

# RECITATION QUESTIONS

FRIDAY, 23 MARCH

1. A rock climber of mass 70 kg is climbing a cliff face when she slips and falls. There is 4m of slack in her climbing rope, so she undergoes free fall for 4 meters before the rope begins to arrest her fall. If the stiffness in her rope is 1400 N/m, then:

(a) How far will she fall in total?

(b) What is the maximum force that her rope will exert on her as it arrests her fall?

(c) When would it be desirable for a rock climber to use a rope with a large spring constant? What about a smaller spring constant? You'll need to think about the engineering reasons for climbers to use ropes at all: the goal is to minimize the forces involved in arresting a climber's fall.

2. A laptop battery says it has a capacity of 51 “watt-hours”.
- (a) What are the dimensions of this odd unit “watt-hour”, and what does it measure?  
What is 51 watt-hours in more familiar units?
- (b) If this battery were used to power an electric motor, how high could it lift the battery? Assume the battery has a mass of 300 grams.

3. A ball of mass  $m$  on a cord of length  $L$  is held at an angle  $\theta$  to the left of the vertical and released. A very strong wind blows from left to right, exerting a constant horizontal force  $F$ .

(a) Find the speed of the ball at the bottom of its swing.

(b) Find an equation for the maximum angle that the ball reaches when it swings to the right. You do not need to actually solve it, since it's messy and involves a lot of trig identities; just write it down.

(c) When the ball swings back to the left, find the height that it reaches. Will it come back to the same point where it was released? (You should be able to answer this question without doing anything difficult.)