Physics 1210
Homework 5 Written-out Problems

1.
You work as an engineer for Admiral Beverage in Worland, which can fill as many as 1,200 cans per minute (https://www.admiralbeverage.com/production/) in its automated production line in service of 7 states desires for sodie-pop. Admiral Beverage is interested in acquiring a third production facility and you are ensuring, one by one, that the retro-fitted ramps at the new location will not result in cans exploding. The particular ramp you are working on is 150 cm long at a 12 degree angle above horizontal, the cans are already in a 8.5 kg (24 can) box and the coefficient of kinetic friction between the box and the ramp is $u_k = 0.31$ as they travel down the ramp.

a) Find the work done by friction
b) Find the work done by gravity
c) Find the work done by the normal force
d) Find the total work done on the box
e) If the box has a speed of 2.2 m/s downward at the top of the ramp, what is the speed at the bottom?
f) At the bottom of the ramp is a dramatic turn on which the cans will explode if their speed is more than 0.25 m/s, does the system work as designed? If not, what could be changed to further slow the final speed?

2.
You have a top-loading washing machine that spins at 60 rpm to 'wring' the clothes of the water after a wash cycle. The diameter of the cylindrical cage area is 1.5 ft. The 'wringing' occurs because, unlike the clothing that is stuck in the cage, water is free to pass out of the cylinder into a collecting shell. The path of any droplet of water is identical to the path of the ball on the string when it is cut in book figure 5.29.

a) What is the speed of a shirt at the edge of the cylinder?
b) Assuming a droplet of water is $5.0 \cdot 10^{-5}$ kg what is the kinetic energy of a droplet of water that comes off the shirt?
c) What was the work done to give the droplet of water that kinetic energy?
d) Given that a typical top-loading washing machine can use 100 L of water per cycle, how many droplets is that? How much total work does that mean the wash machine does removing water from the clothes?
e) What is the average power that the washing machine demands for just this work on the 100 L if it is completed in one revolution? If the most efficient washing machines consume 400 Watts of power is most of it spent giving kinetic energy to the water in the cylinder?