

Gravitation

1) What is Gravitation?

Earth attracts everything towards it by an unseen force of attraction. This force of attraction is known as gravitation or gravitation pull.

2) Define: - Universal Law of Gravitation

Every object in the universe attracts other object by a force of attraction, called gravitation, which is directly proportional to the product of masses of the objects and inversely proportional to the square of distance between them. This is called Law of Gravitation or Universal Law of Gravitation. The distance is considered between the centres of the objects. Suppose there are two objects having mass M and m respectively. The distance between their centres is equal to d . The force of attraction is F .

Therefore, from Law of Gravitation which states that force of attraction by which an object attracts other object is directly proportional to the product of their masses,

$$\text{Thus, } F \propto M.m \text{ ----- (i)}$$

Now, Law of Gravitation also states that force of attraction by which an object attracts other object is inversely proportional to the square of distance between them.

$$\text{Thus, } F \propto \frac{1}{d^2} \text{ ----- (ii)}$$

Now from equation (i) and (ii) we get

$$F \propto \frac{M.m}{d^2}$$
$$\Rightarrow F = G \cdot \frac{M.m}{d^2} \text{ ----- (iii)}$$

Where, G is the proportionality constant and called Universal Gravitation Constant. From equation (iii)

$$F \times d^2 = G.M.m$$

$$\Rightarrow G = \frac{F d^2}{M.m} \text{----- (iv)}$$

The expression (iii) and (iv) are called expression for Universal Law of Gravitation. This Law is applicable everywhere in universe, thus it is known as Universal Law of Gravitation.

3) SI Unit of Gravitation

The SI unit of G is $N m^2 kg^{-2}$

The accepted value of G is $6.673 \times 10^{-11} Nm^2 kg^{-2}$.

The value of G was found out by Henry Cavendish, a British philosopher and scientist.

4) What do you mean by free fall?

Whenever objects fall towards the earth due to gravitational force alone, we say that objects are in free fall.

5) What do you mean by acceleration due to gravity?

It is defined as uniform acceleration but used in a freely falling body due to gravitational force of attraction of earth. Its symbol is G and its average value on the surface of the earth is $G = 9.8 M/S^2$