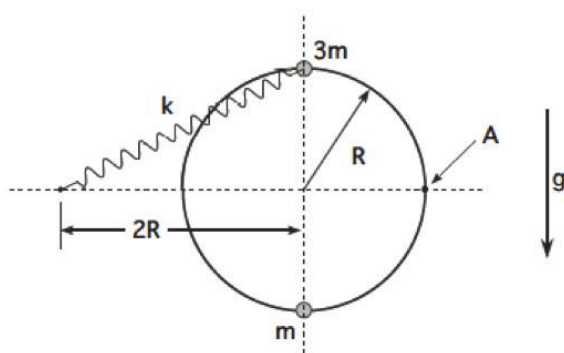# Afleveringsopgave, Mekanik og Termodynamik, Ugeseddel 5.

Objects on a Ring

Two objects slide without friction on a circular ring of radius R, oriented in a vertical plane.

The heavier object (of mass 3m) is attached to a spring with an unstretched length of zero (admittedly an unphysical assumption) and spring constant k. The fixed end of the spring is attached to a point a horizontal distance 2R from the center of the circle.

1. What is the kinetic and potential energy of the heavy particle (i) in the initial state, (ii) when it passes the left most position, horizontal with respect to the center of the circle, and (iii) just before it hits the light particle.

The lighter object (of mass m) is initially at rest at the bottom of the ring. The heavier object is released from rest at the top of the ring, then collides with and sticks to the lighter object.

2. What is the velocity of the heavy particle when it hits the light particle, and what is their joint velocity after the collision.

3. Find the value for m that will allow the combined object (of total mass 4m) to just reach the point A on the ring, but go no higher.

4. What is the work done by gravity and the work done by the spring on the masses from the release of the heavy particle until they both stop at point A in the figure?

5. What is the change in potential energy of the total system from the release of the heavy particle until they both stop at point A in the figure?

Express your answers in terms of some or all of the quantities k, R and the acceleration of gravity g.