

Energy Storage and Transfer Model Worksheet 4: Quantitative Energy Calculations & Energy Conservation

Be careful with units and unit conversions!

1. How much kinetic energy does a 2000 kg SUV traveling 70 mph have? (1 mile = 1600 meters)

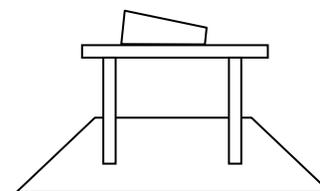
2. How much energy does a 180 Calorie, half-pint carton of chocolate milk store?
(One food Calorie = 4186 Joules)

3. Consider your 3 kg physics binder resting on the table in the classroom. Determine the gravitational energy of the earth-book system if the zero reference level is chosen to be:

a) the table

b) the floor, 0.68 meters below the book

c) the ceiling, 2.5 meters above the book

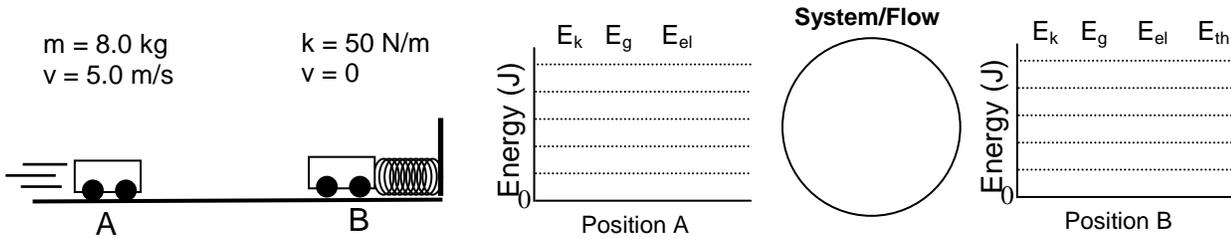


4. A bungee cord stretches 25 meters and has a spring constant of 140 N/m. How much energy is stored in the bungee?

5. How fast does a 50 gram arrow need to travel to have 40 joules of kinetic energy?

6. How much energy is stored when a railroad car spring is compressed 10.0 cm?
(The spring requires about 10,000 N to be compressed 3.0 cm.)

7. A cart moving at 5.0 m/s collides with a spring. At the instant the cart is motionless, what is the largest amount that the spring could be compressed? Assume no friction.
- a. Define the system with the energy flow diagram, then complete the energy bar graphs qualitatively.

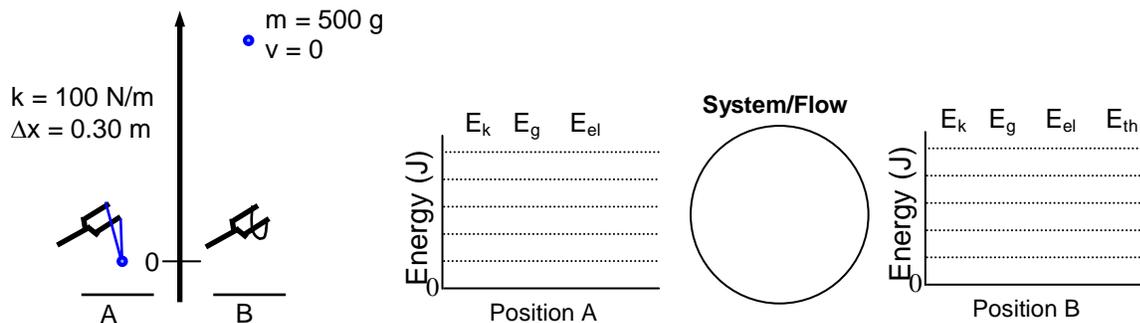


- b. Quantitative Energy Conservation Equation:

- c. Determine the maximum compression of the spring.

8. A rock is shot straight up into the air with a slingshot that had been stretched 0.30 m. Assume no air resistance.

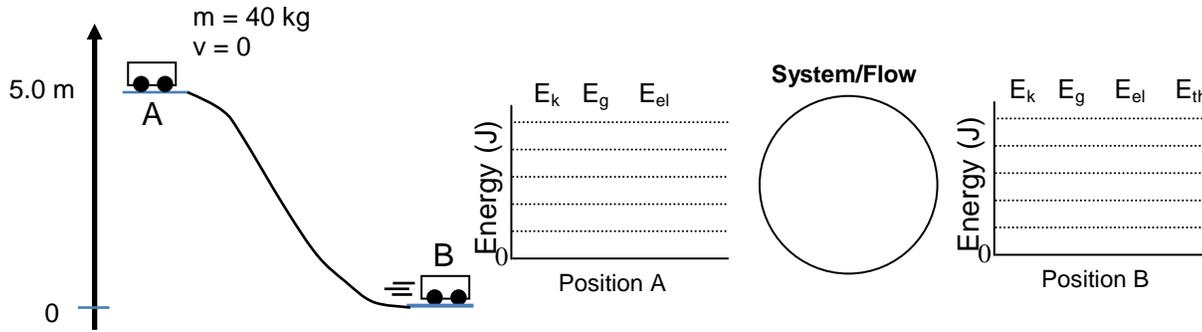
- a. Qualitatively complete the energy flow diagram and the energy bar graphs.



- b. Quantitative Energy Conservation Equation:

- c. Determine the greatest height the rock could reach.

9. Determine final velocity of the rollercoaster, assuming a 10% loss to friction.



10. The moon could be an ideal spaceport for exploring the solar system. A moon launching system could consist of a magnetic rail gun that shoots items into moon orbit. How much energy would be needed from the rail gun to get a 10,000 kg capsule into an orbit 100 km above the moon surface? The moon's gravitational field strength is 1.6 N/kg and the orbital velocity for this altitude is 1700 m/s. Hint: Put the rail gun outside of the system.

