In this simulator lab, you will be using what you know about KE and PE and how they convert from one to another. Go to Ms. Braniff’s website at www.braniff.weebly.com. Under the Science tab at the top, select science websites and Energy Skate Park tab. If unable to find it, then type in the address below in the internet’s address window: http://phet.colorado.edu/en/simulation/energy-skate-park. You should now be on the screen pictured below. Click on “Download” and the simulation will begin.

**Part 1 – Total Energy**

Select show path and allow the skate to make 2 passes on the track, then hit pause. Click on a bubble that is near the top of the track, middle, and bottom. Record the amounts of energy shown.

1. What do you notice?
Part 2 – Observations & Explanations

BEFORE STARTING THE SIMULATION, select reset, pause the skater and drag the bottom part of the track so that it touches the ground. Click on the “Bar Graph” button allowing a bar graph to appear to help with observing results. Place the skater at the top of the track and press play. Watch the bar graph change.

Color in the bar graphs below at the indicated spots on the track. Label on the track where the skater has MAX KE, MAX PE, MIN PE, and MIN KE

2. Compare and contrast what happens to potential energy and kinetic energy as the skater moves up and down the track. What statement can you make about the relationship between potential and kinetic energy?

________________________________________________________________________________________

3. Why does the amount of thermal energy stay at zero and never changes?

_______________________________________________________________________________________

4. Why does the skater keep going and never stops?

_______________________________________________________________________________________

5. What do we need to add to the track?

_______________________________________________________________________________________
Stop your skater and press reset. Drag the track to the bottom again. Select track friction, move the cursor so friction coefficient is in the middle. Select bar graph as well.

*Color in the bar graphs below at the indicated spots on the track.*

6. Explain what happens to potential energy and kinetic energy as the skater moves up and down the track. Is the PE and KE lost?

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________________________________________________________________________________________

7. Did the **TOTAL ENERGY** change? Explain why or why not.

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________________________________________________________________________________________

8. Why did the skater stop? ___________________________________________________________________
________________________________________________________________________________________
Stop your skater and press reset again. Open a bar graph to view the energy transformations. Edit the skater at the bottom. Change the mass while the skater is in motion. Change the mass to 25 kg, and 150 kg. Observe the bar graph and then record on the blank bar graphs to the right.

9. How does **mass of the skater** affect the energy of the skater? ______________________________
   _______________________________________________________________________________________

Stop your skater, reset all. Pull the track down to the bottom, and extend both ends up to make the track larger. Open a bar graph again. Without changing the mass, move the skater up and down the track using your mouse. Observe what happens to the energy in the bar graph. DO NOT PRESS PLAY! MOVE WITH MOUSE!

10. How does **height of the skater** affect the energy of the skater? ______________________________
11. Why did only the Potential energy of the skater change when you moved the skater? ________________
_________________________________________________________________________________________

12. What can you predict would happen if you pressed play? ________________________________
_________________________________________________________________________________________

13. Try it! What happened? _____________________________________________________________
_________________________________________________________________________________________

Press pause, and move your skater to the **TOP of ONE SIDE** of the track using your mouse, set **friction to the middle**, then press play. Watch how the skater descends and moved back up the other side. Notice how far up the other side he skater travelled in relation to his starting point.

14. How far up the other side did the skater travel on his first descent? Pick one option below and explain your choice.
   a. Travelled up the other side LESS than the top.
   b. Travelled up the other side THE SAME as the start.
   c. Travelled up the other side MORE than the top and went over the edge.

   Explanation:___________________________________________________________________________
_________________________________________________________________________________________

15. After his first pass going down and back up, what happened on his second pass? And third? Explain what is happening and why. Use energy in your explanation.
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_________________________________________________________________________________________
_________________________________________________________________________________________
16. How far up the other side did the skater travel on his first descent? Pick one option below and explain your choice.
   a. Travelled up the other side LESS than the top.
   b. Travelled up the other side THE SAME as the start.
   c. Travelled up the other side MORE than the top and went over the edge.

Explanation: ____________________________________________

_________________________________________________________________________________________

17. How might this relate to roller coasters and the height of the first and second hill? _________________

_________________________________________________________________________________________

_________________________________________________________________________________________

**Sketch a picture of your explanation:**
Reset your skater. Under the “tracks” pull down menu, select “Double Well (Roller Coaster)”. Pull the first well to the ground, and set the friction to the middle of the slider.

Select “Double Well (Roller Coaster)” under this Tracks Pull down at the top of the screen.

Pull the first well to touch the ground.

Set friction to the middle of the slider.

18. When you press play from this position, the skater **DOES NOT** make it over the first hill. Explain why using the forms of energy in your explanation. **Use the bar graph if needed!!**

_________________________________________________________________________________________
_________________________________________________________________________________________
_________________________________________________________________________________________

Create a **DOUBLE WELL (ROLLER COASTER)** track that does work! Sketch in your track in the picture below.
Reset your skater. Under the “tracks” pull down menu, select “LOOP”. Set the friction to the middle of the slider.

Select “LOOP” under this Tracks Pull down at the top of the screen.

Start the skater at the top of the loop.

Set friction to the middle of the slider.

19. When you press play from this position, the skater **DOES NOT** make it around the loop. Explain why using the forms of energy in your explanation. **Use the bar graph if needed!!**

Can you imagine if you were really on a coaster that did this???? Ouch!!!!!

Create a **LOOP TRACK** that does work! Sketch in your track in the picture below.
Reset your skater. Under the “tracks” menu at the top of the page, add a “DOUBLE WELL” to the track. You will have to zoom out a couple of times, and pull the bottoms to the ground and extend both ends up to make a really large “W”. Open a bar graph and place your skater at the top of the LEFT SIDE. Use the play button and watch the bar graph to label the items below. You may have to press the “Step” button to slow the skater down.

20. Where is GPE the greatest?______________
21. Where is KE the greatest?_________
22. Where is Thermal energy created the most?_______
23. What happens to the skater in the end and why?

Part 3: Explorations

Now use the controls on the side to make some modifications. You can change the skater, change the skater’s mass, add more or less friction and even change the location of the skater! As you make each of these modifications, make sure to record the changes and your observations that you notice about the motion of the skater. Use words like gravity, friction, velocity, acceleration, inertia, kinetic and potential energy to describe the motion of the skater as it changes. Some modifications are listed. Try those first, then create some of your own.

<table>
<thead>
<tr>
<th>Modifications Made (Independent Variable)</th>
<th>Observed Changes (Dependent Variable) and explanations.</th>
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<tbody>
<tr>
<td>Reset the skater, and select the location as “Space”.</td>
<td></td>
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</table>
Reset the skater, and select the location as “Jupiter” and then “Moon”.

24. Make a list below of at least 5 things you learned or things that reinforced what you already knew about energy by doing this computer simulation.

1. 
2. 
3. 
4. 
5. 

If time permits, search the web for any other interesting sites that offer either simulations on energy, great energy information, or awesome energy pictures. List the sites below.

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