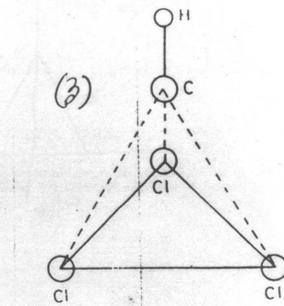
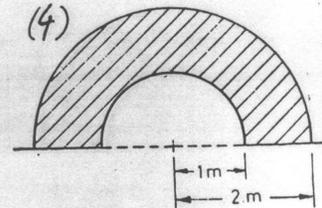


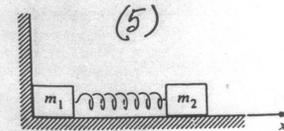
- The density of a thin rod of length l varies with the distance x from one end as $\rho = \rho_0 x^2/l^2$. Find the position of the center of mass.
- Find the center of mass of a thin uniform plate in the shape of an equilateral triangle with edges a .
- Chloroform molecule has three Cl ions forming an equilateral triangle. The carbon atom is at the apex of the pyramid. $C - Cl$ distance is 1.76 \AA and each $Cl - C - Cl$ angle is 109° . Hydrogen - Carbon distance is 1.1 \AA . Find the CM relative to the carbon atom.



- Determine the location of the center of mass of a uniform lamina occupying region between two concentric semicircles of radii 2 m and 1 m .

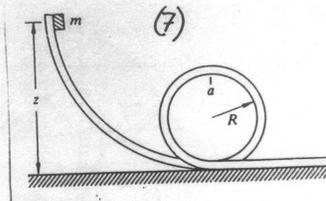


- A system consists of two blocks of mass m_1 and m_2 connected by a massless spring with spring constant k and slides on a frictionless plane. The unstretched length of the spring is l . Initially m_2 is held so that the spring is compressed to $l/2$ and m_1 is forced against a stop, as shown. m_2 is released at $t = 0$. Find the motion of the center of mass of the system as a function of time.

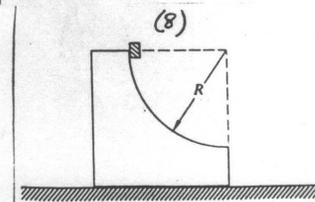


- A 60 Kg man is standing at the center of a barge of mass 240 Kg which is resting frictionlessly on still water. Initially the center is 20 m from the shore. The man walks up towards the shore with a constant speed of 1 m/s with respect to the barge. Calculate the speed with which he is approaching the shore.

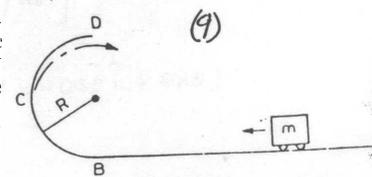
- A small block of mass m starts from rest and slides along a frictionless loop-the-loop as shown in figure. What should be the initial height z , so that m pushes against the top of the track (at a) with a force equal to its weight?



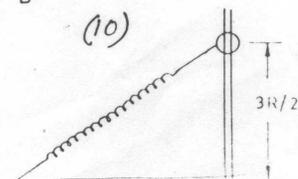
- A small cube of mass m slides down a circular path of radius R cut into large block of mass M , as shown in figure. M rests on a table, and both blocks move without friction. The blocks are initially at rest, and m starts from the top of the path. Find the velocity v of the cube as it leaves the block.



- The track shown in figure is straight in the horizontal section AB and is a semicircle of radius R in the vertical part BCD . A particle of mass m is given a velocity of $\sqrt{22Rg/5}$ to the left along the track. The particle moves up the vertical section, and ultimately loses contact with it. How far from point B will the mass land?



- A ring of mass m can slide over a smooth vertical rod as shown. The ring is connected to a spring of force constant $k = 4mg/R$, where $2R$ is the natural length of the spring. The other end of the spring is fixed to the ground at a horizontal distance $2R$ from the base of the rod. If the mass is released at a height of $1.5R$,



- Calculate the work done by the spring.
- Using the work-energy theorem, calculate the velocity of the ring as it reaches the ground.