**Michigan GLCE’s corresponding to this lesson:**

* S.IA.06.11 Analyze information from data tables and graphs to answer scientiﬁc questions.
* P.EN.M.1 Kinetic and Potential Energy- Objects and substances in motion have kinetic energy. Objects and substances may have potential energy due to their relative positions in a system. Gravitational, elastic, and chemical energy are all forms of potential energy.

**Objectives:**

1: Explain the difference between kinetic and potential energy.

2: Explain how to tell when an object has potential energy and when it has kinetic energy.

3: Explain how gravity affects the total energy of a system.

**Context/time frame:** This lesson is meant to be an hour long, independent activity on the computer. I would recommend, in order to make this a complete UDL lesson, that the questions be available with a text to speech program. This is meant as an introductory lesson for kinetic and potential energy. With this simulation, it is hopeful that the students experience how different types of energy work in various systems, and that they will build patterns from their experiences.

**Procedure:**

Instructions----Open up the **Energy Skate Park Simulation**. In the column on the right hand side of the page, click the potential energy reference box. This will show you where the potential energy of the system is equal to zero. Under energy graphs, select the show pie chart box. Make sure that the with thermal box is selected too. You can set the speed at which your skater moves by moving the arrow at the bottom of the page (all the way *left* is the *fastest* speed, all the way *right* is the slowest speed, **start out with something in the middle**). Any time you want to **pause** your skater, or stop him from moving, click the button next to the speed that looks like a circle with two lines in the middle.

Now you are ready to begin!

1. Look at the box in the right hand corner at the top. There are three colors. What does each color stand for?

**Green: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Red:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Blue:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. Now that you know what each color stands for, look at the pie chart that is following the skater. Notice how the colors from above appear in the chart.
   1. When do you see the most blue?
   2. When do you see the most green?
   3. Do you see any red? Remember what the color stands for. Write what red stands for here.
2. At the bottom of the column on the right, there is a button that says track friction. Click on the button to open it up. Move the arrow from the left **one notch** over to the right (----->). Watch the skater for a minute or two.
   1. Do you notice any new colors on the pie chart? What color?
   2. What happens to the skater? Specifically, how does his **motion** change.
3. Set the coefficient of friction back to none (do this by sliding the arrow all the way to the left <-----). Under energy graphs, click the energy vs position button.
   1. Right now all of the boxes in the bottom left hand corner are checked. Uncheck **all of the boxes except kinetic energy.** The only color that should be on the graph right now should be green. Sketch a picture of the graph.
      1. Where is the skater when the kinetic energy is the **highest**? Circle on your graph the **highest** point of kinetic energy.
      2. Where is the skater when the kinetic energy is the **lowest**? Circle on your graph the **lowest** point of kinetic energy. *Hint: There may be more than one spot.*
   2. **Uncheck kinetic energy and check potential energy**. Now the graph should only show a blue line on it. Sketch a picture of the graph.
      1. Where is the skater when the potential energy is the **highest**? Circle on your graph the **highest** point of potential energy. *Hint: There may be more than one spot.*
      2. Where is the skater when the potential energy is the **lowest**? Circle on your graph the **lowest** point of potential energy.
   3. **Uncheck potential energy and check total**. Now the graph should only show a gold line on it. This represents the total energy of the system. Sketch a picture of the graph.
      1. Does the gold line change? Brainstorm why
   4. **Uncheck the total box**. Check **the kinetic and potential** boxes to see them plotted together. Your graph should show a green and a blue line now. Sketch a picture of your graph. Where are potential and kinetic energy *the same*? Circle the points on your sketch where potential and kinetic energy are *the same*.
4. Exit out of the graph. Select the box at the top that says choose skater. Select the dog, the bug, or the ball. Then click on the energy vs position graph again. How did the graph change? Draw a sketch of the graph when the **total, kinetic, and potential boxes are checked**. Did the size of the pie chart next to the skater change (did it get bigger/smaller)?
5. Go back to the boy skater by selecting the choose skater box again. Look at the gravity box on the right. Write down what number you see. ***Gravity is a type of pull force***, this is how much of a pull we feel from gravity on Earth.
   1. Gravity on Earth:
   2. Now change the **location** of the skater by clicking on the moon. What number do you see now? How does the motion of the skater change?
   3. Change the location to Jupiter. What number do you see? How does the motion of the skater change?
   4. Change the location to Space. What number do you see? How does the motion of the skater change?
6. Have some fun!! Go to the top of the page and click on Tracks from the tool bar. This will change the kind of track the skater goes on. Change the tracks, see how the skater does on the track in different locations, look at the graphs and see how those change too. You can even add your own track by clicking and dragging the track in the upper left hand corner. Push and pull at the circle to move the track around.
   1. Pick out one track, draw a picture of it. Then sketch a picture of the graph that goes along with it. **Make sure you label what lines are kinetic energy and what lines are potential energy**.