Name_____

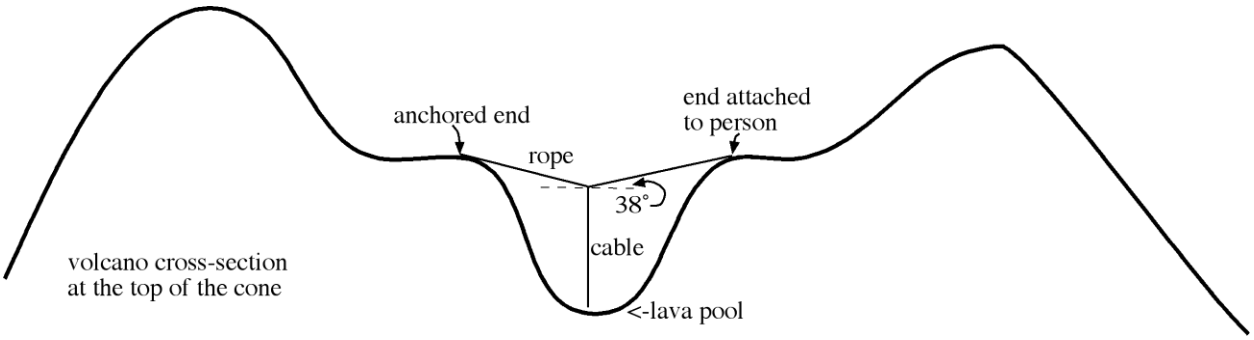
Date _____ **Pd**____

Unit 3 Worksheet 4:

For each of the problems below, <u>carefully draw a system schema diagram and a force diagram of the system before attempting to solve the problem</u>.

1a. Volcanologists need a lava sample from an active lava pool below a plateau inside the volcano. After one end of a rope is anchored to the rock, another scientist hikes around the plateau rim so that the rope, and an attached cable, hangs over the lava pool. The cable is dipped into the lava pool and then the lava that congeals on the cable is retrieved. (This was done at Mt. Nyiragongo in Africa.)

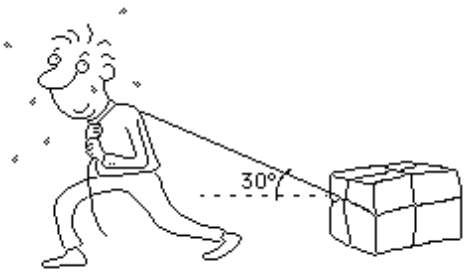
When the cable with the lava sample has a weight of 125 N, how large is the tension in the rope? (Hint: make your force diagram for the junction of the cable and the rope, and don't worry about the fact that the rope has weight too.)



1b. The actual apparatus has a pulley in the middle of the rope. The cable parallels one side of the rope, goes over the pulley and down to the lava pool. The reason for this is that simply tightening the rope can't lift the lava sample out. Here's why: calculate how much tension would be needed in the rope to decrease the angle to 5°.

2. A man pulls a 50 kg box *at constant speed* across the floor. He applies a 200 N force at an angle of 30°.

System Schema and Force diagram for the box:



a. Write an equation for all the forces and components of force on the box in the vertical direction.

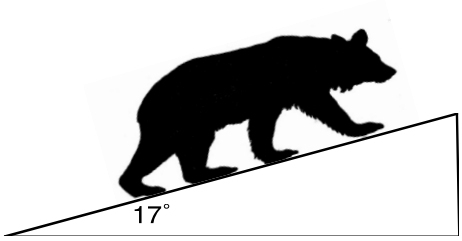
b. Calculate the size of the normal force on the box.

c. Write an equation for all the forces and components of force on the box in the horizontal direction.

d. Calculate the size of the frictional force opposing the motion of the box.

3. Determine the weight of the tram. The cable at left exerts a 30,000 N force. (The tram is attached to the cable so the tension in the left cable is not necessarily equal to the tension in the right cable.)

4. In the space at right, draw the system schema diagram and the force diagram for a bear climbing a hill at constant speed.

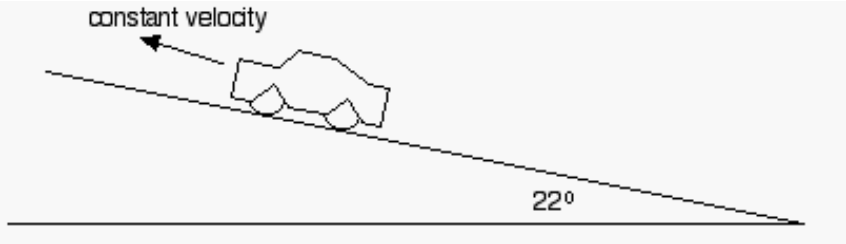


a. Write the equation that describes the forces that act parallel to the ramp.

b. Write the equation that describes the forces that act perpendicular to the ramp.

c. If the mass of the bear is 400 kg, determine the value of the normal force.

5. A 950 kg car is driven up a hill at constant velocity of 7 m/s, where 1200 N of friction and drag oppose its motion. [L SEP]



a. Draw a system schema diagram and a force diagram for the car.

b. What is the weight of the car?

c. Calculate the normal force on the car. Show your work.

d. Calculate the force on the car that allows it to go up the hill. Show your work.