**Title: Energy**

**Introduction:**

In this activity you will investigate the relationships among kinetic, potential, thermal, and total energy. You will see how these energies are used and change through measuring a simulated skateboarder on a half-pipe. Then, you will see what happens to the energy levels of the skater when friction is an added factor.

1. Click on the link: <http://phet.colorado.edu/en/simulation/energy-skate-park-basics>

This is a screen shot of the website:

This is a screen shot of the simulation: 

1. When you see this screen you will then click on “Run Now!”
2. Switch between this document and the simulation “Energy Skate Park: Basics” to complete this activity.

**Exploration Phase #1:**

1. Make sure the simulation is on the tab Introduction.
2. Check the speed and the pie chart application boxes.
3. Click and drag the skater to the top of the ramp’s left side. Your screen should look like this.



1. Now release.
2. Observe what is happening to the speed and energy levels of the skater in motion.
3. Check the Grid box.
4. Use slow motion and the pause/play button to help you fill in the following table:

|  |  |
| --- | --- |
| The Skater’s Height in Meters | Is there more potential or kinetic energy? |
| 5 |  |
| 4 |  |
| 3 |  |
| 2 |  |
| 1 |  |
| 0 |  |

When the skater is at the \_\_\_\_\_\_\_\_\_\_\_ (top, bottom) of the ramp, potential energy is at its highest level.

Where is the skater at the \_\_\_\_\_\_\_\_\_\_\_(top, bottom) of the ramp, kinetic energy is at its highest level.

What is the relationship between speed and the kinetic/potential energies of the skater?

**Predict:**

Will anything be affected by altering the mass of the skater? (Will it cause him to go faster? Slower? Will it alter his energy levels?)

If \_\_\_\_\_\_\_\_\_\_\_\_\_ then \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Explain:**

1. Reset all.
2. Set skater mass to small.
3. Click on bar graph application. Your screen should look like this:
4. Place skater on top of the ramp.
5. Repeat for a medium mass and large mass skater.

The speed of the skater \_\_\_\_\_\_\_\_(increases, decreases, remains the same) when the skater’s mass increased.

The energy level of the skater \_\_\_\_\_\_\_\_\_ (increases, decreases, remains the same) when the skater’s mass increased.

What can you conclude about the relationship between the mass of the skater and the energy level?

**Exploration Phase # 2:**

1. Click the “Friction” tab on the top of the simulation.
2. Click “On” below Friction to add the element of friction to the ramp, make sure the friction level is set to “none”
3. Check off the bar graph box
4. Check the Grid Box. Your screen should look like this:



1. Click and drag the skater to the top of the ramp, now release.

Is thermal energy present?

**Prediction:**

What will happen to the skater when friction is present? How will his energy levels be affected?

If \_\_\_\_\_\_\_\_\_\_\_ then \_\_\_\_\_\_\_\_\_\_\_.

**Explain:**

Fill in the table below. Every time you alter the friction level, reset all and check off the bar graph. (The first row is done for you)

|  |  |  |  |
| --- | --- | --- | --- |
| **Friction Level** | **Number of times Skater passes middle of the ramp until he stops** | **Highest point of Skater first time he goes to the right side of ramp? *(Use red dot in middle of skateboard for your measurement)*** | **What is happening to the energy levels?** |
| None | Infinite | approximately 5.5 meters | **Total:** remains the same**KE:** increasing and decreasing oppositely than potential**PE:** increasing and decreasing oppositely than kinetic**ThE:** not present |
| Quarter way toward Lots |  |  | **Total:****KE:****PE:****ThE:** |
| Half Way toward Lots |  |  | **Total:****KE:****PE:****ThE:** |
| Three Quarters toward Lots  |  |  | **Total:****KE:****PE:****ThE:** |
| Lots |  |  | **Total:****KE:****PE:****ThE:** |

**Questions**

What is the relationship between friction and thermal energy?

Compare and Contrast Potential Energy with Thermal Energy:

If you were sitting on the couch and someone said, “You have no energy.” Would you agree or disagree with this statement? What might you say in response?

If you designed a rollercoaster, how might you design it? Would you have friction?

**Application**

Select the Track playground tab.

Design a rollercoaster to make a loop de loop.

The skater must be able to go completely around the

loop de loop.

Explain your design choice; you must use the following vocabulary:

Total Energy, Kinetic Energy, Potential Energy, Thermal Energy, Friction