Name____________________________________
Date __________ Pd___

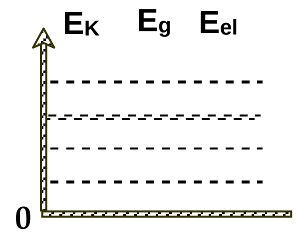
UNIT IV: Worksheet 3

For each situation shown below:

1. Assume the systems to be frictionless unless stated otherwise.
2. Complete the energy bar graph.
3. In the space below each diagram use conservation of energy equations to solve for the quantity called for in the question.

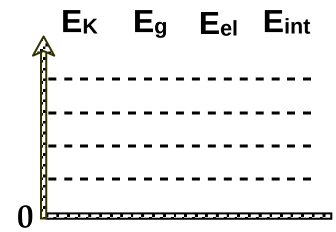
1. A moving cart hits a spring, traveling at 5.0 m/s at the time of contact. At the instant the cart is motionless, calculate how much is the spring compressed.

Initial

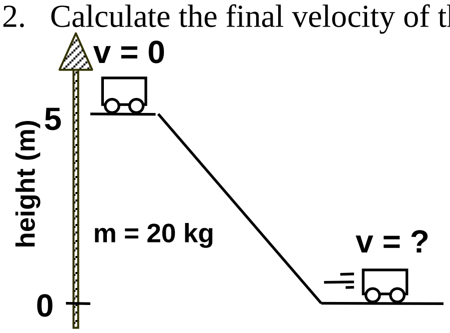


Energy Flow Diagram

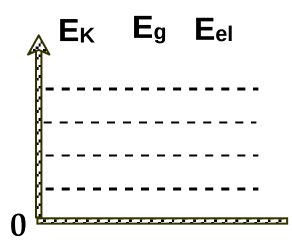
Final



2. Calculate the final velocity of the cart, assuming that 10% of the energy is dissipated by friction.

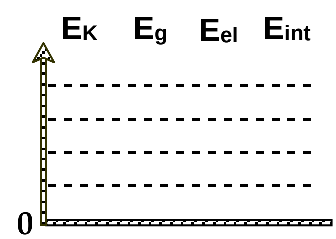


Initial

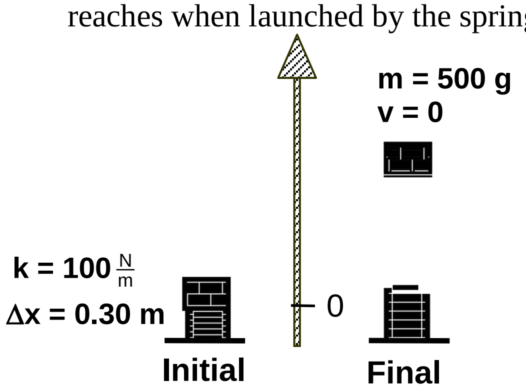


Energy Flow Diagram

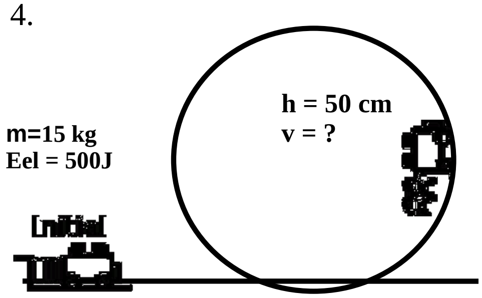
Final

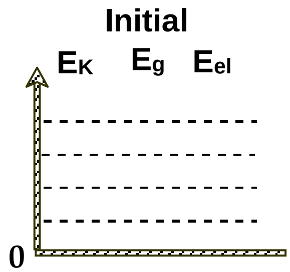


3. A block is placed on a spring, compressing it 0.30m. Calculate the maximum height the block reaches when launched by the spring.

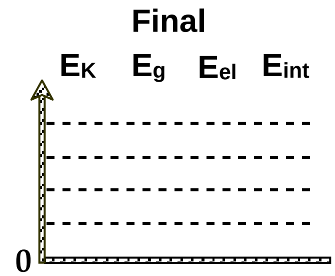


4.





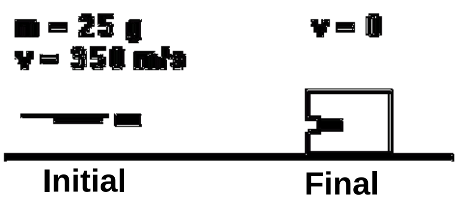
Energy Flow Diagram

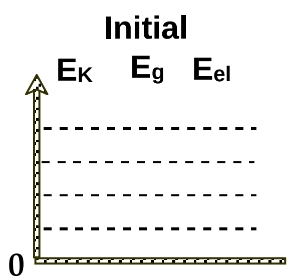


a. Calculate the velocity of the cart when it is half way up the loop.

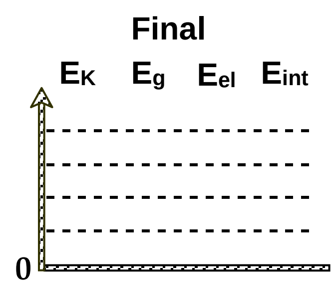
b. Calculate if the cart will make it through the loop.

5. The bullet strikes a block of wood which exerts, on average, a force of 50,000N opposing the motion of the bullet. Calculate how far does the bullet penetrates into the wood.

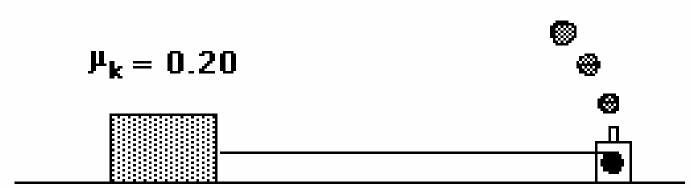




Energy Flow Diagram



6. 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.

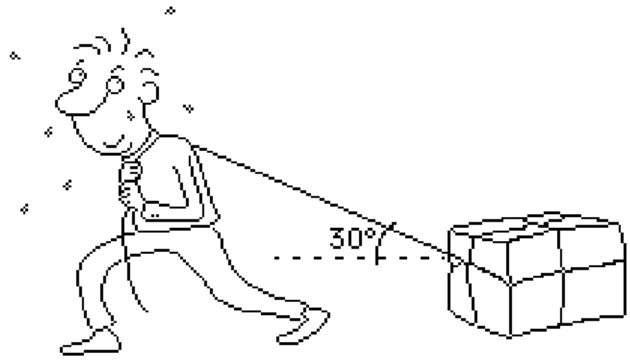
b. Sketch a qualitative energy bar graph/flow diagram for this situation. Be sure to specify your system.

c. Calculate how much energy is transferred by the engine.

d. Describe the motion of the box if the engine pulled with a force of 500 N. Justify with a force diagram and calculations.

7. Calculate how far could the box in problem 6 be pulled *at constant velocity* with the expenditure of 8,000 J of energy.

8. A person pulls a 50 kg box pictured below with a force of 100 N. The coefficient of kinetic friction is 0.15.



a. Sketch a force diagram for the box.

b. Determine how much of the force acts in the direction of motion. Calculate how much energy is transferred (via working) by the person who pulls the box a distance of 10 m.

c. Is the box moving at constant speed? Explain how you know. Explain what this tells you about the kinetic energy E_k of the system.

d. Calculate how much energy is stored as internal energy due to friction in the pulling process. Explain what eventually happens to this energy.

e. Use the energy bar chart to show that energy is conserved in the system, accounting for all the energy transferred in the process.