1. Detail of Unit Revision

Subject Name	Physics
Course Name	Physics 01 (Physics Part-1, Class XI)
Module Name/Title	Unit 6: Gravitation Study Guide
Objectives	After going through this module, the learners will be able to • Plan consolidation of the unit on gravitation
Keywords	Gravitational force, Kepler's law, Acceleration due to gravity, escape velocity, Orbital velocity

2. Development team

Role	Name	Affiliation
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STUDY GUIDE

After going through the modules: e content and the videos. We advise you to complete assignments. This will help you spot concepts that need to be understood, or revisited again.

Now get ready to consolidate the unit .Read the syllabus again. Make a check list with the same.

UNIT 6

GRAVITATION

Syllabus and its module-wise breakup

Chapter 8: Gravitation

Kepler's laws of planetary motion; universal law of gravitation; Acceleration due to gravity and its variation with altitude and depth; Gravitational potential energy and gravitational potential; escape velocity; orbital velocity of a satellite; Geo-stationary satellites.

Unit Check list

- Kepler's laws of planetary motion;
- universal law of gravitation;
- Acceleration due to gravity and its variation with altitude and depth;
- Gravitational potential energy
- gravitational potential;
- escape velocity;
- orbital velocity of a satellite;
- Geo-stationary satellites.

Tick mark against each only when you understand it

The above unit was divided into five modules for better understanding.

Module 1	• Gravitation • Laws of gravitation • Early studies • Kepler's laws
Module 2	• Acceleration due to gravity • Variation of g with altitude • Variation of g due to depth • Other factors that change g
Module 3	• Gravitational field • Gravitational energy • Gravitational potential energy

	• Need to describe these values
Module 4	• Satellites • India's satellite programme and target applications • Geo stationary satellites and Polar satellites • Escape velocity • India's space program
Module 5	• Numerical problems based on Gravitation

This unit is challenging because it involves a number of concepts which we feel we have already learnt in our secondary school science course.

We stated many of the laws,

Law of gravitation
Laws of planetary motion.

At this stage we analyze the gravitational constant, gravity, acceleration due to gravity, and explain gravitational potential.

We had earlier just, said gravitational potential energy possessed by an object of mass m held at a height of h above the surface of the earth = mgh and also the difference between potential energies of two identical masses at different heights at the same location would be $mg(h_2 - h_1)$,

The assumption here was acceleration due to gravity and hence gravitational force was takes as constant. But as the body moves away from the surface of the earth, gravitational force is not constant . The value of 'g' decreases.
Gravitational potential now is calculated under variable gravitational force. This requires calculus (integration).

So make your own notes for

1. **Kepler's laws of planetary motion;**

   You need to know the laws, explanation of the laws, meaning of elliptical orbit, foci, areal velocity, planar motion, time period, radius of an orbit, speed of planet in an orbit, explanation of Kepler's second and third law

2. **Universal law of gravitation;**

   Two points are important here

The force of attraction between a hollow spherical shell of uniform density and a point mass situated outside is just as if the entire mass of the shell is concentrated at the centre of the shell

The force of attraction due to a hollow spherical shell of uniform density, on a point mass situated inside it is zero

Also understand the Cavendish experiment to determine the value of gravitational constant

$G = 6.67 \times 10^{-11}$ Nm ^{2} kg $^{-2}$

Notice the unit

3. **Acceleration due to gravity and its variation with altitude and depth;**

   Difference between G and g, unit of each, factors which contribute to the value of g at a place on earth, what causes the variation, altitude, depth below the surface of the earth, read the other factors that change g from the e content.

4. **Gravitational potential energy and gravitational potential;**

   The force of gravity is a conservative force

   For points at arbitrary distance from the surface of the earth, the assumption that the gravitational force *mg* is a constant is no longer valid.

5. **Escape velocity; Why are rockets /satellites placed in orbits stage wise? How is energy given to satellites ?**
6. **Orbital velocity of a satellite; What is the shape of satellite orbits?**
7. **Geo-stationary satellites.**

Now go over the e content and the videos, in case there is some misconception

Try and answer questions from the NCERT book and the NCERT Exemplar

Give a lot of emphasis to the modules and corresponding videos.