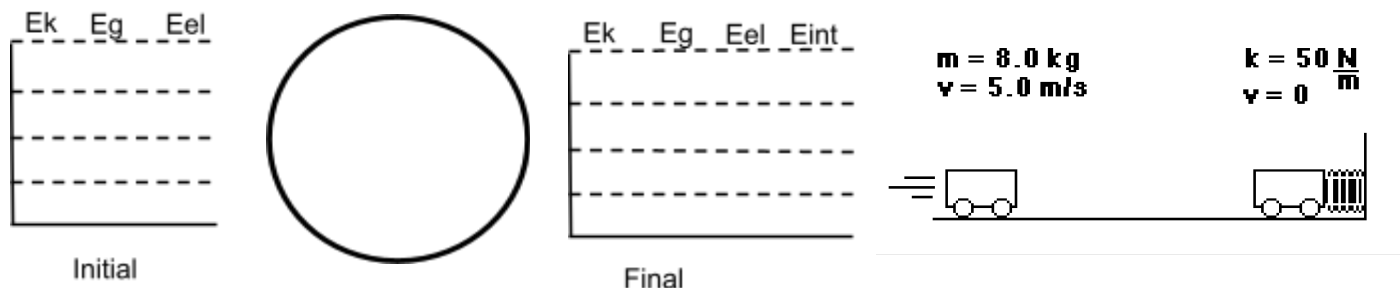


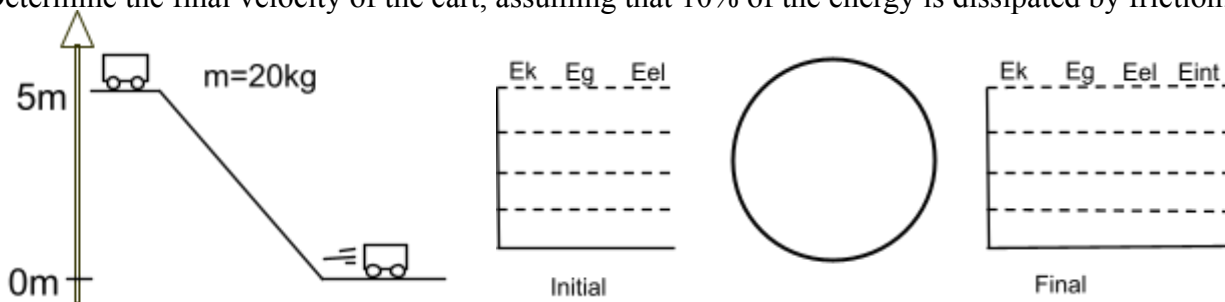
## Quantitative Energy Problems

For each situation shown below:

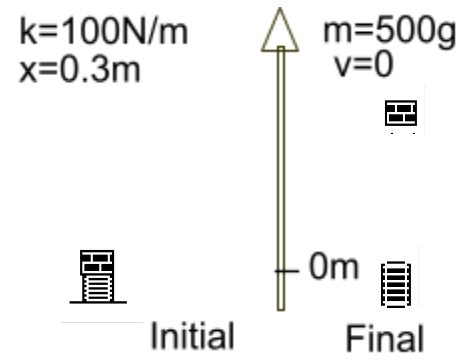
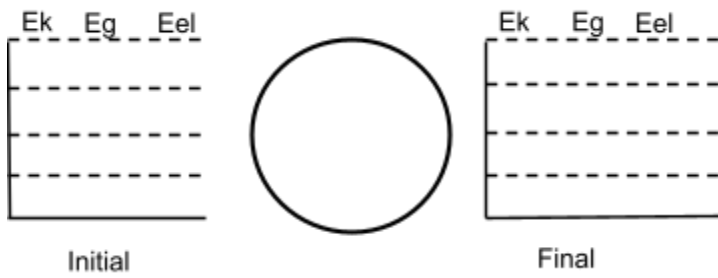
1. Assume the systems to be frictionless unless stated otherwise.
  2. Complete the energy bar graph.
  3. In the circle, show whether all the blocks of energy are remaining in the system (the circle) or if any energy is coming in or going out of the system between the initial and final stages, using arrows into or out of the circle
  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 rolls across a frictionless surface and 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?



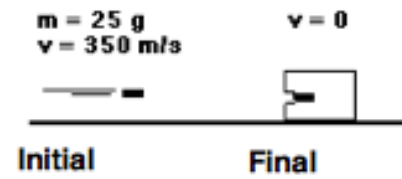
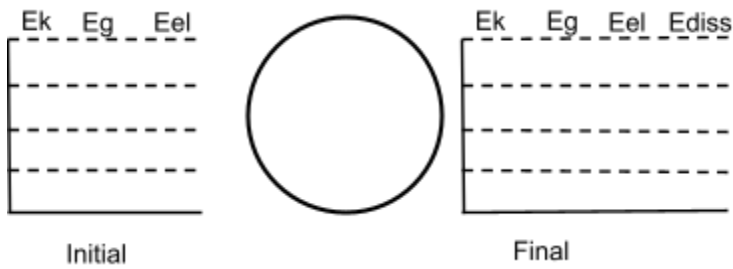
2. Determine the final velocity of the cart, assuming that 10% of the energy is dissipated by friction.



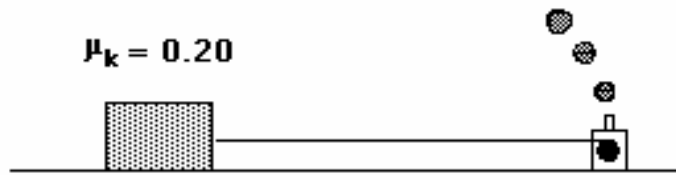
3. A block is pressed into a spring, compressing it 0.30m. What height does the block reach when launched by the spring, ignoring air resistance?



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? (Hint: use the work equation.)



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. The “system” is constituted by just the box and the ground, but not the engine.



- Draw a force diagram of all forces acting on the box.
- How does the dissipated energy change over time? What happens to the total energy of the “system”?
- Construct three qualitative energy bar graphs for this situation, at three different moments, as the box moves along the ground.
- How much energy is transferred into the system by the engine? (Hint: use the work equation.)
- How far could the box in problem 5 be pulled *at constant velocity* with the expenditure of 8,000 J of energy?
- What type of motion (constant velocity or constantly accelerating) would occur if the engine pulled with a force of 500 N? Redraw your force diagram here for this situation.