Name: ____ Period: _____

Energy Skate Park Simulation

<u>Pre-Lab Reading:</u>

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 <u>total</u> 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.

<u>Procedure (answer all questions that follow):</u>

1.) Check the “Grid” and “Bar Graph” boxes in the top right corner. **Keep them open at all times.**

2.) Explore the simulation, trying the various track designs in the top left corner. Observe how the skater's potential and kinetic energy change as he moves. Record your initial observations below:

3.) 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* <u>potential</u> energy?

b.) When does the skater have the *lowest* <u>potential</u> energy?

c.) When does the skater have the *highest* <u>kinetic</u> energy?

d.) When does the skater have the *lowest* <u>kinetic</u> energy?

4.) 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?

5.) 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

6.) 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*

7.) What is the relationship between kinetic and potential energy?

8.) What **evidence** from the simulation supports your claim from question 7?

9.) Check the “speed” box in the upper right corner. What is the relationship between speed and KE?

10.) What happens to the total (mechanical) energy of the skater as time passes?

11.) 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?

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

13.) 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.**

g.) How could you change your track so that the skater's kinetic energy stayed **low? Explain.**

<u>Post-Lab Questions:</u>

1.) Describe a situation in a basketball game when a player has a lot of **kinetic** energy. **Explain.**

2.) Describe a situation in a basketball game when a player has a lot of **potential** energy. **Explain.**

3.) Based on what you observed in the simulation, what factors affect **kinetic** energy?

4.) Based on what you observed in the simulation, what factors affect **potential** energy?

5.) 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)?

6.) 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? (Look back to questions 11 and 12.)

7.) An archer stands on the ground and fires an arrow at a target. A second archer stands at the top of a building and holds an arrow in his hand. Which arrow has more *potential* energy? **Explain.**

8.) In the same scenario described in question 7, which arrow has more *kinetic* energy? **Explain.**