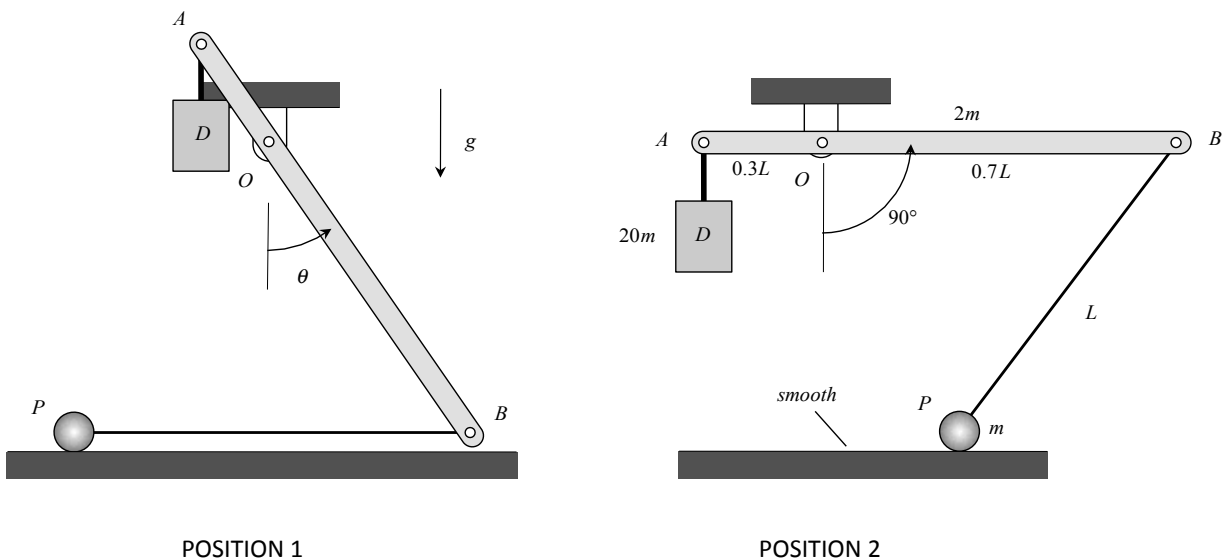


## Homework H.5.P

**Given:** A trebuchet is a catapult device first used by as a siege weapon during the Middle Ages. The essential parts of a trebuchet are shown in the figures below. A beam of length  $L$  and mass  $2m$  is pinned to ground at  $O$ . On one end of the beam is attached counterweight  $D$  (of mass  $20m$ ). A projectile  $P$  (having a mass of  $m$ ) is held by a sling that is attached by a rope to the other end of beam. For this problem, the system is released from rest in the configuration of the figure shown below left with the beam being at an angle of  $\theta_1$  with respect to the vertical. As the system moves,  $P$  initially slides to the right along the horizontal ground surface. At some point,  $P$  loses contact with the ground, with  $P$  eventually being flung to the left as it moves over the top of the support  $O$ . We are asked here to analyze the dynamics of the trebuchet during the time that the projectile is being dragged along the ground. Assume that the length of the support rod  $AD$  is small compared to the other dimensions of the problem.

**Find:** Determine the speed of  $P$  when  $\theta = 90^\circ$ .



Use the following parameters in your analysis:  $\theta_1 = 30^\circ$ ,  $m = 50$  kg and  $L = 8$  m.