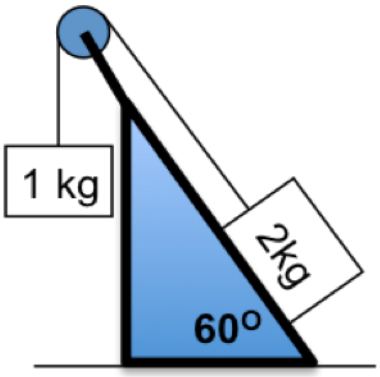
Midterm #2, 141 retake, Schwartz Name_____

From the syllabus: In order to achieve an "A": Consistently

- correctly identifies underlying physics concepts,
- sets up problem with good drawing and reasons,
- formulates method to solve problem,
- correctly uses units and
- verifies whether answer makes sense.

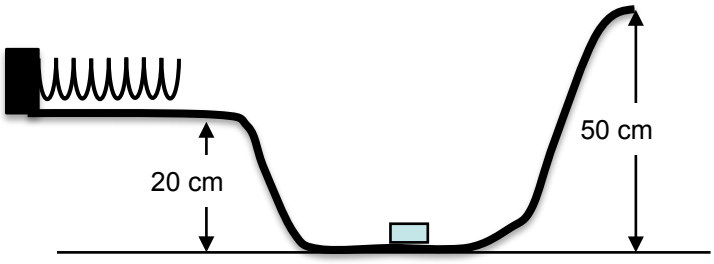
An answer alone is worth no credit and a question may require more than one lens.
Please estimate answers: don't leave them in roots, trig., fractions.
Extra room for extra work, thought, reasons, calculations:

1) See the system of masses at right. The masses are attached by a massless, frictionless string over massless frictionless pulley. The system is released from rest and the coefficient of friction between the two kg mass and the incline is 0.2.
Dynamics because we have forces and want to find acceleration. You could always use conservation of energy, but you'd need some kinematics to solve for acceleration and force in the end. You can solve this as a system, then you don't have to worry about tension because it pulls equally both ways.



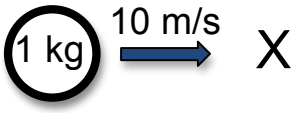
a) Please find the acceleration of the system. ~ $2 m/s^2$
b) Please find the tension in the string ~ 11 N. You *can't* look at this as a system to get the tension. You have to pick one object that tension is acting on and look at the forces on that single object.

2) I compress the spring in the picture by 20 cm and put the 2 kg mass on it. It is accelerated across the frictionless surface by the spring, down the frictionless slope and up the frictionless slope on the other side where it has a final velocity of 2 m/s. The horizontal surface on the bottom is 50 cm long and has a coefficient of friction of 0.2. Please find the spring constant of the compressed spring.



Dynamics won't work for this because we don't know the slopes (although we could make some up and it would work the same regardless of the slopes we choose). Energy is the best way to look at this because everything can be correlated to an energy, which we can account for. Remember heat is the result of the work done my friction, so include this. I get k = 600 N/m.

3. (8 pts) A 1.0 kg ball moving at 10 m/s *to the right,* has an *elastic* collision with *stationary* "Ball X" of unknown mass, and *continues on to the right* at 8 m/s. We want to find the mass of Ball X, and its final velocity. Is it a good idea to draw a picture?



a. Without doing any math, can you tell me if the mass of Ball "X" is more or less than 1 kg? That is: fill in the space with < , >, or = : m_X___1 kg
please give a reason. Mass of X > 1 kg. Think about what happens in a perfectly elastic collision when they both have the same mass.

b. What must be the momentum of Ball X after the collision? Conserve momentum. What is the change of the momentum of one ball? I get an answer of +2 kg m/s

c. What must be the kinetic energy of Ball X after the collision?
Conserve energy. What is the change in energy of the one ball?
I get +18 J

d. *(extra credit)* Find the mass of ball X and the final velocity of ball X.
This is just math. Use the two values from b and c, I get
m = (1/9) kg, v = 18 m/s