

Lesson plan for *Energy Skate Park Activity 1: Introduction to Conservation of Mechanical Energy*

Time for activity 50 minutes <http://phet.colorado.edu>

Learning Goals: Students will be able to

- Explain the Conservation of Mechanical Energy concept using kinetic and gravitational potential energy.
- Design a skate park using the concept of Mechanical energy

Background:

Students, in general, know about conservation of energy. For example, they can tell you that energy comes from the sun and is converted by plants into food. It is unlikely that my students have done any quantitative analysis. In class lecture, kinetic, elastic potential, and gravitational potential energy will be defined accompanied by common demonstrations. This is the first of 4 Energy Skate Park activity and I also used an activity with Masses and Springs. My students are familiar with Excel and so I decided to use the term “chart” for the graphs and chart like it does.

PreLesson: There are some Pre-lesson questions (see the power point associated with this lesson) adapted from Karen King’s lesson published in the activity database.

1. Say: “Draw pictures showing something that has a lot of potential energy and something that does not.” Display the ppt that goes with this lesson. (slide 1)
 2. Explain why you think the object on the left has more potential energy. (slide 2)
 3. Now draw pictures for kinetic energy. (slide 3)
 4. Explain why you think the object on the left has more kinetic energy. (slide 4)
- (The other slides are clicker questions for after the students do the lab)

Energy Skate Park Introduction:

I think I’ll show how to add track and the **Return Skater** and **Clear Heat** buttons are really handy for repeating experiments or running an experiment once the Skater doesn’t leave the track. Also, if you can resize the windows when you open the graphs and charts, to make them fit.

Energy Skate Park Helpful hints for teachers:

1. I often make a track that I want to project for class discussion and then save it.
2. You can Pause the sim and then put the Skater wherever you like easily. Then the **Return Skater** will let you rerun the scenario.
3. When the Skater lands on the track, the vertical component of his kinetic energy is converted to thermal energy. You can do experiments where there is only PE and KE by making sure he doesn’t leave the track. One way to do that is to right click on a track, you can make in into roller coaster mode.
4. The thermal energy can be “zeroed” using the **Clear Heat** button.
5. **Return Skater** and **Bring Back the Skater** (*name changes with the character*) buttons puts the character at the location that the user last let go.
6. The **Energy Position Graph** erases, but you can **Pause** the simulation and the graph will not change. The **Copy** button will let you freeze the graph to compare different scenarios, but it cannot be saved as a file. If you Zoom, the graph clears; you can make a new graph by rerunning your scenario using **Return Skater**.

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7. **Step** is a good way to incrementally analyze. It is very useful to have the students make predictions. The button next to **Play** in the large window moves the character forward in time. The button in the **Energy Time** window moves the vertical cursor on the graph (Steps through the Playback).
8. If you use the **Show Path** feature, then you can click on the purple dots and show quantitative information about the energies. Click again to hide. Height refers to height from Potential Energy Reference line.

Lesson: Have the students use the lab sheet for guidance. The activity took my honors physics students about 40 minutes.

Post lesson:

I have written some clicker questions. I saved the tracks that are in the questions so I can easily prove the answers. Go through questions 1-4 and then show the answers using the saved track. Go through 5-7, then show the answers using the second saved track.

Next lesson: Energy Skate Park activity 2. The learning goals are specific to chart interpretation and chart prediction.