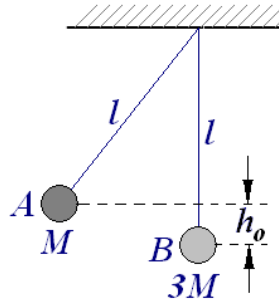


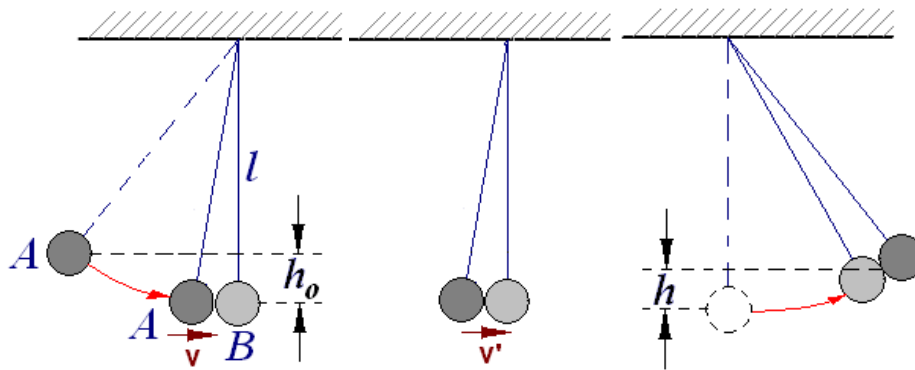
Classical Mechanics

Simple pendulum

Problem 1.- Two small spheres of wet clay, A and B, of mass M and $3M$, respectively, hang from strings of equal length l . Sphere A is drawn aside so that it is raised to a height h_0 as shown in the figure and then released. Sphere A collides with sphere B; they stick together. Calculate the maximum height h reached by the two spheres.



Solution: You can divide this problem in three parts:



a) Find the velocity of mass A just before hitting mass B: Mechanical energy is conserved in the trajectory because the only force other than gravity acting on the mass is the tension in the string and that force doesn't do any work, so:

$$Mgh_0 = \frac{1}{2}Mv^2 \text{ So the velocity is: } v = \sqrt{2gh_0}$$

b) Find the velocity of the two spheres just *after* the collision: since momentum is conserved in the collision, we can write:

$$Mv = 4Mv' \rightarrow v' = \frac{v}{4} = \frac{\sqrt{2gh_0}}{4} \text{ where } v' \text{ is the velocity after the collision.}$$

c) Find how high the two balls will get: Again, the forces due to string tension do not do any work, so energy is conserved and:

$$\frac{1}{2}(4M)v'^2 = 4Mgh \rightarrow h = \frac{v'^2}{2g} = \frac{1}{16}h_0$$