

Potential and Kinetic Energy of a Roller Coaster

Introduction:

During the course of this lab, you will design, construct, and test a simulated "ball rollercoaster" with three hills. The ball in each design must start from the top of the first hill, roll up and down the other two hills, and end on the ground.

Consider the following questions **before** designing your roller coaster:

- Will the ball make it to the end of the track if all of the hills are the same height? Why or why not?
- Will the ball make it to the end of the track if the hills continually increase in size?
- How steep should you make the hills?
- What shape should you make the hilltops and valleys of the roller coaster? Why?
- What provides resistance on the roller coaster causing the ball to slow down? How can this resistance be reduced?

Instructions:

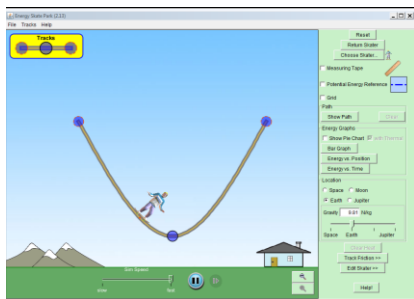
1. Copy the following web address into your browser: <http://phet.colorado.edu/en/simulation/energy-skate-park>
OR Google the search term "energy skate park, phet" and select the first result.
2. You will get to a page that looks as pictured below. Click on the play (right facing arrow) button.

Energy Skate Park

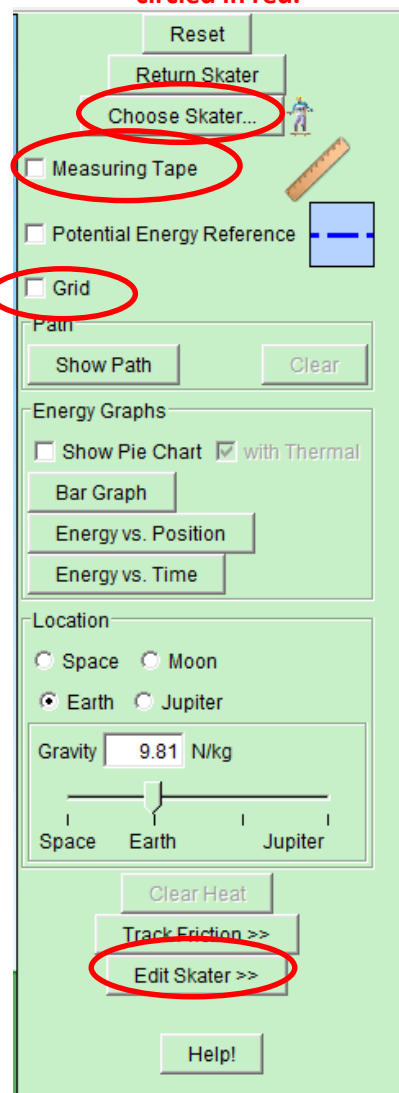


Functions you will be using are circled in red.

3. A file will download. Open it. It will **NOT** harm your computer.
4. Confirm running the program in Java.
5. You may be prompted to update or download Java. Go ahead and do this.
6. When the skate park opens, you will see a boy skating on a track as pictured below.

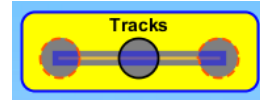


7. To change the boy to a ball, click on the "Choose Skater..." button. A new screen will open. Select the red Ball then click "OK."
8. Now you need to change the mass of the ball. To do this, click on the "Edit Skater>>" button. The menu will elongate and you will be able to change the mass of the ball from the default 5.00 kg to 10.00 kg. (This heavier ball will stay on the track better than the lighter one.)



9. Now you can design your track.

- Add track pieces to your roller coaster by dragging and dropping from the yellow “Tracks” box in the upper left hand corner of the simulation screen. You will need to add 2 additional pieces of track to make the 3 dips needed.



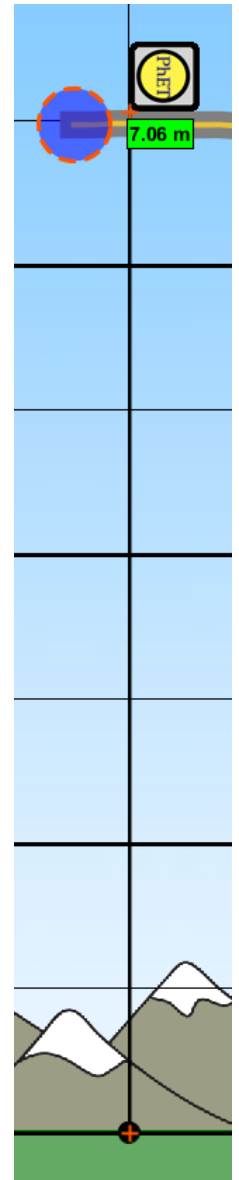
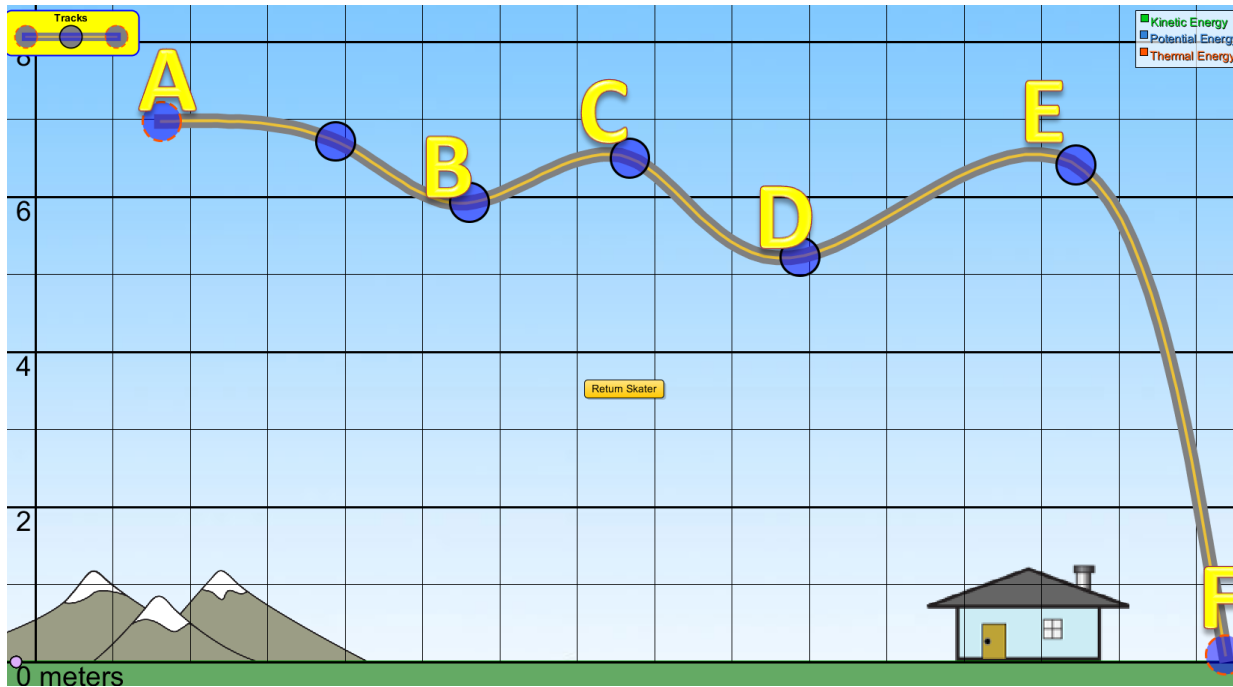
10. Drag and drop the pieces of the track to make a track that appears functional. **Make sure your track has 3 peaks, 2 valleys, and that it ends touching the ground.**

- Test your roller coaster. Place the ball at the beginning of your track and release it.
- If your ball does not make it to the end of the track, reshape your hills and valleys by dragging and dropping the track. Repeat this process until the ball can travel the entire length of the track. *Make sure that the ball remains in contact with the track during the entire trial.*

11. Use the measuring tape tool to measure the vertical heights of your coaster. Measure from the horizontal ground line. It may help you to turn on the grid.

Turn in:

- Include a screenshot of your rollercoaster simulation. Do this by clicking on the “Print Screen” button while the Skate Park Screen is up. Then, press Ctrl + V to paste this image in a Word document. Need help? Ask me!
- Measure the vertical distance to the peaks (A, C, E) and valleys (B, D, F) of your own rollercoaster. Use the diagram below as a guide for completing the table in regard to **your own coaster**. Include your table in your assignment.



Vertical Distance from
Ground (m)

A
B
C
D
E
F

3. What force slowed down the ball as it moved up towards a peak? What other force was acting on the ball as it moved along the track? How can these forces be reduced?
4. Refer back to the track that you made. Choose the words that will make the statements true.
 - a. Point A: Potential Energy is _____ (large or small?) and Kinetic Energy is _____ (large or small?)
 - b. Point F: Potential Energy is _____ (large or small?) and Kinetic Energy is _____ (large or small?)
 - c. Moving from A to B: Potential Energy _____ (increases or decreases?) and Kinetic Energy _____ (increases or decreases?)
 - d. Moving from B to C: Potential Energy _____ (increases or decreases?) and Kinetic Energy _____ (increases or decreases?)
5. What is the gravitational potential energy of the ball at the top of each hill (points A, C, E)? Remember that the mass of this ball is 10.00 kg.
6. Relate the principle of conservation of energy in an analysis of a roller coaster ride from start to finish.