Physics 1210
Homework 9 Written-out Problems

1.
You are investigating an avalanche caught on a wildlife camera in the
Medicine Bow-Routt Forest where a boulder of mass M and radius R
rolled
down a slope of angle θ from a height of h before rolling off a cliff some
height H above the valley floor. You may assume that the boulder does
not
change mass, has some rolling friction, and starts from rest without
slipping.
You also notice that there is a small frictionless ledge at the cliff (as
shown)
so that the boulder left the cliff with completely horizontal motion.
Derive an
expression for the distance D that it lands from the base of the cliff.
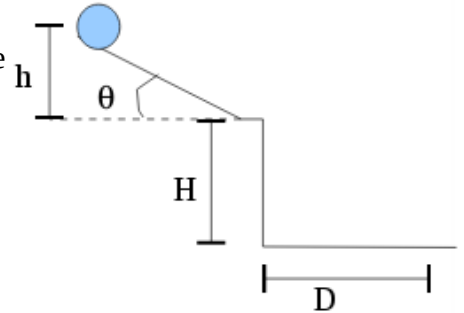
2.
A ship's anchor chain is wrapped around a hollow steel drum of mass M=500 kg and radius R=0.5 m.
The drum is located on the deck of the ship while the L=75 m anchor chain (with linear density l=2 kg/
m) drops to just above the ocean floor where it holds a m=60 kg anchor. A motor applies a constant
force to the drum at radius R in order to raise the anchor (initially at rest) at an initial acceleration of 1
m/s2. Assume there are no buoyant forces.
A. What force F must the motor apply to turn the steel drum and raise the anchor/chain?
B. As the chain is raised, describe what is happening to the chain and also what is happing to the steel
drum rotator.
C. After one revolution, assuming the motor supplies the same constant force, what is the new linear
acceleration of the system?