

Science

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(Chapter – 10) (Gravitation)

(Class – IX)

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Question 1:

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

Answer 1:

S.No.	Mass	Weight
I.	Mass is the quantity of matter contained in the body.	Weight is the force of gravity acting on the body.
II.	It is the measure of inertia of the body.	It is the measure of gravity.
III.	Mass is a constant quantity.	Weight is not a constant quantity. It is different at different places.
IV.	It only has magnitude.	It has magnitude as well as direction.
V.	Its SI unit is kilogram (kg).	Its SI unit is the same as the SI unit of force, i.e., Newton (N).

Question 2:

Why is the weight of an object on the moon $\frac{1}{6}$ th its weight on the earth?

Answer 2:

Let M_E be the mass of the Earth and m be an object on the surface of the Earth. Let R_E be the radius of the Earth. According to the universal law of gravitation, weight W_E of the object on the surface of the Earth is given by,

$$W_E = \frac{GM_E m}{R_E^2}$$

Let M_M and R_M be the mass and radius of the moon. Then, according to the universal law of gravitation, weight W_M of the object on the surface of the moon is given by:

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$$W_M = \frac{GM_M m}{R_M^2}$$

Now,

$$\Rightarrow \frac{W_M}{W_E} = \frac{M_M R_E^2}{M_E R_M^2}$$

Where,

$$M_E = 5.98 \times 10^{24} \text{ kg}$$

$$M_M = 7.36 \times 10^{22} \text{ kg}$$

$$R_E = 6.4 \times 10^6 \text{ m}$$

$$R_M = 1.74 \times 10^6 \text{ m}$$

$$\Rightarrow \frac{W_M}{W_E} = \frac{7.36 \times 10^{22} \times (6.4 \times 10^6)^2}{5.98 \times 10^{24} \times (1.74 \times 10^6)^2} = 0.165 \approx \frac{1}{6}$$

Therefore, weight of an object on the moon is $\frac{1}{6}$ of its weight on the Earth.



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