Q 1.
State the universal law of gravitation.

SOLUTION:
According to universal law of gravitation, every particle in the universe attracts every other particle with a force which is directly proportional to the distance between them. The direction of the force is along the line joining the two particles.

Q 2.
What do you mean by free fall?

SOLUTION:
All objects falling towards earth under the action of gravitational force of earth alone are said to be in free fall.

Q 3.
What do you mean by acceleration due to gravity?

SOLUTION:
The acceleration with which an object fall freely towards the earth is known as acceleration due to gravity. It is denoted by g and its value is 9.8 m s^{-2}.

Q 4.
What are the differences between the mass of an object and its weight?

SOLUTION:
Ans.:

	Mass	Weight
1.	Mass of a body is the measure of its inertia.	Weight of the body is the force with which it is attached towards the earth ($W = m \times g$).
2.	Its S.I. unit is kg.	Its S.I. unit is Newton.
3.	It remains constant everywhere.	Its value changes from the place to place.
4.	It can be measured by common balance.	It is measured by spring balance.

Q 5.
Write the formula to find the magnitude of the gravitational force between the earth and an object on the surface of the earth.

SOLUTION:
The formula for the magnitude of gravitational force between the earth and an object on its surface is

$$F = G\frac{M_e m}{R_e^2}$$

where F is the gravitational force.
G is the gravitational constant.
M_e is the mass of the earth.
m is the mass of the object on the surface of the earth.
R_e is the radius of the earth.

Q 6.
Why is the weight of an object on the moon 1/6th its weight on the earth?

SOLUTION:
The weight of an object depends on the value of acceleration due to gravity g. The value of g on earth is 6 times more than that of moon because, the mass and radius of the earth is more than the mass and radius of the moon.

We have, $g = \frac{GM}{R^2}$ and $W = mg$

Weight of a body of mass m on earth is

$$W_e = mg_e = m\frac{GM_m}{R_m^2}$$

Weight of a body of mass m on moon is

$$W_m = mg_m = \frac{mGM_m}{R_m^2} \quad \text{or} \quad \frac{W_m}{W_e} = \frac{M_m}{R_m^2} \times \frac{R_e^2}{M_e}$$

As mass of moon M_m is $\frac{1}{100}$ times the mass of earth M_e and radius of moon R_m is $\frac{1}{4}$ times the radius of earth R_e.

$$\therefore \quad \frac{W_m}{W_e} = \frac{M_m}{M_e}\left(\frac{R_e}{R_m}\right)^2 = \frac{1}{100} \times (4)^2 = \frac{1}{6}$$