Name_____

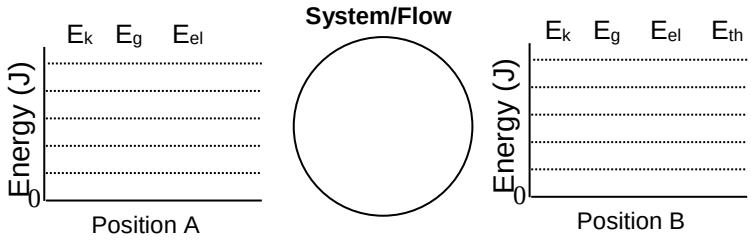
Date_____ **Pd**____

Energy Storage and Transfer Model Worksheet 5:

Energy Transfer and Power

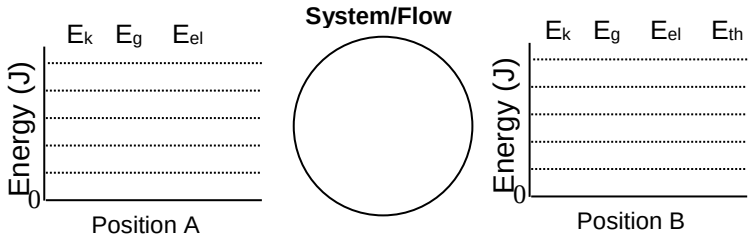
1. A student eats a tasty school lunch containing 700. Calories. (One food Calorie = 4186 joules.) Due to basal metabolism, the student radiates about 100. joules per second into the environment.
   a. How long would the student have to sit on a couch to radiate away all of the energy from lunch?

   b. If all of the energy from the student's lunch did something useful, like lifting pianos weighing 5000. newtons to the top of a 10-meter tall apartment building, how many pianos could be lifted with the energy from lunch? (Ignore the energy radiated by the student.) Complete the energy bar graph below to aid your solution.



Energy Conservation Equation:

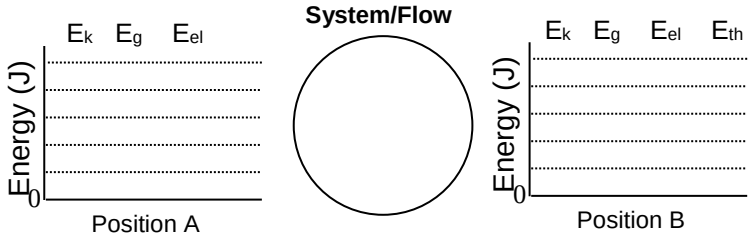
2. Jill pulls on a rope to lift a 12 kg pail out of a well, while the clumsy Jack watches. For a 10.0 meter segment of the lift, she lifts the bucket straight up at constant speed. How much power is required to complete this task in 5.0 seconds? Complete the energy bar graph as part of your solution.



Energy Conservation Equation:

3. Hulky and Bulky are two workers being considered for a job at the UPS loading dock. Hulky boasts that he can lift a 100 kg box 2.0 meters vertically, in 3.0 seconds. Bulky counters with his claim of lifting a 200 kg box 5.0 meters vertically, in 20 seconds. Which worker is more powerful?

4. The trains on the Boss rollercoaster are raised from 10.0 m above ground at the loading platform to a height of 60.0 m at the top of the first hill in 45 s. Assume that the train (including passengers) has a mass of 2500 kg. Ignoring frictional losses, how powerful should the motor be to accomplish this task? Complete the energy bar graphs below.



Energy Conservation Equation:

5. a. An aerodynamic 1,000 kg car takes about 270 newtons of force to maintain a speed of 25 m/s. How much horsepower is required from the engine to maintain this speed? (1 hp = 746 W)

b. How much horsepower is required for the same car to accelerate from 0-25 m/s in 6.0 seconds?

6. Your electric utility company sends you a monthly bill informing you of the number of kilowatt-hours of energy you have used that month.

   a. What is a kilowatt-hour (kilowatt x hour, or kWh)? Determine how many Joules equal one kilowatt-hour.

   b. A frost free, 17 cu. ft. refrigerator-freezer uses energy at a rate of 500. watts when you hear the compressor running. If the fridge runs for 200. hours per month, how many kilowatt-hours of energy does the refrigerator use each month?

   c. In the Phoenix area, electricity rates range from 8.0 cents per kilowatt-hour (winter) to 11.5 cents per kWh (summer). How much does the energy cost each month to run the refrigerator?