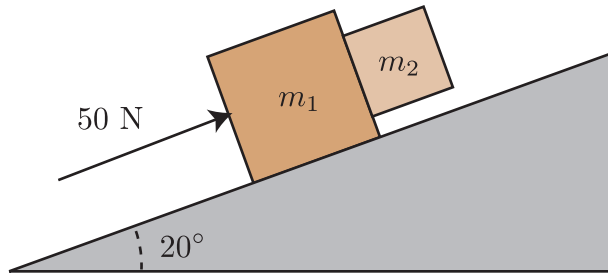


Physics 161 Sample Final

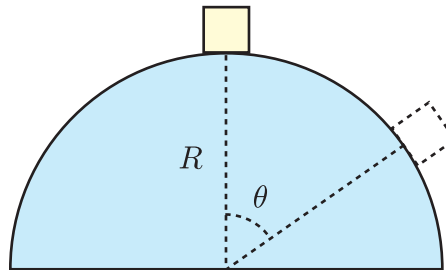
There are three (5) problems, worth 20 points each. You must show your work to receive full credit.

1. (20 points) A ball of mass 0.60 kg is thrown with an initial speed of 25 m/s at an angle of 60° above the horizontal. In addition to the force of gravity, the ball is subject to a constant horizontal wind force of 4.0 N. How far away does the ball land if it is thrown into the wind? How far away does it land if it is thrown in the same direction as the wind?

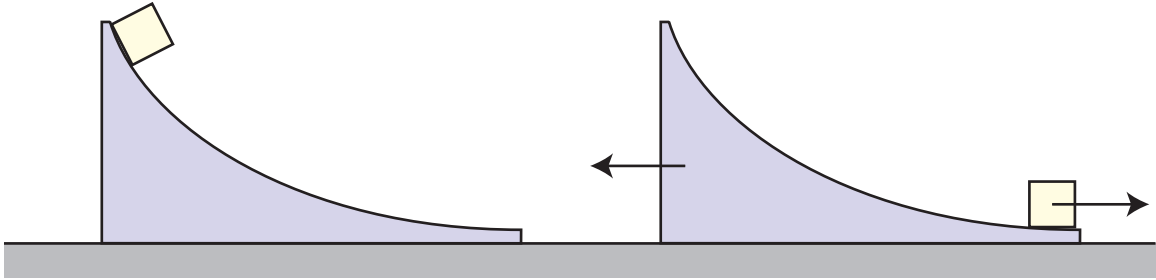
2. (20 points) Two boxes of mass $m_1 = 1.2$ kg and $m_2 = 0.23$ kg are on an inclined plane that makes an angle of 20° with the horizontal. The coefficients of friction between the boxes are $\mu_k = 0.14$ and $\mu_s = 0.31$. The inclined plane is frictionless. Box 2 is placed on the front of box 1 and a constant force 50 N is applied to box 1 parallel to the incline, as shown below. Does box 1 slip down or do the boxes move together? *Back up your answer with a calculation.*



3. (20 points) An block of mass m is on top of a dome (half sphere) with radius R . It starts nearly at rest at the top and slides down the globe. At what angle θ does it fall off the globe? Neglect friction.



4. (20 points) A block of mass m slides down a ramp of mass $3m$ from an initial height h , starting from rest. The ramp is free to slide on a horizontal surface. All surfaces are frictionless. Find the speed of the block and the speed of the ramp relative to the horizontal surface when the block is at the bottom of the ramp, where it is moving horizontally.



5. (20 points) An Atwood machine consists of masses m and $2m$ hanging over a cylinder of mass M and radius R (and moment of inertia $\frac{1}{2}MR^2$). The system is released from rest. Find the speed of the heavier mass when it has dropped a vertical height h . Neglect friction.

