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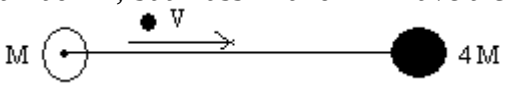
Time -1h **Class-XI** **M.M- 27**

1. In the HC1 molecule, the separation between the nuclei of the two atoms is about 1.27 Å (1 Å = 10^{-10} m). Find the approximate location of the CM of the molecule, given that a chlorine atom is about 35.5 times as massive as a hydrogen atom and nearly all the mass of an atom is concentrated in its nucleus. [2]

2. Find the centre of mass of three particles at the vertices of an equilateral triangle. The masses of the particles are 100g, 150g, and 200g respectively. Each side of the equilateral triangle is 0.5m long. [2]

3. A body weighs 63 N on the surface of the earth. What is the gravitational force on it due to the earth at a height equal to half the radius of the earth? [2]

4.Two uniform solid spheres of equal radii *R*, but mass *M* and 4 *M* have a center to center separation 6 *R*, as shown in Fig. 

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The two spheres are held fixed. A particle of mass *m* is projected from the surface of the sphere of mass *M* directly towards the centre of the second sphere. Obtain an expression for the minimum speed v of the projectile so that it reaches the surface of the second sphere. [5]

5. What is the moment of inertia of a uniform circular disc of radius R and mass M about an axis (i) passing through its centre and normal to the disc ; (ii) passing through a point on its edge and normal to the disc? The moment of inertia of the disc about any of its diameters is given to be (1/ 4) MR^2. [3]

6. Deduce an expression for the minimum velocity for the velocity with which a rocket must be fired to escape earth's gravitational field. [3]

7. Explain why hydrogen is found in abundance around the sun while it is absent form the earth's atmosphere? [2]

8. Derive an expression to explain the decrease in acceleration due to gravity inside the earth as one approaches the centre. [3]

9.. State and prove the parallel theorem of rotation. [2]

10. A solid sphere rolls without slipping along the track shown in figure. The sphere starts form rest from a height h above the bottom of a loop of radius R which is much larger than the radius of the sphere r. The minimum value of h for the sphere to complete the loop is [3]