

Newton's Law of Universal Gravitation

According to Newton's law of universal gravitation, two bodies in space pull on each other with a force proportional to their masses and the distance between them. This means that massive objects orbiting each other, such as the moon and Earth, exert substantial influence on one another. Applications of Newton's Law of Universal Gravitation play an important role in the GATE ME exam. Although it appears that the moon is orbiting a relatively stationary Earth, the moon and Earth are actually revolving around the third point between them. This is known as the barycenter.

Definition of Newton's Law of Universal Gravitation

Newton's Law of Universal Gravitation states that every particle in the cosmos attracts every other particle with force directly proportional to the product of their masses and inversely proportional to the square of their distance.

According to Newton's law, every item in the universe attracts every other object with a measured force (however slight). The force is as follows:

- Directly proportional to the product of the masses of two objects
- Inversely proportional to the square of the distance between the items

Equation of Newton's Law of Universal Gravitation

Let us see the equation of Newton's Law of Universal Gravitation, where F is the gravitational force between two bodies, m_1 and m_2 are their masses, r is the distance between their centers, and G is the universal gravitational constant.

$$F = G(m_1m_2/r^2)$$

Weight and Gravitational Force

Newton's law of gravity saw that mass is a significant quantity. We often confuse mass with weight, although they are not the same thing. Weight is the gravitational force imparted on a mass object. The weight of an object can be calculated by multiplying its mass m by the acceleration due to gravity g at the Earth's surface. The observed gravitational acceleration at the Earth's surface is 980 cm/second/second. Various questions are formulated on gravitational acceleration in the GATE question paper.

Mass is the amount of material in an item, whereas weight is the gravitational force imposed on the material in a gravitational field; consequently, mass and weight are

proportional to each other acceleration owing to gravity as the proportionality constant. As a result, it is noticed that the mass of a given object is stable, but the weight depends on the object's location. Consider the following example: if we transferred an object of mass m to the surface of the Moon, the gravitational acceleration would alter since Moon's radius and mass differ from Earth's.

Universality of Gravity

Gravitational interactions exist between the earth and other objects and between all things with an intensity proportional to the product of their masses. Scientists use the law of universal gravitation to investigate planetary orbits, which are also important for the GATE exam. Because all objects exert gravitational forces on one other, tiny disturbance in a planet's elliptical motion are simply explained.

Applications of Newton's Law of Universal Gravitation

The law of universal gravitation applies to many issues in modern science. These are some examples:

1. Tides (produced by the moon's gravitational pull on Earth)
2. The interaction of two terrestrial objects
3. Interaction of one earthbound item with the Earth itself
4. Astrophysics includes how celestial things exert force on one another and much smaller items like spacecraft.

