Unit 1 - Test

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 and State Diagram analysis, showing how the energy storage of the system changes over time. Include at least 3 energy pies with corresponding State Diagrams:
   3. Write a verbal description of how the system’s energy storage is changing over time:
2. 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.
   1. Sketch a System Schema:
   2. Complete an Energy Pie Chart and state diagram analysis, showing how the energy storage of the system changes over time. Include at least 3 energy pies and their corresponding state diagrams:
   3. Write a verbal description of how the system’s energy storage is changing over time:
3. 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 their 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 you drew above 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. Represent the energy storage for each mass load using energy pie charts and state diagrams:

0 Washers: 1 Washer: 2 Washers: 3 Washers:

* 1. Explain your reasoning for the pies you drew:

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 how energy storage changes in this system.
   2. Complete an Energy Pie Chart analysis that goes with your description, showing how the energy storage of the system changes over time.