Chapter-10

GRAVITATION

Sub-Topic Name:

Universal Law of Gravitation, Free Fall, Acceleration Due to Gravity (g), Difference between G and g, Mass and Weight, Weight of an Object on the Surface of Moon.

1 Mark Questions

Multiple Choice Question (MCQS)

1. A body of mass 1kg is attracted by the earth with a force which is equal to
   a. 9.8N
   b. 6.67×10^{11}
   c. 1 N
   d. 9.8m/s

2. What is the gravitational force between two objects?
   a. attractive at large distances only
   b. attractive at small distances only
   c. attractive at all distances
   d. attractive at large distances but repulsive at small distances

3. The value of 'g'
   a. Increases as we go above the earth's surface
   b. Decreases as we go to the centre of the earth
   c. Remains constant
   d. Is more at equator and less at poles

4. The ball is thrown up, the value of 'g' will be
   a. Zero
   b. positive
   c. negative
   d. negligible

5. The gravitational force causes

a. Tides
b. Motion of moon
c. None of them
d. Both a n b

6. The mass of the body on moon is 40kg, what is the weight on the earth.

a. 240kg
b. 392N
c. 240N
d. 400kg

7. Newton's law of gravitation applies to

a. Small bodies only
b. Plants only
c. All bodies irrespective of their size
d. For solar system

8. The gravitational force between two objects is F. If masses of both the objects are halved without altering the distance between them, then the gravitational force would become

a. f/4
b. f/2
c. f
d. 2f

9. The Earth attracts the moon with a gravitational force of 1020N. The moon attracts the earth with a gravitational force of

a. Less than 10^{20}N
b. 10^{20}N
c. Greater than 10^{20}N
d. 10^{-20}N

10. The distance between two bodies becomes 6 times more than the usual distance. The the F becomes

a. 36 times
b. 6 times
c. 12 times
d. 1/36 times

Easy-Very Short Answers (1 Mark Questions)

1.State the significance of universal law of gravitation.

2.The value of gravitational constant G on earth is 6.67×10^{-11} Nm^2/kg^2 .What is its value on the surface of moon?

3. Two objects of masses m_1 and $m_2$are dropped in vacuum from a height above the surface of earth (m_1 is greater than m_2). Which one will reach the ground first and why?

4.Suppose gravity of earth suddenly becomes zero, then which direction will the moon begin to move if no other celestial body affects it?

5.State the name and type of force which is responsible for holding the solar system together.

6.The factors associated with the motion of an object are: Force, Velocity, Acceleration and Momentum. Out of these four factors which one remains constant for all bodies large or small undergoing a free fall?

7.Which force is responsible for acceleration of a body in free fall?

8.What will be the acceleration of free fall?

LEVEL-2

9.A cricket ball thrown vertically upwards, reaches a maximum height of 5 meters. Find the initial speed of the ball. (g=9.8 m/s2g=9.8 m/s2)

10.What will be the mass of a body at the center of the earth as compared to other places on the earth?

11.If the weight of a body on the earth is 6 N, what will it be on the moon? (Given that acceleration due to gravity on moon is one sixth of that on the earth.)

12.State universal law of gravitation. How the force between the two bodies is affected if the distance between them is tripled?

13. What do we call the gravitational force between the earth and an object?

14. Why will a sheet of paper fall slower than one that is crumpled into a ball?

2 Marks Questions

Short Answer type Questions

1.Several phenomena of celestial bodies were believed to be unconnected but universal law of gravitation was successful to explain them. Mention any two phenomena.

2.A stone and the earth attract each other with an equal and opposite force. Why then we see only the stone falling towards the earth but not the earth rising towards the stone?

3.Give reasons:

(a) Moon does not have atmosphere

. (b) If you jump on the moon, you will rise much higher than if you jump on the earth.

4. Give reasons

(a) As the altitude increases, how do the weight and mass of the body vary?

(b) A stone resting on the ground has a gravitational force of 20 N acting on it. What is the weight and mass of the stone? (Take g=10 ms^{-2})

5.Your mass on earth is 50 kg. Planet m has two times force of gravity of that on earth. What will be your mass and weight on planet m?

6.What is the source of centripetal force that a planet requires to revolve around the sun? on what factors does that force depend?

7.All the planets are moving in circular orbits. What provides the necessary force for this motion and what is the direction of this force? Write the name of this force. What will happen if this force disappears suddenly?

8. What happens to the gravitational force between two objects if the mass of one object is tripled? Explain with the help of formula.

LEVEL-2

9. The mass of sun is 2×10^{30} kg and the mass of earth is 6×10^{24} kg. if the average distance between the sun and the earth be 1.5×10^{8} km calculate the force of gravitation between them. (Take G = 6.7×10^{-11} Nm^2/kg^2)

10.An object is thrown vertically upwards and rises to a height of 10 m. calculate the velocity with which the object was thrown upwards.

11.A stone thrown vertically upwards reaches the maximum height in 3 m. if the acceleration of the stone be 10 m/s^2, calculate its initial velocity.

12.What is meant by:
(i) Free fall
(ii) Acceleration due to gravity?
13.A stone resting on the ground has a gravitational force of 20 N acting on it. What is the weight of the stone? Find its mass. (g=10 ms^{-2})
14. It is said that the mass of an object remains constant at all places while weight may change. Why?
15.How does weight of an object change on moving from equator to poles? When can the weight of an object be zero?

5 Marks Questions

Long Questions

1.(a) Differentiate between acceleration due to gravity and universal gravitational constant. Derive a relation between 'g' and 'G'.
(b) State universal law of Gravitation.
2.How does the weight of an object vary with respect to mass and radius of the earth? In a hypothetical case, if the diameter of the earth becomes half of its present value and its mass becomes four times of its present value, then how would the weight of any object on the surface of the earth be affected?
3.How does the gravitational force between two objects change when the distance between them is reduced to 1/4th?
4.(a) Write the formula to find the magnitude of gravitational force between earth and an object on earth's surface.
(b) Derive how does the value of gravitational force 'F' change between two objects when the
(i) distance between them is reduced to half, and
(ii) mass of one object is increased four times?

LEVEL-2

5.If the distance between masses of two objects is increased by five units, by what facto would the mass of one of them have to be altered to maintain the same gravitational force? Would there be an increases or a decrease in the mass?
6.(a) A planet has mass five times of earth and radius three times that of earth. Calculate it acceleration due to gravity, if the value of 'g' on earth is 10 ms^{-2}

(b) Differentiate between 'G' and 'g'.

7.Derive the formula for the gravitational force using the factors on which it depends .

HOTS Questions

1. Earth attracts apple from the tree and it falls on it but the earth does not move towards the apple. Why?

2. Is uniform circular motion taking place at a constant speed or constant velocity? Why?

3. Name the force which is required to maintain a body in uniform circular motion?

4. A ball is projected vertically upwards with an initial velocity of u goes to a maximum height h before coming to ground. What is the value of h?

5. Is value of 'g' same everywhere?

6. Find relationship between 'g' and 'G'

7. During a free-fall what is the weight of a body. Give reason for the answer.

8. A stone and feather are thrown from a tower; both the objects should reach the ground at same time but it does not. Why?

9. Find the value of 'g', acceleration due to gravity.

10. Calculate value of 'g' on moon.

Show that the weight of the body on moon =1/6 of the weight of the body in earth.