VALUE OF g ON MOON:

Mass of moon = 7.4 x 10^22 kg

Radius of moon = 1,740 km

= 1,740,000 m = 1.74 x 10^6 m

$$g = G\frac{M}{R^2} = \frac{6.67\times10^{-11}\times7.4\times10^{22}}{(1.74\times10^{6})^2} = 1.63\ m/s^2$$

$$\frac{g_m}{g_e} = \frac{1.63}{9.8} = \frac{1}{6}$$

✺ Important Facts of 'g'

- From the expression $g = \frac{GM}{R^2} = \frac{4}{3}\pi\rho GR$ it is clear that its value depends upon the mass radius and density of planet and it is independent of mass, shape and density of the body placed on the surface of the planet. i.e. a given planet (reference body) produces same acceleration in a light as well as heavy body.
- The greater the value of (M/R^2) or ρR greater will be value of g for that planet.
- Acceleration due to gravity is a vector quantity and its direction is always towards the centre of the planet.
- Dimension [g] = [LT^{-2}]
- it's average value is taken to be 9.8 m/s^2 or 981 cm/sec^2or 32 $feet/sec^2$, on the surface of the earth at mean sea level.
- The value of acceleration due to gravity vary due to the following factors : (a) Shape of the earth, (b) Height above the earth surface, (c) Depth below the earth surface and (d) Axial rotation of the earth.

EQUATIONS OF MOTION FOR FREELY FALLING OBJECT:

When the bodies are falling under influence of gravity, they experience acceleration g i.e., 9.8 ms^{-2}. However, when these are going up against gravity, they move with retardation of 9.8 ms^{-2}. All the equations of motion already read by us are valid for freely falling body with the difference that a is replaced by g. For motions vertically upwards a is replaced by – g.

Thus equation of motion

General equationsof motion for of motion freely falling bodies

- Mass of a body is usually denoted by the small letter ‘m’.
- Mass of a body is a measure of inertia of the body and hence it is also known as inertial mass. The mass of a body cannot be zero.

WEIGHT:

We know that the earth attracts every object with a certain force and this force depends on the mass (m) of the object and the acceleration due to gravity (g).

The weight of an object is the force with which it is attracted towards the earth.

We know that, F = m x a

That is, F= m x g

The force of attraction of the earth on an object is known as the weight of the object. It is denoted by W.

So we have, W = m x g

- As the weight of an object is the force with which it is attracted towards the earth, the S.I. unit of weight is the same as that of force i.e. Newton (N).
- The weight is a force acting vertically downwards; it has both magnitude and direction, so it is a vector quantity.
- The value of g is constant at a given place. Therefore at a given place, the weight of an object is directly proportional to the mass, say m, of the object, that is, $W \propto m$. It is due to this reason that at a given place, we can use the weight of an object as a measure of its mass.

The mass of an object remains the same everywhere, that is, on the earth or on any planet whereas its weight depends on its location.

Difference Between Mass and Weight:

Mass	Weight
1. Mass is quantity of matter possessed by a body?	1. Weight is the force with which a body is attracted towards the centre of the earth.