

NAME: _____

DATE: _____

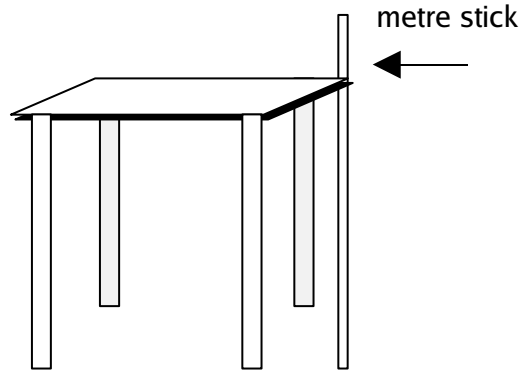
PARTNERS: _____

Procedure:

To investigate the relationship between **potential energy** and **kinetic energy**.

Materials:

1. Super-ball, or raquette ball
2. Metre stick and tape
3. calculator
4. table or desk
5. scale

Diagram:**Warm-Up (to do BEFORE you move on to the activity!!!):**

1. In general terms, something has potential if it has the ability to do something in the future. In physics terms, we often use the word *potential* to describe different forms of stored energy. In your own words, describe what you know about the *potential energy* of a falling object. How can you increase the potential energy of an object?

2. *Kinematics* is the study of objects *in motion*. In your own words, describe what you know about the *kinetic energy* of a moving object. How can you increase the kinetic energy of an object? What is the kinetic energy of an object at rest?

Procedure:

1. Tape the metre stick to the side of the table or desk, so the 0-cm mark is on the floor.
2. Hold the ball so its bottom edge aligns with the 40 cm mark, then drop the ball. Have someone in your group measure the height to which the ball bounces. Record this bounce height in the table below.
3. Repeat step 2 once more (ie. do two trials), and record in the first table below.
4. Drop the ball twice each for the following initial heights: 60cm, 80cm, 100cm.
5. Calculate the average bounce height (m) and record in col 4 of the first table.
6. Calculate the speed of the ball just before it hits the ground: $V_{\text{ground}} = \sqrt{2gh} = \sqrt{2 \cdot 9.81 \cdot \text{initial height}}$, and record in column 5 of the first table (m/s).

Data:

Initial height of ball	Trial	Bounce Height (m)	Average Bounce Height (m)	Speed at Ground (m/s)
0.4 m	1			
	2			
0.6 m	1			
	2			
0.8m	1			
	2			
1.0m	1			
	2			

Energy Calculations:

Mass of ball: _____ kg

Initial height of ball	Average Bounce Height (m) *from 1 st table*	Potential Energy (initial height) (J)	Potential Energy (bounce height) (J)	Speed at Ground (m/s) *from 1 st table*	Kinetic Energy (J)
0.4 m					
0.6 m					
0.8m					
1.0m					

Questions:

1. The equation for **potential energy** (PE) is: Potential Energy = (mass) x (height) x (acceleration of gravity), where mass is in kilograms, height is in meters, acceleration of gravity is 9.8 m/s^2 , and potential energy is in joules.
 - a) Weigh the ball on a scale, and record the mass in **kilograms** where indicated above the 2nd table.
 - b) Calculate the potential energy of the ball at its initial height, and at its average bounce height, and fill in your answers in the second table.

2. What happens to the average bounce height as you increase the initial height? Does this make sense? Does the bounce height equal the initial height? Why or why not?

5. Calculate the **kinetic energy (KE)** of the ball just before it hits the ground:

KE = $\frac{1}{2} m\mathbf{v}_f^2$ where v_f is the speed of the ball just before it hits the ground, which you calculated in the first data table. Fill in your results in the last column of the 2nd data table.

6. Compare the KE of the ball with its initial PE. Do they increase together as the drop height increases? Does this make sense?

7. At what point in a drop does the ball have *maximum kinetic energy*? At what point does the ball have *minimum kinetic energy*?

8. What can you conclude then about the relationship between gravitational potential energy, and kinetic energy?

Reference:

Wikipedia. *Potential Energy*, http://en.wikipedia.org/wiki/Potential_energy#Gravitational_potential_energy

Summary and Suggestions for the Future:

(Please attach extra pages as necessary to fully answer these questions)

1. What were the important concepts of physics/science that you learned from this activity? What else did you learn?
2. Can you think of alternative hands-on ways in which these concepts could be demonstrated? Can you suggest any improvements to these activities?
3. What changes would you make to teach these activities in a Grade 7-8 classroom? What difficulties can you foresee?