Gravitation: In-Text Questions

[Page 134]

Q.1 State the universal law of gravitation.

Sol: The universal law of gravitation states that every object in the universe attracts each other with attraction force, this force is called gravitational force. This attraction force between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

Q.2 Write the formula to find the magnitude of the gravitational force between the earth and an object on the surface of the earth.

Sol: Let 'm' as the mass of the object on the surface of earth and 'M' as the mass of earth and the distance between the earth's centre and object is radius of the earth = R.

Therefore, the formula: $F = \frac{GMm}{R^2}$

[Page 136]

Q.1 What do you mean by free fall?

Sol: When an object is dropped from a certain height, under the gravitational force it moves to the surface of Earth. This type of object's movement is called free fall.

Q.2 What do you mean by acceleration due to gravity?

Sol: When an object is dropped freely from a certain height, its velocity keeps change and produces acceleration in the motion of the object. This acceleration is known as acceleration due to gravity and represented by 'g'.
The value of the acceleration due to gravity on Earth is, g = 9.8 m/s^2

[Page 138]

Q.1 What are the differences between the mass of an object and its weight?

Sol: The differences between the mass of an object and its weight are:

Mass	Weight
1. It is the quantity of matter.	1. It is the gravitational force act on an object.
2. It has only magnitude.	2. It has both magnitude and direction.
3. It is the constant quantity in the universe.	3. It is not constant quantity in different places.
4. Its SI unit is kilogram (kg).	4. Its SI unit is newton (N).

Q.2 Why is the weight of an object on the moon 1/6th its weight on the earth?

Sol: If compare the earth and moon, the mass of moon is 1/100 times of earth and radius of moon is 1/4 times the earth's radius. Now, if we calculate, the gravitational attraction force on the moon, it will is about one sixth of the earth's gravitational force. Thus, an object's weight on the moon is $1/6^{th}$ its weight on earth.

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[Page 141]

Q.1 Why is it difficult to hold a school bag having a strap made of a thin and strong string?

Sol. It is difficult to hold a school bag having thin straps because pressure depends on contact surface area. Pressure is directly inverse to contact surface area.

$$P = F/A$$

So, pressure exerted by the thin straps due to lesser contact surface area on the shoulder will be higher than broad strap.

Q.2 What do you mean by buoyancy?

Sol. Buoyancy is the upward force experienced by an object partially or fully immersed in a fluid.

Q.3 Why does an object float or sink when placed on the surface of water?

Sol. An object floats or sinks when placed on water. It depends on the net force. If the object's weight is less than buoyant force then object will float, and if object's weight is more than buoyant force, then it will sink.

[Page 142]

Q.1 You find your mass to be 42 kg on a weighing machine. Is your mass more or less than 42 kg?

Sol. While weighing our body on a weighing machine, our mass is measured by comparing weights. The weighing machine is acting by an upward buoyancy force. It pushes the body up slightly and reduces the weight. Therefore our actual weight is slightly more than that measured by the machine.

Q.2 You have a bag of cotton and an iron bar, each indicating a mass of 100 kg when measured on a weighting machine. In reality, one is heavier than other. Can you say which one is heavier and why?

Sol. As we know that, Actual weight = Measured weight + Buoyant Force.
The cotton bag experience higher air thrust than the iron bar. So, Cotton bag is much heavier than iron bar.

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