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Home Assignment

Q1) How does the force of gravitation between 2 objects change when the distance between them is reduced to half?

Ans) The force of gravitation between two objects is inversely proportional to the square of the distance between them therefore the gravity will become four times if distance between them is reduced to half.

Q2) Gravitational force act on all objects in proportion to their masses, Why then, a heavy object does not fall faster than a light object?

Ans) All objects fall on ground with constant acceleration called acceleration due to gravity (in the absence of air resistance) It is constant and doesn't depend upon the mass of an object. Hence heavy object do not fall faster than lighter object.

Q3) The earth and Moon are attracted to each other by gravitational force. Does the earth attract the moon with a force that is greater or smaller or the same as the force with which the moon attracts earth? why?

Ans) According to the universal law of gravitation two objects attract each other with equal force but in opposite direction. Therefore the earth attracts the moon with the same force as the moon attracts earth.

Q4) what happens to the force between two objects if (i) the mass of one object is doubled.
(ii) the distance between the objects is doubled and tripled?
(iii) The masses of both objects are doubled?

Ans) we know that gravitational force between 2 objects is given by $f = \frac{GMm}{r^2}$

where,
G = Gravitational constant
M = Mass of Object 1
m = Mass of object 2
r = distance between the two objects.

(i) Let mass of object 1 be doubled
Mass = 2M
So, New force = $\frac{G \times 2M \times m}{r^2}$

$\Rightarrow \frac{2GMm}{r^2}$

$\Rightarrow 2 \times$ Old force.

so force is doubled.

(11) distance doubled

New distance = $2r$

New force = $\frac{GMm}{(2r)^2}$

= $\frac{GMm}{4r^2}$ = $\frac{1}{4}$ × Old force

distance tripled

New distance = $3r$

New force = $\frac{GMm}{(3r)^2}$ = $\frac{GMm}{9r^2}$

2) $\frac{1}{9}$ × Old force

- Hence when distance is doubled, force becomes 1/4 times of old force
- when distance is tripled, force becomes 1/9 of old force.

Q- Statement - 1 - when distance between two bodies is doubled and also mass of each body is also doubled. gravitational force between them remains the same.

Statement - 2 - According to Newton's law of gravitation, force is directly proportional to mass of bodies and

Ans (1) statement - 1 is true, statement - 2 is true. Statement - 2 is a correct explanation for statement - 1

Q1) Define acceleration due to gravity.

Ans) The acceleration of freely falling bodies due to the force of attraction of the other body is called acceleration due to gravity. It is a constant quantity for a given attracting body at a given place. Like for earth or near its surface, the average value of acceleration due to gravity is $9.8 m/s^2$.

Q2) The earth attracts falling apple, but do you think that the apple also attracts earth? If so why the earth does not move towards apple?

Ans) The earth attracts an apple and so does the apple attract earth with an equal and opposite force. Mass of the earth is more as compared to apple. So the acceleration produced is very small as compared to that in apple. Hence the motion of earth towards apple is not very noticeable.

Q-3) What is the importance of universal law of gravitation.

Ans) The gravitational force of earth ties the terrestrial objects to earth. This law explains the attractive force between any two objects having a mass. The formation of tides in the ocean is due to the force of attraction between the moon and ocean water.

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Qu) 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 the Radius of earth = 6400 km.

Sol) We know that $\frac{g}{g'} = \frac{r^2}{R^2}$ where g is gravitational force on earth and g' is gravitational force at a height.

$g' = \frac{g}{2} \Rightarrow g' = \frac{gR^2}{r^2} = \frac{g}{2}$

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

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

$h = R(1.414 - 1) \Rightarrow 0.414R$

$\frac{414}{1000} \times 6400 \Rightarrow 2649.6$

Qs) The value of the universal gravitational constant

(a) changes with change of place

(b) Does not change from place to place.

(c) becomes more at night

(d) becomes more during day.

02) The radius of earth is about 6400 km and that of mars is 3200 km. The mass of earth is about 10 times the mass of mars. An object weighs 200 N on earth's surface. Then its weight on the surface of mars will be

(a) 80 N (b) 200 N (c) 400 N (d) 500 N

03) Statement 1 - The value of acceleration due to gravity does not depend upon the mass of body

Statement - 2 - Acceleration due to gravity is a constant quantity.

Ans) (2) statement - 1 is true, statement - 2 is true statement - 2 is not a correct explanation for statement - 1.