

Name:

Date:

Per:

PhET Energy Skate Park


https://phet.colorado.edu/sims/html/energy-skate-park/latest/energy-skate-park_en.html

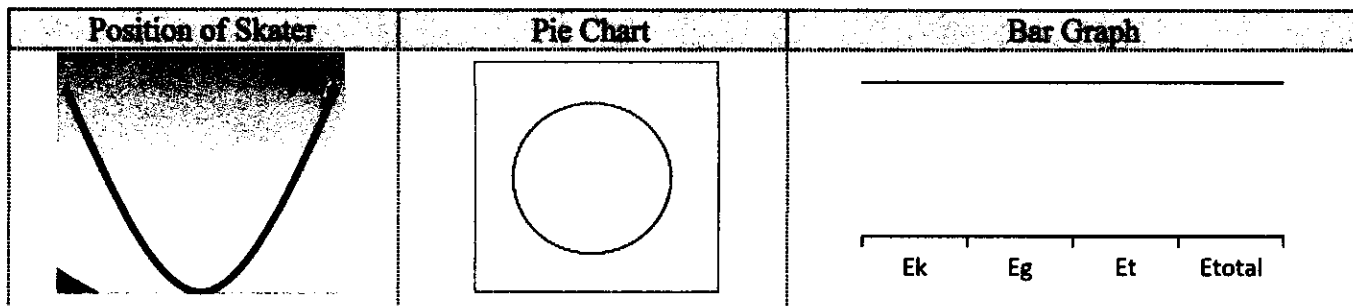
1. Define the following terms:

Kinetic Energy: (E_k)	Gravitational Potential Energy: (E_g)
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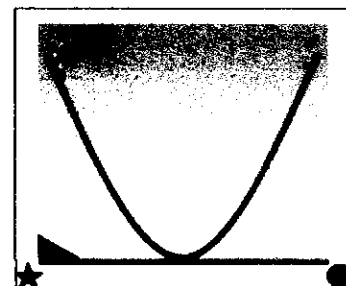
- On a computer, search the internet for Energy Skate Park Phet (NOT “Basics”) or use this link https://phet.colorado.edu/sims/html/energy-skate-park/latest/energy-skate-park_en.html
- Click the “Play” button on the picture to start the PhET Energy Skate Park Simulation.
- Navigate to the “Intro” Section.

Part I. E_k and E_g transfers as the skater moves along the track.

- Pause the simulation. Click “Pie Chart” in the top right and  in the top left.
- Using your mouse cursor, place the skater at one top side of the track (6.0 meters).
- Fill in the pie chart and bar graphs for the skater’s energy at his initial position.



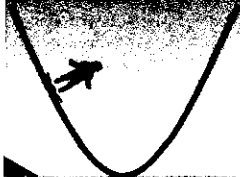
- Press play!
- Watch the pie chart and bar chart.
 - Draw (or drag) a star (★) on the picture to the right where the E_k is greatest.
 - Draw (or drag) a smiley face on the picture to the right (☺) where the E_g is greatest.



10. When the skater moves faster, what happens to E_k ?	11. When the skater is higher above the ground, what happens to E_g ?	12. What happens to E_k when E_g goes up? Why do you think this happens? What is true about the total energy?
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Part 2. The effect of height, mass, and gravitational field strength on gravitational energy.

13. Switch to the “Measure” Section. Place your skater HALFWAY up the track (3.0 meters). What is his initial gravitational energy (E_g)?

Position of Skater	Result
	

14. In #13, your height was half of #8. How does the gravitational potential energy at 3 meters compare to the gravitational potential energy at 6 m?

15. Change the mass of the skater from 60 kg to 30 kg, and place her at 6 meters high. How does the gravitational potential energy at 30 kg compare to the bar for gravitational potential energy at 60kg?

16. Change the gravitational field strength from Earth’s (9.8 N/kg) to Jupiter’s. Place the skater back at 6 meters high. How does the gravitational potential energy in Jupiter’s gravitational field compare to the gravitational potential energy in Earth’s field?

Height, mass, and gravitational field strength have directly proportional relationships to gravitational potential energy. The following equation and variables represent this relationship:

$$E_g = mgh$$

m = mass,

g = gravitational field strength (for Earth use, $g = 10 \text{ N/kg}$),

$$h = \text{height}$$

17. Use the equation above to calculate the initial gravitational potential energy (E_g) of a 60 kg skater when the skater is waiting at the top of the ramp (6 meters) on the planet Earth.

18. When the skater reaches the bottom of the track, then all of the energy is _____.

19. What is the amount of kinetic energy at the bottom of the track? (Hint: no calculation is required!)

20. Change the initial height and mass of the skater. Place the skater at your new initial height and solve for E_g .

Knowns and Unknowns	Equations and Solution
$m = \underline{\hspace{2cm}}$ $h = \underline{\hspace{2cm}}$ $g = 10 \text{ N/kg}$ $E_g = ?$	

The following equation and variables represent the relationship among kinetic energy, mass, and speed:

$$E_k = \frac{1}{2}mv^2$$

Energy is conserved in any defined system (unless an outside force is present to add or remove it) so the **total energy** of the skater will remain the same at all points on his journey.

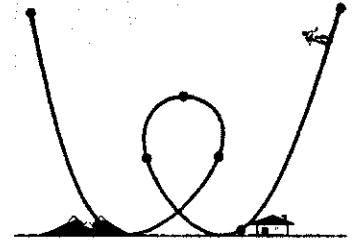
$$E_{Ti} = E_{Tf} \quad \therefore \quad E_{gi} + E_{ki} = E_{gf} + E_{kf}$$

21. Using this relationship, how much **speed** will your skater have at the bottom of the ramp if he starts from your position in #22 and all of the energy is converted to Kinetic (because no friction is present)?

Do it with symbols! This is a relationship you are expected to recognize and remember!	Numeric Result:

22. Turn up the friction. What happens to the skater? What happens to the energy?

23. In the Playground part make a loop in your track. (Or several!) Turn on the the graphs. What patterns do you see? How high does your skater have to begin in order to NOT fall off the loop? Try it with friction and without. Sketch your track and some examples of your graphs on the back of this sheet.



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