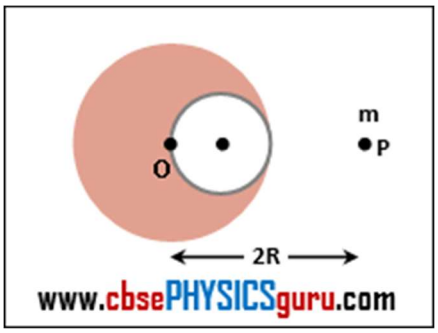
KEPLER'S LAWS OF PLANETARY MOTION, UNIVERSAL LAW OF GRAVITATION

1. In planetary motion, the angular momentum conservation leads to the law of:
   (a) orbits **(b)** areas (c) periods (d) conservation of kinetic energy
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 x 10^8 km away from the sun?
   (a) 1.1 x 10^9 km **(b)** 1.4 x 10^9 km (c) 1.6 x 10^9 km (d) 1.8 x 10^9 km
3. A planet is revolving in an elliptical orbit around the sun. Its closest distance from the sun is R_1 and the farthest distance is R_2. If the velocity of the planet nearest to the sun be v_1 and that furthest away from the sun be v_2, then v_1/v_2=
   (a) $\frac{R_1}{R_2}$ (b) $\left(\frac{R_1}{R_2}\right)^2$ (c) $\left(\frac{R_2}{R_1}\right)^2$ **(d)** $\frac{R_2}{R_1}$
4. A system of binary stars of masses m_A and m_B are moving in circular orbits of radii R_A and R_B respectively. If T_A and T_B are the time periods of masses m_A and m_B respectively then:
   (a) $\frac{T_A}{T_B} = \left(\frac{R_A}{R_B}\right)^{3/2}$ **(b)** $T_A = T_B$ (c) $\frac{T_A}{T_B} = \frac{R_A}{R_B}$ (d) $T_A > T_B (If\ m_A > m_B)$
5. The mean distance of mars from sun is 1.5 times of earth from sun. What is approximately the number years required by mars to make one revolution about sun:
   (a) 1.35 years (b) 2.65 years **(c)** 1.84 years (d) 2.95 years
6. The area swept out by the line joining the earth and the sun during February 2018 is A. The area swept out by line during a typical week in February 2018 is:
   (a) A/2 (b) A **(c)** A/4 (d) 4A
7. A binary star system consists of two stars. One star has twice the mass of the other. The star rotates about their common centre of mass. Which of the following statement is correct?
   (a) Star having the smaller mass has twice angular momentum compared to heavier star. (b) Both stars have same angular momentum about centre of mass. (c) Both stars have same linear speed. (d) Both the stars have same kinetic energy.
8. Three equal masses of 1 kg each are placed at the vertices of an equilateral triangle ABC and a mass of 2 kg is kept at the centroid O of the triangle which is at a distance $\sqrt{2}$ from each of the vertices of the triangle. The force acting on the mass 2 kg is:
   (a) 4 N (b) 6 N (c) 9 N **(d)** zero
9. Three particles each of mass m are placed at the vertices of an equilateral triangle of side L. The magnitude of the gravitational force on any one particle due to others two is:
   (a) $\frac{Gm^2}{3L^2}$ (b) $\frac{Gm^2}{L^2}$ **(c)** $\frac{\sqrt{3}\,Gm^2}{L^2}$ (d) $\frac{\sqrt{2}\,Gm^2}{L^2}$
10. A mass M is divided into two parts m and (M – m) which are separated by a certain distance. The ratio m/M which maximizes the gravitational force between the parts is:
    (a) 1 : 1 **(b)** 1 : 2 (c) 1 : 3 (d) 1 : 4
11. Two solid spherical planets of equal radii R having masses 4M and 9M have their centres separated by a distance 6R. A projectile of mass m is sent from the planet of mass 4M towards the heavier planet. What is the distance r of the point from the lighter planet, where the gravitational force on the projectile is zero?
    (a) 1.6 R (b) 1.8 R (c) 2.0 R **(d)** 2.4 R
12. A point mass m is placed inside a spherical shell of radius R and mass M at a distance R/2 from the centre of the shell. The gravitational force exerted by the shell on the point mass is:
    (a) Zero (b) $\frac{4GMm}{R^2}$ (c) $\frac{GMm}{4R^2}$ (d) $\frac{GMm}{R^2}$

13. A uniform sphere of mass M and radius R exerts a force F on a small mass m situated at a distance of 2R from the centre 0 of the sphere. A spherical portion of diameter R is cut from the sphere as shown in figure. The force of attraction between the remaining part of the sphere and the mass m will be:



(a) 7F/9 (b) F/9 (c) 4F/9 (d) F/3

14. Two point masses X and Y having masses in the ratio 4:3 are separated by a distance of 1 m. When another point mass Z of mass M is placed in between X and Y, the force between X and Z is 1/3 rd of the force between Y and Z. Then the distance of Z from X, in m, is:
(a) 1/2 **(b)** 2/3 (c) 1/4 m (d) 3/7
15. Two spherical bodies of masses M and 5M and radii R and 2R respectively are released in free space with initial separation between their centres equal to 12R. If they attract each other due to gravitational force only, then the distance covered by the smaller body just before collision is:
(a) 1.5R (b) 2.5R (c) 5.5R **(d)** 7.5R