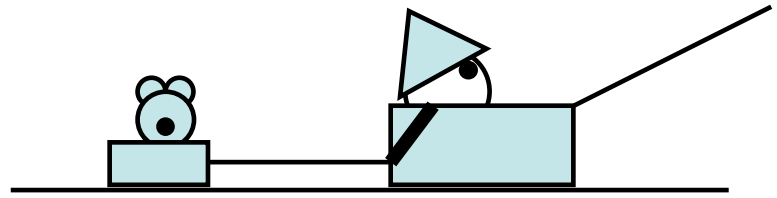


1. (10 pts) I pull my little girl (10 kg) in her sled and she pulls Teddy (2 kg). I pull with a tension of 60 N at an angle of 30° above the horizon. The girl's sled is frictionless (on wheels) but the coefficient of friction for Teddy's sled is 0.8.



a) After reading the questions, please state which of the 4 concepts are central to your solving this problem and why.

b) What is the acceleration of my daughter?

a = _____

c) What is the tension of the string pulling Teddy?

T = 22 N _____

2. Your Statements:

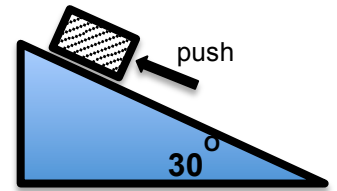
a) Please write and sign the following statement: "I will not communicate any information about this test to those outside the 10 AM class until after 2:00 PM today."

Signature _____

b) If you didn't use a calculator for this test and would like extra credit for it, please write and sign the following statement: "I didn't use a calculator on this test - *your signature*"

Signature _____

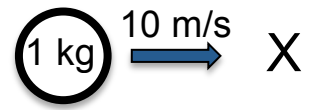
3. (15 pts) Your job is to keep boxes moving up a 30° incline as shown at right. Boxes ($m = 10 \text{ kg}$) are pushed from below on a surface with a 0.3 coefficient of friction and reach you with a speed of 3 m/s . You push the boxes up the next 4 m stretch of ramp with a force of 100 N as shown, and we want to find the speed of the box when you're done pushing it. Clearly show your work, identifying which concept you're using.



- Find the force of friction.
- How much heat is liberated in this process?
- How much work did I do on the system?
- What is the change of potential energy of the system?
- What is the final speed at the end of the 4 m stretch? $\sim 5.3 \text{ m/s}$

4. (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 is reflected back at 8 m/s *back to the left*. 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? please give a reason



b. What is the momentum of Ball X after the collision?

c. What is the kinetic energy of Ball X after the collision?

d. (*extra credit*) Find the mass of ball X and the final velocity of ball X.

$m = 9 \text{ kg}, v = 2 \text{ m/s}$

5. (7 pts) My friend lives on top of a 30 m plateau, and I want to lob a nice parcel up to her. I have a slingshot that can propel something at 30 m/s, and so I back up from the edge of the plateau and shoot my parcel up to her at a 60° above the horizontal.

About how far from the cliff's base should I put my slingshot so that the parcel clears the edge of the cliff at its highest point (as shown at right)? ~ 39 m

If it's not clear how to solve this, find anything else that you can

(Extra Credit: find the final velocity of the parcel as it lands on top of the cliff) ~ 17 m/s, ~ 30 degrees

