



ATOMIC ENERGY CENTRAL SCHOOL- KAKRAPAR

CLASS- IX

SUBJECT- PHYSICS

NAME OF THE CHAPTER- GRAVITATION

MODULE-6

Subtopics-

NCERT Text book Question.

Learning outcomes

Worksheet based on Chapter-10(Gravitation)

NCERT TEXT BOOK QUESTION

Question:

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

Answer:

All objects fall on ground with constant acceleration, called acceleration due to gravity (in the absence of air resistances). It is constant and does not depend upon the mass of an object. Hence, heavy objects do not fall faster than light objects.

NCERT TEXT BOOK QUESTION

Question:

If the moon attracts the earth, why does the earth not move towards the moon?

Answer:

The Earth and the moon experience equal gravitational forces from each other. However, the mass of the Earth is much larger than the mass of the moon. Hence, it accelerates at a rate lesser than the acceleration rate of the moon towards the Earth. For this reason, the Earth does not move towards the moon.

NCERT TEXT BOOK QUESTION

Question:

What is the acceleration of free fall?

Answer:

When objects fall towards the Earth under the effect of gravitational force alone, then they are said to be in free fall. Acceleration of free fall is 9.81 ms^{-2} , which is constant for all objects (irrespective of their masses).

Calculate the force of gravitation between the earth and the sun. [Given that the mass of the earth = 6×10^{24} kg, mass of the sun = 2×10^{30} kg, average distance between the two is 1.5×10^{11} m and $G = 6.67 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$].

According to the universal law of gravitation, the force of attraction between the Earth and the Sun is given by

$$F = \frac{G \times M_{\text{Sun}} \times M_{\text{Earth}}}{R^2}$$

Where,

M_{Sun} = Mass of the Sun = 2×10^{30} kg

M_{Earth} = Mass of the Earth = 6×10^{24} kg

R = Average distance between the Earth and the Sun = 1.5×10^{11} m

G = Universal gravitational constant = $6.7 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$

$$F = \frac{6.7 \times 10^{-11} \times 2 \times 10^{30} \times 6 \times 10^{24}}{(1.5 \times 10^{11})^2} = 3.57 \times 10^{22} \text{ N}$$

Hence, the force of gravitation between the Earth and the Sun is $3.57 \times 10^{22} \text{ N}$

What you have learnt?

- The law of gravitation states that the force of attraction between any two objects is proportional to the product of their masses and inversely proportional to the square of the distance between them. The law applies to objects anywhere in the universe. Such a law is said to be universal.
- Difference between acceleration due to gravity 'g' and Universal Gravitational constant 'G'
- Gravitation is a weak force unless large masses are involved.
- Force of gravitation due to the earth is called gravity.
- During free fall acceleration experienced by an object is independent of its mass.
- It is seen that a falling apple is attracted towards the earth. Does the apple attract the earth? If so, we do not see the earth moving towards an apple. Why?

- According to the third law of motion, the apple does attract the earth. But according to the second law of motion, for a given force, acceleration is inversely proportional to the mass of an object. The mass of an apple is negligibly small compared to that of the earth. So, we do not see the earth moving towards the apple. Extend the same argument for why the earth does not move towards the moon.
- The force of gravity decreases with altitude. It also varies on the surface of the earth, decreasing from poles to the equator.
- The weight of a body is the force with which the earth attracts it.
- The weight is equal to the product of mass and acceleration due to gravity.
- The weight may vary from place to place but the mass stays constant.
- All objects experience a force of buoyancy when they are immersed in a fluid.

- Objects having density less than that of the liquid in which they are immersed, float on the surface of the liquid. If the density of the object is more than the density of the liquid in which it is immersed then it sinks in the liquid.

Explanation:

Weight of object > Buoyant Force(liquid)

or $m \cdot g > V \rho g$

or $V' \rho' g > V \rho g$

or $V' \rho' > V \rho$

if an object immersed in a liquid completely or partially, then volume of object will be equal to volume of liquid displaced ($V' = V$).

Hence $\rho' > \rho$ object sink

Similarly $\rho' < \rho$ object float

Worksheet based on chapter-10

1. Which force is responsible for the moon revolving around the earth?
2. Does the acceleration produced in a freely falling body depend on the mass of the body?
3. Name the scientist who gave the three laws of planetary motion.
4. Name the scientist who explained the motion of planets on the basis of gravitational force between the sun and planets.
5. The volume of a solid of mass 500 g is 350 cm^3 .
 - (a) What will be the density of this solid?
 - (b) What will be the mass of water displaced by this solid?
 - (c) What will be the relative density of the solid?
 - (d) Will it float or sink in water?
 - (e) If mass is increased by two times then how much density of same object will increase?

MULTIPLE CHOICE QUESTION



If you achieve 10 out of 10 – Genius

If you achieve 09 out of 10 – Excellent

If you achieve 07 to 08 – Very Good

If you achieve 05 to 06 – Good

If you achieve Below 05- Do work hard

(It is not compulsory to anyone, this is just for check yourself)

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Thank you