Name _____

Class _____

**Activity Overview:**

- *With this action/consequence/reflect .tns file, students will develop an understanding of kinetic energy, gravitational potential energy, and the conservation of mechanical energy.*

**Materials:**

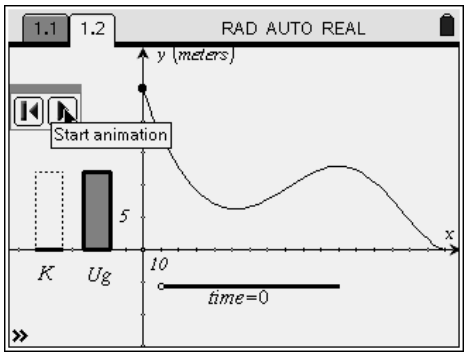
- *TI-Nspire™ CAS handheld*
- *RollerCoasterEnergy_Physics.tns*

**Frictionless Roller Coasters Depict Conservation of Mechanical Energy**

Press the play button to animate the frictionless roller coaster. Observe the bar graph.

1. Describe what is happening to the kinetic energy *K* bar graph and the gravitational potential energy $U_g$ bar graph. What connections can you make?

2. Indentify the important parts of the graph on the right.




   a) Is this a distance versus time graph? _____

   b) What variable is on the horizontal axis? _____

   c) What is the vertical axis? _____

   d) How many meters above ground level is the roller coaster at the start? _____

3. a) Describe the gravitational potential energy when the roller coaster is at its highest point.

   b) Describe the kinetic energy when time = 0 and the roller coaster is at its highest point.

4. a) In the part of the roller coaster shown, how many times does $U_g$, the gravitational potential energy, equal *K*, the kinetic energy?

   b) Why? What is the approximate height when $U_g = K$?

Press pause. Grab the open point for time and manually move the roller coaster.

5. Even though you cannot see what happens to the roller coaster from 9 to 10 seconds, use your observations of the energy bar graphs to explain what happens. (Does the roller coaster go up again or down? Explain how the bar graphs help you determine this. Can you tell about how high the roller coaster goes at the end of 10 seconds?)

6. Gravitational potential energy is measured from some arbitrary ground level. Grab the small open point on the origin and move it up and down. Press play and observe the energy bar graphs.

   a) What happens to the gravitational potential energy bar graph?

   b) Can potential energy ever be negative?

   c) When the ground level is changed, does this affect the kinetic energy? If so, how?

   d) Can the kinetic energy ever be negative?

7. Since kinetic energy is the energy of motion, where is the roller coaster moving the fastest? Explain your answer using the energy bar graphs.

8. The total mechanical energy of a system is the sum of the kinetic and potential energies. Describe the sum total of the two bar graphs for this frictionless roller coaster.

9. What did you learn from this exploration activity?