Scientist: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Per: \_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Skate Park Physics**

Pre-Lab Reading Answer all questions in your notebook

**Energy Skate Park Simulation Kinetic Energy (KE)** is the energy of *motion.* Any object that is moving has kinetic energy.

**Potential Energy (PE)** is the energy an object has due to its *position* or condition. In this simulation, we will be focusing on a specific type of potential energy: **gravitational potential energy (GPE).**

**Mechanical Energy** is the total energy an object has: the sum of kinetic energy and potential energy.

The **law of conservation of energy** states that energy cannot be *created* or *destroyed*, but can be *transferred* from one form to another. This means that if an object has a certain amount of energy, it will keep that energy unless the energy is transferred to another object.

**Directions:**

Go to the Skate Park Basics

Turn on Pie Chart and Bar Graph

1. Explore the simulation, trying the various track designs. Observe how the skater's potential and kinetic energy change as he moves. Record your initial observations:

2. Switch to the U-shaped track. Drag the skater to the top of one side, then let him go. Observe the energy bar graph as he goes back and forth. You may also explore the W-shaped track.

a.) When does the skater have the *highest* potential energy?

b.) When does the skater have the *lowest* potential energy?

c.) When does the skater have the *highest* kinetic energy?

d.) When does the skater have the *lowest* kinetic energy?

3. While he is moving, change the mass using the slider on the right side. Observe the energy graph. a.) If mass increases, what happens to *kinetic* energy?

b.) If mass increases, what happens to *potential* energy?

c.) If mass increases, what happens to *mechanical* (total) energy?

4.) Complete the table based on what you observed (circle one answer for each KE and PE box):

|  |  |  |
| --- | --- | --- |
| **Position (height) of skater on track**  | **Kinetic Energy**  | **Potential Energy**  |
| Top  | high medium low  | high medium low  |
| Middle  | high medium low  | high medium low  |
| Bottom  | high medium low  | high medium low  |

5.) Circle the correct answer:

a.) As the skater goes **up** the hill, his **kinetic** energy: *increases / decreases / stays constant*

b.) As he goes **up** the hill, his **potential** energy: *increases / decreases / stays constant*

c.) As he goes **up** the hill, his **mechanical** energy: *increases / decreases / stays constant*

d.) As he goes **down** the hill, his **kinetic** energy: *increases / decreases / stays constant*

e.) As he goes **down** the hill, his **potential** energy: *increases / decreases / stays constant*

f.) As he goes **down** the hill, his **mechanical** energy: *increases / decreases / stays constant*

6.) Switch to the “Friction” tab at the top of the page. Turn friction **on** using the button on the right side of the page. What is different about the skater's motion *with* friction, compared to *without* it?

7.) **Compare** how a *small* amount of friction affects the motion of the skater to how a *large* amount of friction affects his motion.

8.) Switch to the “track playground” tab at the top of the page. Make sure that friction is **off** on the right side of the page.

a.) Design your own track (something **unique,** not just a U or W), and draw it below:

b.) Label the points on your track where *kinetic* energy was **high** with the letters **“KH”**c.) Label the points on your track where *kinetic* energy was **low** with the letters **“KL”**d.) Label the points on your track where *potential* energy was **high** with the letters **“PH”**e.) Label the points on your track where *potential* energy was **low** with the letters **“PL”**

f.) How could you change your track to **maximize** the kinetic energy of the skater? **Explain.**

Post-Lab Questions:

1. Find a way to increase the “total energy”. Draw diagrams of the bar graph and pie chart before and after you increase the “total energy”.

2. What did you do to increase the total energy?

3. Based on what you read in the pre-lab reading, why does the mechanical (total) energy of the skater not change over time (unless friction is turned on)?

4. Re-read the law of conservation of energy in the pre-lab section. What do you think happens to the skater's energy when friction is involved?

5. Based on your observations of total energy at different times and positions, write an equation to show the relationship between the total energy, potential energy and kinetic energy.