

Chapter 7

Gravitation

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Introduction

Have you ever wondered, why does anything thrown up fall down? Why does not the moon fall to the earth? Why does not the earth fly off into space rather than remaining in orbit around the sun? Why do all the planets revolve around the sun? Why is the life of astronauts inside an orbiting satellite very different? Why is going uphill is lot more tiring than going downhill? In all these cases, there must be some force acting on the moon, the planets and the falling bodies. The force acting on them is called Gravitational force.

In this chapter we shall learn about the basic laws governing gravitation and the motion of objects under the influence of gravitation. We shall apply the law of gravitation to phenomena such as the variation of weight with altitude, the orbits of satellites around the earth and the orbits of planets around the sun.

UNIVERSAL LAW OF GRAVITATION

"Every particle of matter in the universe attracts every other particle with a force that is directly proportional to the product of the masses of the particles and inversely proportional to the square of the distance between them".

Mathematically

$$|\vec{F}| \propto m_1 m_2$$

$$|\vec{F}| \propto \frac{1}{r^2}$$

$$|\vec{F}| \propto \frac{m_1 m_2}{r^2}$$

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

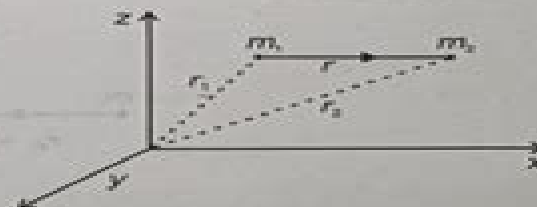


Fig.: Gravitational force on m_1 due to m_2 is along $\vec{r}$ where the vector $\vec{r}$ is $(\vec{r}_2 - \vec{r}_1)$

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