Unit 1 - Test

For Problems 1 and 2 draw a system schema and complete the energy flow diagram, bar charts and state diagrams. In the box below the bar charts compare the initial and final energies of the system using equal to (=), greater than (>), or less than (<) (for example, Ei >Ef) and indicate whether the energy transfer mechanism is *working*, *heating* or *radiating*.

1. A spring-loaded dart gun fired a dart straight up which then sticks to the ceiling. The initial condition is when the dart is still in the gun waiting to be fired. The final condition is the dart at rest stuck on the ceiling. The system is the dart gun (with the spring), the dart, the ceiling and the earth’s gravitational field.
   1. Sketch a System Schema:
   2. Complete an Energy Pie Chart analysis, showing how the energy storage of the system changes over time. Include at least 3 energy pies along with their corresponding state diagrams:
   3. Complete the Energy Bar Chart analysis:

Position A

Position B

Ek

Eg

Ee

Ech

Eint

Ek

Eg

Ee

Ech

Eint

Energy Flow Diagram

1. Your friends push your broken down car out of the parking lot, which is flat but very rough, before it gets towed. In the initial state your friends are just about to begin pushing the stationary car. In the final state, the car’s velocity is greater than zero but your friends are collapsing left and right – only two remain standing. The system is your friends.
2. Sketch a System Schema:
3. Complete an Energy Pie Chart analysis, showing how the energy storage of the system changes over time. Include at least 3 energy pies and their corresponding state diagrams:
4. Complete the Energy Bar Chart analysis:

Initial State

Final State

Ek

Eg

Ee

Ech

Eint

Ek

Eg

Ee

Ech

Eint

Energy Flow Diagram

1. Consider two identical balls sitting in front of identical compressed springs at the base of the ramps shown. Each spring is initially compressed the same amount. The ramps have two different angles of incline, but both are the exact same height. The springs are released, and each sphere is still moving when it reaches top of its ramp. **Assume that there is no friction or air resistance.**

B

B

Case I

A

A

Case II

If the system is defined as the earth, ground/wall, spring and the ball are in your system, draw two pie charts and corresponding state diagrams for points A and B for both Case I and Case II.

Case I

Case II

How do the sizes of the 4 pies compare? Explain.

1. In lab, a student measures the length of a spring with 0 washers hanging from it, then measures the spring length again with 1 washer, 2 washers, and 3 washers suspended from it.
   1. Sketch a System Schema for this lab experiment:
   2. Complete an energy bar chart and corresponding state diagrams showing the energy storage before and after loading the spring with washers:

Initial State

Final State

Ek

Eg

Ee

Ech

Eint

Ek

Eg

Ee

Ech

Eint

Energy Flow Diagram

* 1. In your analysis above, by what process is energy being transferred?

1. Clearly describe a scenario in a diagram and words where the type of energy stored corresponds to the following series of pie charts. (Please indicate what each shaded area represents). Illustrate your scenario with state diagrams.

Pt A Pt B Pt. C Pt. D Pt. E

1. An imaginative group of students successfully constructed a small windmill powered merry go round, complete with Lego people riding on it.
   1. Starting with the wind and ending with the Lego people, describe at least 2 energy transfers involved in using wind to make the ride work.
   2. Complete an Energy Bar Chart (LOL) analysis that goes with your description, showing how the energy is stored and transferred over time.