

CLASS XI

SAMPLE PAPER

PHYSICS

GRAVITATION

Syllabus :

The universal law of gravitation, Gravitational constant; Acceleration due to gravity and its variation with altitude, latitude, depth and rotation of earth. Mass of earth
Gravitational potential near the surface of the earth, gravitational potential; Escape velocity, orbital velocity of satellite, Weightlessness, motion of satellite, geostationary and polar satellites;
Statement of Kepler's laws of planetary motion; proof of second and third law (circular orbits)
Inertial and gravitational mass.

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Questions :

Q.1> Define Gravitation. How is it different from gravity?

Q.2> State Newton's law of gravitation. Express it in vector form

Q.3> What is "G" ? Mention its value, units and dimensions.

Q.4> Mention 5 important characteristics of gravitational force

Q.5> What is acceleration due to gravity? On what factors does it depend?
(b) What is its value at the earth's surface?

Q.6> Assuming the earth to be a uniform sphere of radius 6400Kms and density 5.5gm/cc, find the value of g on the surface of earth

Q.7> Two metal spheres of mass M each are kept at a distance R. The gravitational force b/w them is found to be F. What will be the force b/w them if

- (a) Mass of each is doubled while distance b/w them is made four times
- (b) Mass of one of them is doubles while distance is kept R itself
- (c) Both of them are kept in water at a distance R

Q.8> The mass of a planet is 10^{20} kg while its radius is 5000kms. What will be the gravitational force experienced by a spacecraft of mass 200kg standing on its surface.

(b) What is the acceleration near the surface of this planet

Q.9> The acceleration due to gravity near the earth's surface is found to be 9.81m/s^2 . Radius of the earth is 6400 kms. Using this data find the mass of earth.

Q.10> Using the mass of earth calculated in the previous question, find the density of earth. In real life, is the density of earth uniform?

Q.11> Derive the value of acceleration due to gravity at a height h above the earth's surface

Q.12> Derive the value of acceleration due to gravity at a depth d below the earth's surface

Q.13> How does the shape of earth affect the value of "g" ?

Q.14> How does the rotation of earth affect the value of "g" ? Derive the value of acceleration due to gravity at a place having latitude λ .

Q.15> With what angular velocity should the earth rotate so that a person at the equator does not experience any gravity?

Q.16> At what height above the earth's surface does the value of "g" become one tenth of its value at the surface.

Q.17> At what height above the earth's surface does the value of "g" become 64% of its value on the surface.

Q.18> Find the percentage change in the weight of a body if it is taken to a height equal to the earth's radius

Q.19> At what depth below the earth's surface does the value of "g" become 50% of its value on the surface.

Q.20 Find the value of acceleration due to gravity at the top of Mount Everest (height 10 km)

Q.21> Determine the speed with which the earth should rotate so that a person on the equator would weigh $1/5^{\text{th}}$ as much as present.

Q.22> Define Gravitational field. Mention its SI unit.

Q.23> What is gravitational potential? Mention its units and dimensions. Derive the value of gravitational potential at a distance r from a planet of mass m .

Q.24> Give 4 differences b/w gravitational and inertial mass.

Q.25> What is a satellite? Define geostationary satellite. What are the conditions required for it?

Q.26> A satellite of mass “m” is revolving about a planet of mass “M” in an orbit of radius “r” . Derive the expression for orbital velocity, time period and height of satellite.

Q.27> State Kepler’s laws of planetary motion. Derive the second and the third.

Q.28>The time period of Jupiter is 11.6 years. How far is Jupiter from the sun? Distance b/w earth and sun is known to be 1.5×10^{11} m.

Q.29> what is escape velocity? Find the value of escape velocity from earth.

(b) Find the value of escape velocity from a planet whose mass is double while radius is 4 times that of earth

Q.30> Two particles of mass 5kg and 10kg are kept 100m apart. Due to their mutual force of attraction they start approaching each other. Find the velocity of each of them when the separation b/w them has reduced to 25m.

(b) At what location will they collide?