Name_____
Date _____ **Mods** _____

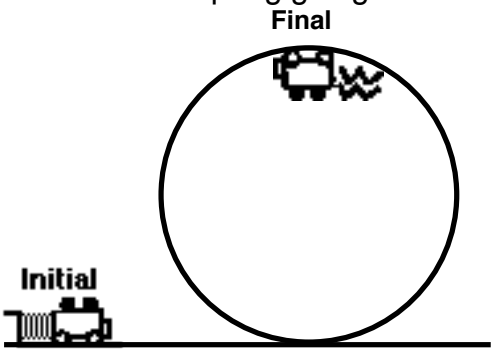
Work energy bar charts (PART 1)

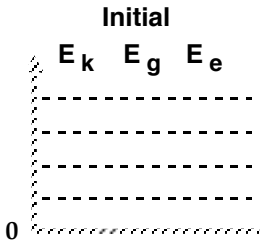
For each situation shown below:

1. Show your choice of system in the energy flow diagram, unless it is specified for you. ***Always include the earth in your system.*
2. Decide if your system is frictionless or not, and state this.
3. Sketch an energy bar graph for the initial situation.
4. Then complete the analysis by showing energy transfers and the final energy bar graph.

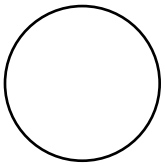
NOTE:
Ek = kinetic energy
Eg = gravitational potential energy
Ee = elastic (spring) potential energy
Eint = internal (thermal) energy)

1. Car on a spring going around a track – still moving at Final. Friction? _____

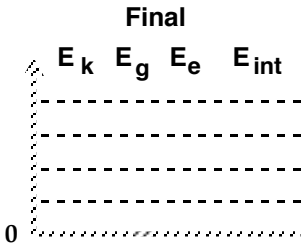




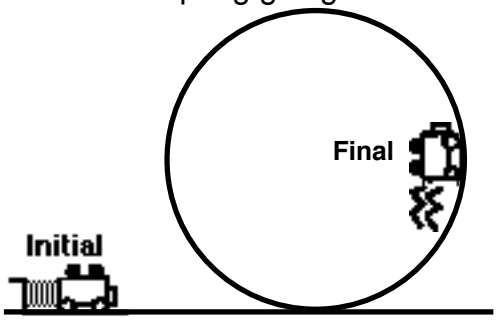
Energy Flow Diagram

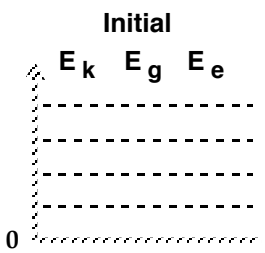


System?

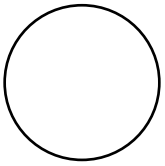


2. Car on a spring going around a track – still moving at Final. Friction? _____

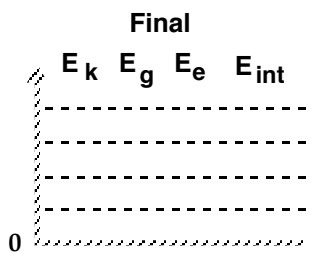




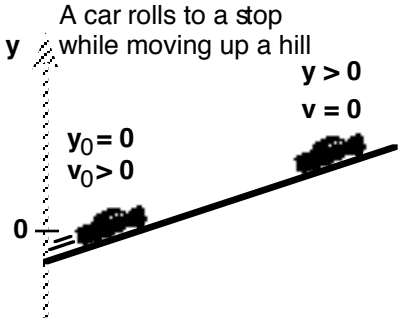
Energy Flow Diagram

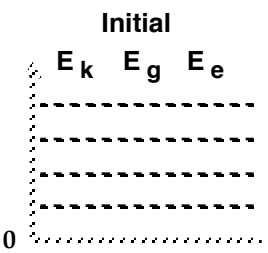


System?

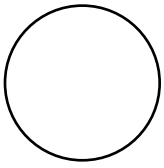


3. Friction? _____

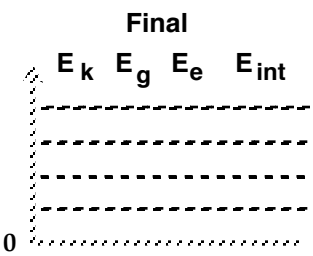




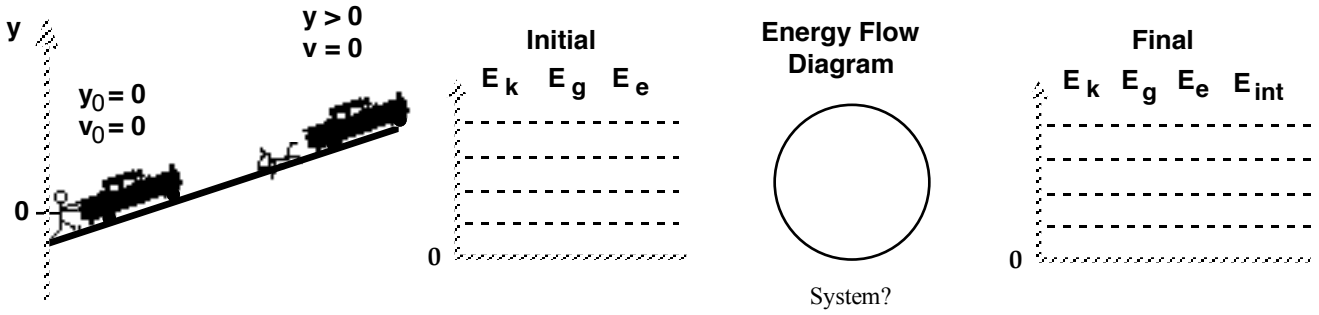
Energy Flow Diagram



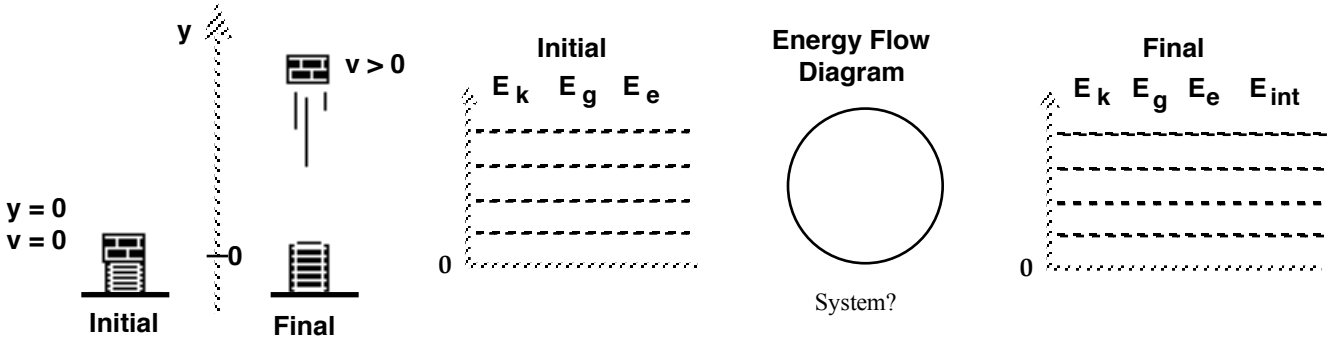
System?



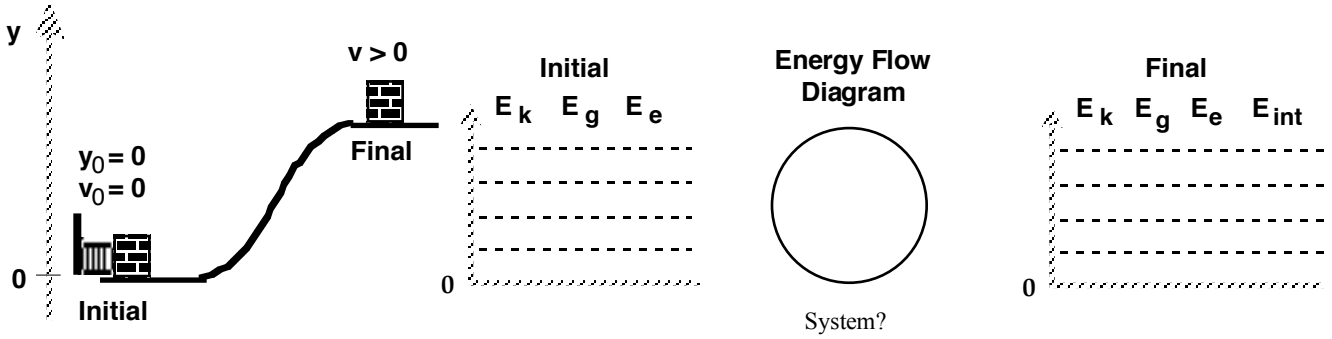
4. A person pushes a car, with the parking brake on, up a hill. Friction? _____



5. A load of bricks rests on a tightly coiled spring, then is launched into the air.
Friction? _____



6. A crate is propelled up a hill by a tightly coiled spring. Friction? _____

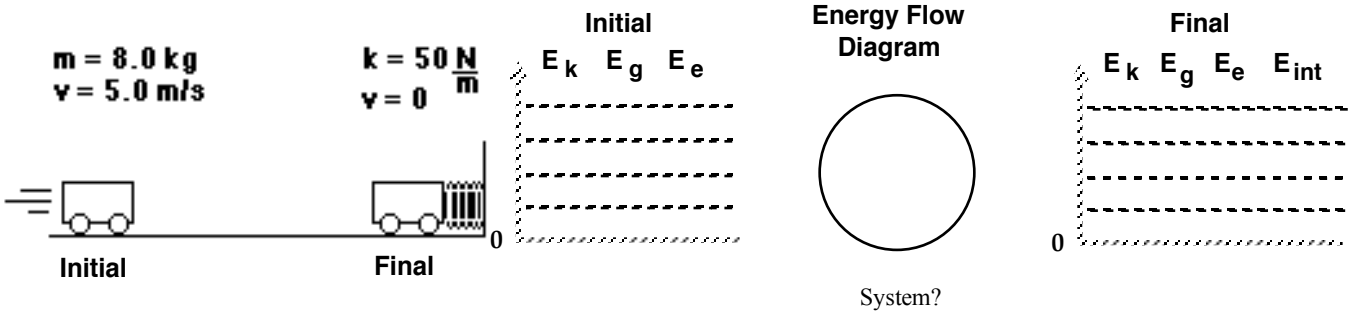


Work energy bar charts (PART 2) Quantitative Bar Graphs and Problems

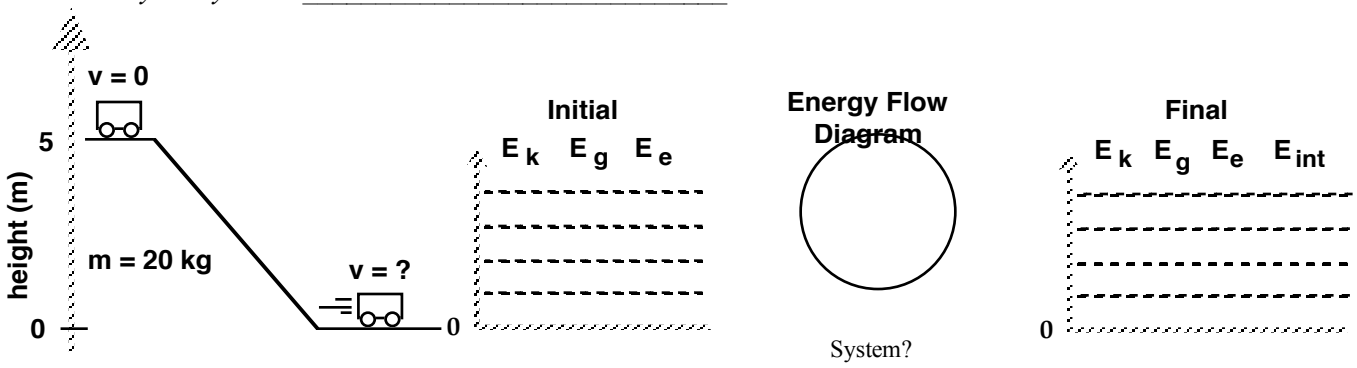
For each situation shown below:

1. In the energy flow diagram show the system you choose to analyze. *Assume the systems to be frictionless, unless stated otherwise.*
2. Complete the energy bar graph QUANTITATIVELY (numerically accurate).
3. In the space below each diagram use conservation of energy equations to solve for the quantity called for in the question.

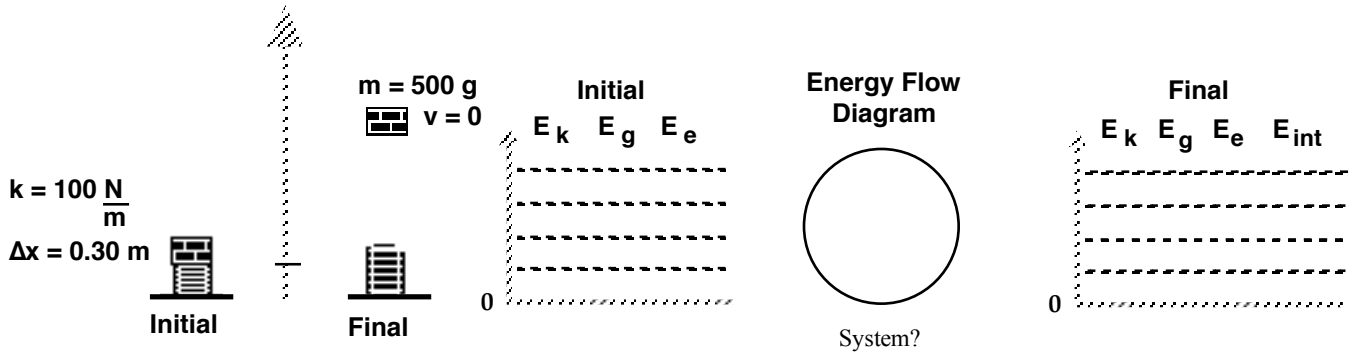
1. A moving cart hits a spring, traveling at 5.0 m/s at the time of contact. At the instant the cart is motionless, by how much is the spring compressed? *Hint: What's your system?* _____



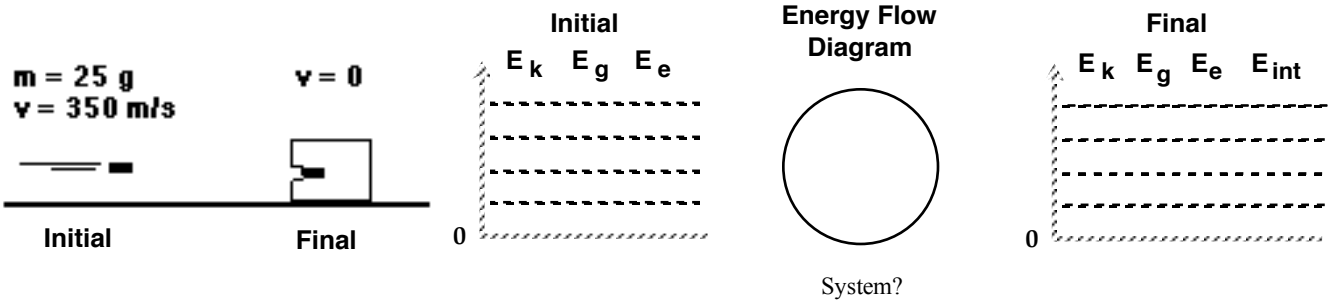
2. Determine final velocity of the cart, assuming that 10% of the energy is dissipated by friction.
What's your system? _____



3. A block is placed on a spring, compressing it 0.30m. What height does the block reach when launched by the spring? *What's your system?* _____



4. The bullet strikes a block of wood which exerts, on average, a force of 50,000N opposing the motion of the bullet. How far does the bullet penetrate? *What's your system?* _____



System?

5. A 200. kg box is pulled at constant speed by the little engine pictured below. The box moves a distance of 2.5 m across a horizontal surface.

a) Draw a force diagram of all relevant forces acting on the box.

b) Construct a qualitative energy bar graph/flow diagram for this situation. Be sure to specify your system.

c) How much energy is transferred by the engine?

d) What type of motion would occur if the engine pulled with a force of 500 N?
Modify your force diagram and apply Newton's 2nd Law.

6. A 2.00 kg ball is attached to a ceiling by a 1.00 m long string. The height of the room is 3.00 m. What is the gravitational potential energy of the ball relative to:

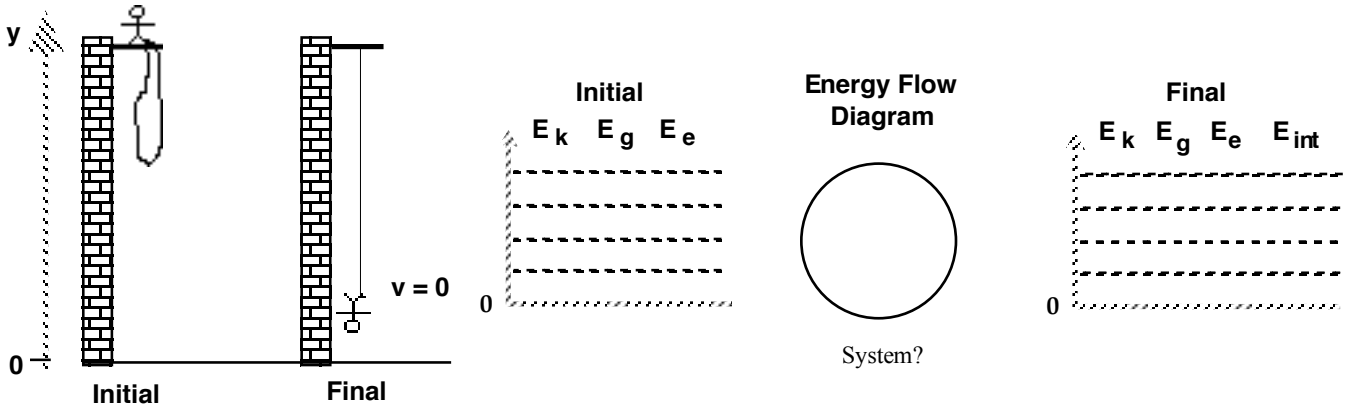
a) the ceiling

b) the floor

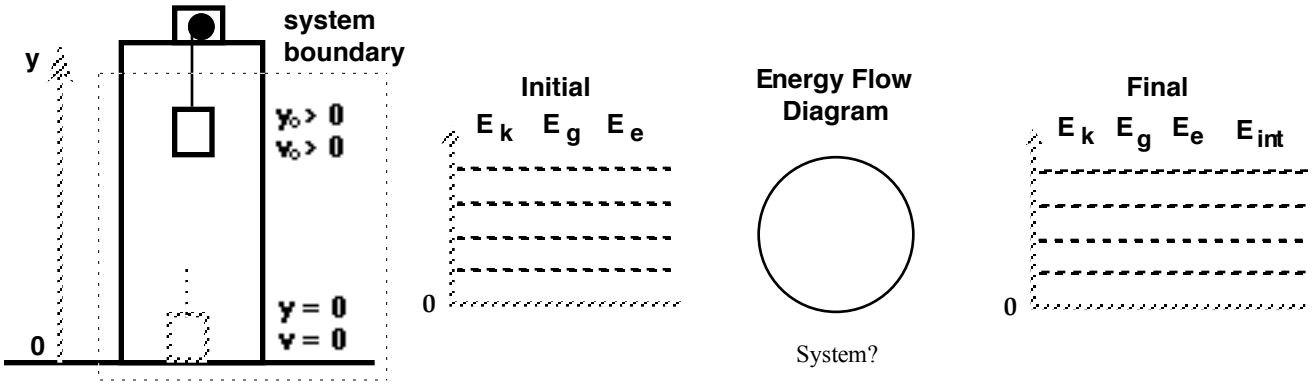
c) a point at the same elevation as the ball

Examples to be done in class by Forrest

Ex1. A bungee jumper falls off the platform and reaches the limit of stretch of the cord.
Frictionless? _____



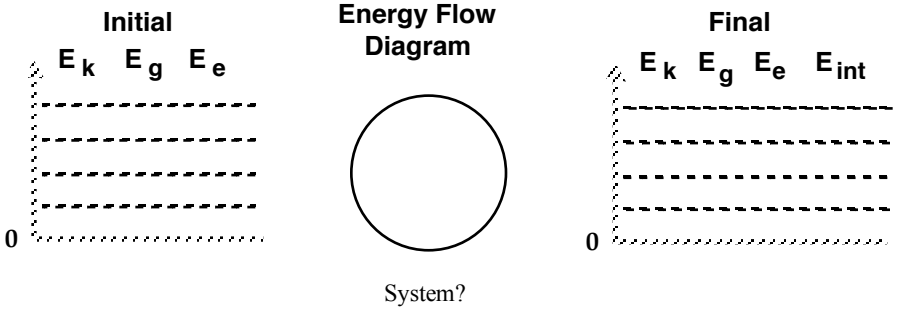
Ex2. A 2,000 kg elevator at a height of 40 meters, initially moving downward at 4.0 m/s, is brought to rest on the ground floor by a braking system. Find the amount of energy transferred to the braking system.
Frictionless? _____



Mathematical answer:

Ex3. Create your own situation and construct corresponding energy bar graphs and system schema.

Frictionless? = _____



System?

Energy demonstrations done by Forrest → Introduction

1) Bag of peanuts and ball dropped on it

2) Bag of peanuts and ball rolled into it

3) Bag of peanuts and elastic band snapped to it

How could I cause more peanuts to come out in each of the 3 demonstrations?

Note that fewer peanuts come out if ball is dropped from same height to table top vs. the floor. Why?

Other demonstrations (to introduce bar charts) → KEY IDEA: What's your system? (What's inside and what's outside? WORK is done when an external force acts on the system!

Toy popping off of table

Toy bug wound up and going across table (to show mechanical energy does not appear to be conserved)

DEMO: Dropping bowling ball on an LCD sheet

SPRING ENERGY LABS: Worked well in 2018 and didn't need computers! Stress area under graphs, have students figure out ranking of spring strengths on their own. Then also show v vs. m*v graph and m*g vs. height graph. Also, make sure to talk about spring in series and springs in parallel.