first observed by Sir Isaac Newton and presented as Newton's law of gravitation.

According to Newton, every object in this universe attracts every other object with certain force. This force with which two objects attract each other is called gravitational force.

If masses of the objects are small, then gravitational force between them is very small (which cannot be detected easily).

If one of the objects is big having a very large mass, then the gravitational force becomes very large and its effect can be seen easily.

### Gravitational force:

Each body in this universe attracts other bodies toward itself with a force known as Gravitational force. Out of the two masses, the heavier one is called source mass and lighter one is called test mass.

### Universal law of Gravitation

Everybody in the universe attracts every other body with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

$$F \propto m_1 \times m_2$$

$$F \propto 1/r^2$$

$$F \propto m_1 \times m_2/r^2$$

$$F = G \times m_1 \times m_2/r^2$$

Where,

F = gravitational force

$m_1$  = mass of first body

$m_2$  = mass of second body

G = gravitational constant

r = distance between two objects

**Value of G =  $6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$**

**Mass of earth =  $6 \times 10^{24} \text{ kg}$**

**Radius of earth =  $6.4 \times 10^6 \text{ m}$**

### **SOME IMPORTANT FACTS ABOUT GRAVITATION**

1. Gravitation is called 4<sup>th</sup> law of Newton.
2. Gravitational forces are weak and attractive force.
3. Gravitational force is valid for all distances (short and long)
4. Value of 'G' is determined by Henry Cavendish.
5. When two objects are dropped from same height in vacuum, they strike at the same time on the surface of earth irrespective of their masses.