



# PHYSICS

## BOOKS - VGS BRILLIANT PHYSICS (TELUGU ENGLISH)

### GRAVITATION

#### Very Short Answer

1. State the unit and dimension of universal gravitational constant.



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2. State the vector form of Newton's law of gravitation.



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3. If the gravitational force of the Earth on the Moon is  $F$ . What is the gravitational force of the moon on the earth? Do these forces form an action-reaction pair?



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4. What would be the change in acceleration due to gravity at the surface, if the radius of Earth decreases by 2% keeping the mass of Earth constant?



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5. As we go from one planet to another, how will  
the mass.



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6. As we go from one planet to another, how will the weight of a body change?



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7. Keeping the length of a simple pendulum constant, will the time period to be the same

on all planets? Support your answer with reason.



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**8.** Give the equation for the value of  $g$  at a depth ' $d$ ' from the surface of Earth. What is the value of ' $g$ ' at the centre of Earth?



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9. What are the factors that make 'g' the least at the equator and maximum at the poles?



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10. "Hydrogen is in abundance around the sun but not around earth". Explain.



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**11.** What is the time period of revolution of a geostationary satellite? Does it rotate from West to East or from East to West?



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**12.** What are polar satellites?



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**Short Answer Questions**

1. State Kepler's Laws of planetary motion.



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2. Derive the relation between acceleration due to gravity at the surface of a planet and Gravitational constant.



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3. How does the acceleration due to gravity change for the same values of height and depth?



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4. What is orbital velocity? Obtain an expression for it.



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5. What is escape velocity? Obtain an expression for it.



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6. What is a geostationary satellite? State its uses.



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7. If two places at the same height from the mean sea level, One is a mountain and other is in air. At which place will 'g' be greater? State the reason for your answer.



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8. The weight of an object is more at the poles than at the equator. At which of these can we get more sugar for the same weight ? State the reason for your answer.





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9. If a nut becomes loose and gets detached from a satellite revolving around the earth, will it fall down to earth or will it revolve around earth? Gives reason for your answer.



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10. An object projected with a velocity greater than or equal to  $11.2 \text{ km. s}^{-1}$  will not return to earth. Explain the reason.



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## Long Answer Quations

1. Define gravitational potential energy and derive an expression for it associated with two particles of masses  $m_1$  and  $m_2$ .



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2. Derive an expression for the variation of acceleration due to gravity above.



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3. Derive an expression for the variation of acceleration due to gravity below the surface of the Earth.



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#### 4. State Newton's Universal Law of Gravitation.

Explain how the value of the Gravitational constant can be determined by Cavendish method.



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### Problems

1. Two spherical balls each of mass 1kg are placed 1 cm apart. Find the gravitational force of attraction between them.



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2. The mass of a ball is four times the mass of another ball. When these balls are separated by a distance of 10 cm, the gravitational force between them is  $6.67 \times 10^{-7} N$ . Find the masses of the two balls.



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3. Three spherical balls of masses 1kg, 2kg and 3kg are placed at the corners of an equilateral triangle of side 1m. Find the magnitude of the gravitational force exerted by the 2kg and 3kg masses on the 1kg mass.



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4. At a certain height above the earth's surface, the acceleration due to gravity is 4%

of its value at the surface of the earth.

Determine the height.



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5. A satellite orbits the earth at a height of 1000 km. Find orbital speed.



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6. A satellite orbits the earth at a height equal to the radius of earth. Find its

orbital speed



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7. A satellite orbits the earth at a height equal to the radius of earth. Find its Period of revolution.



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8. The gravitational force of attraction between two objects decreases by 36% when

the distance between them is increased by 4 m. Find the original distance between them.



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**9.** Four identical masses  $m$  are kept at the corners of a square of side  $a$ . Find the gravitational force exerted on one of the masses by the other masses.



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**10.** Two spherical balls of 1 kg and 4kg are separated by a distance of 12 cm. Find the distance of a point from the 1 kg mass at which the gravitational force on any mass becomes zero.



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**11.** Three uniform spheres each of mass  $m$  and radius  $R$  are kept in such a way that each touches the other two. Find the magnitude of

the gravitational force on any one of the spheres due to the other two.



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**12.** Two satellites are revolving round the earth at different heights. The ratio of their orbital speeds is 2: 1. If one of them is at a height of 100 km what is the height of the other satellite?



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**13.** A satellite is revolving round in a circular orbit with a speed of  $8 \text{ km/s}^{-1}$  at a height where the value of acceleration due to gravity is  $8 \text{ m/s}^{-2}$ . How high is the satellite from the Earth's surface?



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**14.** Calculate the escape velocity of a body from the Earth's surface.



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**15.** If the Earth were made of wood, its mass would be 10% of its current mass. What would be the escape velocity, if the Earth were made of wood?



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## Additional Problems

**1.** A comet orbits the sun in a highly elliptical orbit. Does the comet have a constant (a)



linear speed (b) angular speed ( c) angular momentum (d) Kinetic energy ( e) potential energy (f) total energy throughout its orbit?  
Neglect any mass loss of the comet when it comes very close to the sun.



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2. A Saturn year is 29.5 times the earth year.  
How far is the Saturn from the sun if the earth is  $1.5 \times 10^8$  km away from the sun?



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3. A body weighs 63 N on the surface of Earth. What is the gravitational force on it due to the earth at a height equal to half the radius of the Earth?



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4. Assuming the earth to be a sphere of uniform mass density, how much would a body weigh half way down to the centre of earth if it weighed 250 N on the surface?



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