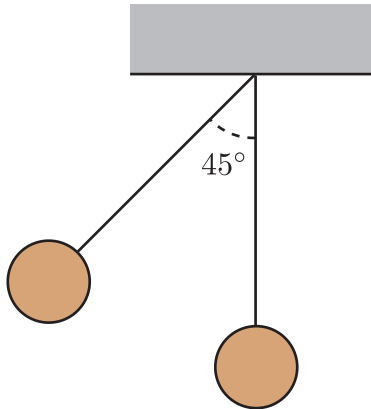


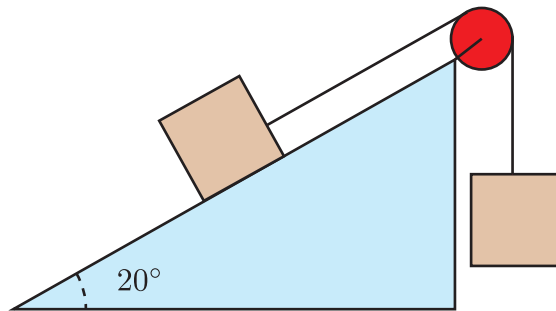
Physics 161 Midterm 3

There are three (3) problems, worth 33 points each. You must show your work to receive full credit.

1. Two clay balls of mass m hang from a string of length ℓ . One ball is released from rest at the position shown. When it hits the other ball, the two balls stick together and continue to swing back and forth.



- (a) (7 points) Is energy conserved in this any part of this process? Explain.
- (b) (7 points) Is momentum conserved in any part of this process? Explain.
- (c) (19 points) Find the maximum vertical height reached by the two balls after they stick together.
2. (33 points) Two blocks with mass 2.0 kg each are attached by a string over a frictionless pulley as shown below. The blocks are released from rest. The coefficient of friction between the block and the inclined plane is $\mu_k = 0.12$.



- (a) (13 points) Find the work done by friction during the time that the hanging block drops by 0.25 m.
- (b) (20 points) Use work and energy to find the speed of the hanging block after it has dropped by 0.25 m.

3. (33 points) Suppose the moon were to stop in its orbit. Find the speed with which the moon would hit the earth's surface. You can ignore the sun's gravitational pull and assume that the earth and the moon are initially at rest. Useful information: $G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$, $M_e = 5.98 \times 10^{24} \text{ kg}$ (earth mass), $M_m = 7.36 \times 10^{22} \text{ kg}$ (moon mass), $R_e = 6.37 \times 10^6 \text{ m}$ (earth radius), $R_m = 1.74 \times 10^6 \text{ m}$ (moon radius), $r_{\text{em}} = 3.84 \times 10^8 \text{ m}$ (earth-moon distance).