GRAVITATION

INTRODUCTION OF GRAVITATION

Introduction to Gravitation

This chapter discusses gravitation and the universal law of gravitation. The motion of objects under the influence of gravitational force on Earth is also examined closely. Students will also understand how weight varies from place to place and the conditions required for objects to float on water.

Gravitation

Gravitation or just gravity is the force of attraction between any two bodies. All the objects in the universe attract each other with a certain amount of force, but in most cases, the force is too weak to be observed due to the very large distance of separation. Besides, gravity's range is infinite but the effect becomes weaker as objects move away.
Some examples of gravity are:

The force that causes the ball to come down is known as gravity
Gravity keeps the planets in orbit around the sun.
Gravity is the force that causes a rock to roll downhill.

Type of forces

There are four fundamental forces in the universe and they are:
Gravitational force
Electromagnetic force
Strong nuclear force
Weak nuclear force

Gravitational Force

Gravitational force is the weakest force out of the four forces. When gravitational force is considered for massive objects, such as the sun, or giant planets, the gravitational force is considered to be strong as the masses of these objects are also large. On an atomic level, this force is considered weak.

Electromagnetic Force

The electromagnetic force is a type of physical interaction that occurs between electrically charged particles. It acts between charged particles and is the combination of magnetic and electrical forces. The electromagnetic force can be attractive or repulsive.

Strong Nuclear Force

The strong force holds together quarks, the fundamental particles that make up the protons and neutrons of the atomic nucleus, and further holds together protons and neutrons to form atomic nuclei.

Weak Nuclear Force

Weak force is the force existing between the elementary particles which are responsible for certain processes to take place at a low probability.

The Universal Law of Gravitation

Newton's Law of gravitation states that every object in the universe attracts every other object by a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

$\Rightarrow F \alpha M * g$

$F \alpha \frac{1}{d^2}$

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

where G is the universal gravitation constant.

Value of G = 6.673*10-11Nm2Kg-2

Acceleration due to Gravity

and also,

Plug the values of G ($6.673*10^{-11}Nm^2Kg^{-2}$)

M(mass of Earth) = $6 * 10^{24}$ kg and R= $6 * 10^6$ m , to get the value of gas ≈ $9.8ms^{-2}$

This is the acceleration due to gravity and the acceleration felt by any freely falling body towards the Earth.

The value of g keeps changing due to the variation of Earth's radius.

The Moon's Falling – Moon's revolution around Earth

The moon revolves around the Earth due to centripetal force, which is the force of gravity of the Earth. If the force of attraction between the Earth and the moon ceases, then the moon will continue to travel in a straight-line path tangential to its orbit around the Earth.