HOME ASSIGNMENT

(1) How does the force of gravitation between two objects change when the distance between them is reduced to half?

Ans- According to the law of gravitation, the force b/w any two objects of mass M & m is directly proportional their masses & inversely proportional to the square and distance between them.

$$F = G \frac{Mm}{r^2}$$

If the distance is halved, i.e now $r = \frac{r}{2}$

So, $F = G \dfrac{Mn}{\dfrac{r^2}{2^2}}$

$$\Rightarrow F = 4G \frac{Mm}{r^2}$$

∴ force of gravitation increases 4 times when distance is reduced to $\frac{1}{2}$.

(2) Gravitation force acts on all objects in proportion to their masses why then a heavy obj. does not fall faster than a light object.

$$Accel^n = \frac{Force}{mass}$$

$\Rightarrow F = mass \times accel^n$

∴ As force is directly proportional to mass and is constant of any mass.

3) The earth & the moon are attracted to each other by gravitational force. Does the earth attract the moon with a force that is greater / smaller / the same as the force with which the moon attracts the Earth. why?

Ans- The earth attracts the moon with an equal force with which the moon attracts the earth but these forces are in opposite direction. By universal law of gravitation the force b/w moon & the sun will be:-

$$F = \frac{G m_1 m_2}{r^2}$$

m_1 = mass of earth

m_2 = mass of moon

r = distance b/w them.

4) what happens to the force b/w 2 objects if,
i) the mass of one obj. is doubled?
ii) the distance b/w the obj is doubled & tripled?
iii) the masses of both obj.s are doubled?

Ans-(i) According to universal law of gravitation,

$$F = \frac{G m_1 m_2}{r^2}$$

If the mass is doubled then,

$$F = \frac{G \times 2m_1 \times m_2}{r^2}$$

$$\Rightarrow F = 2F \ (\text{force is doubled})$$

ii) If the distance b/w the objects is doubled &

tripled then,

$$F = \frac{4 \times m_1 \times m_2}{2r^2}$$

$\rightarrow F = 4F$, hence force becomes $\frac{1}{2}$th of the initial force.

iv) If the mass of both objs are doubled then,

$$F = \frac{4 \times 2m_1 \times 2m_2}{r^2}$$

$\Rightarrow F = 4F$, hence force will be four times more than its initial value.

(5) (Assertion) st - 1) when the distance b/w two bodies is doubled & also mass of the body is also doubled, gravitational force b/w then remains the same.

(Reason) st - 2) According to Newton's law of gravitation force is directly proportional to mass of bodies

Ans) a) st -1 & st - 2 both are true & st 2 is the correct explanation for st-2

6) Define accel^n due to gravity.

> Accel^n due to gravity is the accel^n gained by an obj due to the gravitational force.

> Value is $9.8 \, m/s^2$ (at sea level).

7) The earth attracts the falling apple but do you think that the apple also attracts the earth? 'b'

is why the earth does not move d towards apple ?

Ans- The Apple also attracts the earth, but the earth does not move towards the apple because there is not enough force to move an object that massive.

8) What is the importance of universal law of gravitation?

Ans-→ The Gravitation force holds the solar system together

→ Holding the atmosphere near the surface of the earth

→ Occurance of tide

→ For rain & Snowfall.

→ The flow of water in the rivers.

9) At what height above the surface, the value of the gravity would be half of what it is on the surface of the earth. Take radius of the earth R = 6400 km.

Ans Half of g = $\dfrac{g}{2}$ (g^1)

For height h

$\Rightarrow g^1 = g \left(\dfrac{R}{R+h}\right)^2$

$\dfrac{g}{2} = g \left(\dfrac{R}{R+h}\right)^2$

$\dfrac{\sqrt{1}}{2} = \dfrac{R}{R+h}$

$$\Rightarrow \frac{1}{\sqrt{2}} = \frac{R}{R+h}$$

$$\Rightarrow R+h = \sqrt{2}R$$

$$\Rightarrow h = \sqrt{2}R - R$$

$$\Rightarrow h = (\sqrt{2}-1) \times R$$

$$\Rightarrow h = (1.414-1) \times 6400$$

$$\Rightarrow h = 0.414 \times 6400$$

$$\Rightarrow h = 2649.6 \, Km$$

$$h = 2650 \, km$$

b) does not change from place to place.

(10) a) 80 N

(11) Assertion is correct but reason is incorrect.