Mechanical Energy Lab

Purpose:

- To use previous knowledge of velocity to perform kinetic energy calculations
- To make calculations of gravitational potential energy.
- To determine what affects GPE and KE more.

Part One: Potential Energy:

Potential Energy is the mechanical energy of position. In other words, potential energy is how much potential something has to do work. The formula used to measure P.E. is:

P.E. = Mass x G x Height

Object	Mass (g)	Mass (kg)	Location	Height (m)	P.E. (J)
Golf Ball			On Floor		
Golf Ball			On Desk		
Golf Ball			On Top of a Group Member's Head		
Marble			On Floor		
Marble			On Desk		
Marble			On Top of a Group Member's Head		
Tennis Ball			On Floor		
Tennis Ball			On Desk		
Tennis Ball			On Top of a Group Member's Head		

Part Two: Kinetic Energy

Kinetic Energy is the mechanical energy of motion. In other words, kinetic energy is how much work an object is currently doing. The formula for determining K.E. is:

K.E. = 1/2 (m x v^2)

You will simply drop the objects from Part One from a variety of locations. Fill in the data tables below to determine both the P.E. and K.E. for each situation.

Hint: Talk about what strategies would be helpful to collect an accurate measurement for *TIME* in this experiment.

MARBLE

Mass (kg)	Distance of Drop (m)	Time Trials (s) 1	2	3	Avg.	Velocity (m/s)	Potential Energy (J)	Kinetic Energy (J)

GOLF BALL

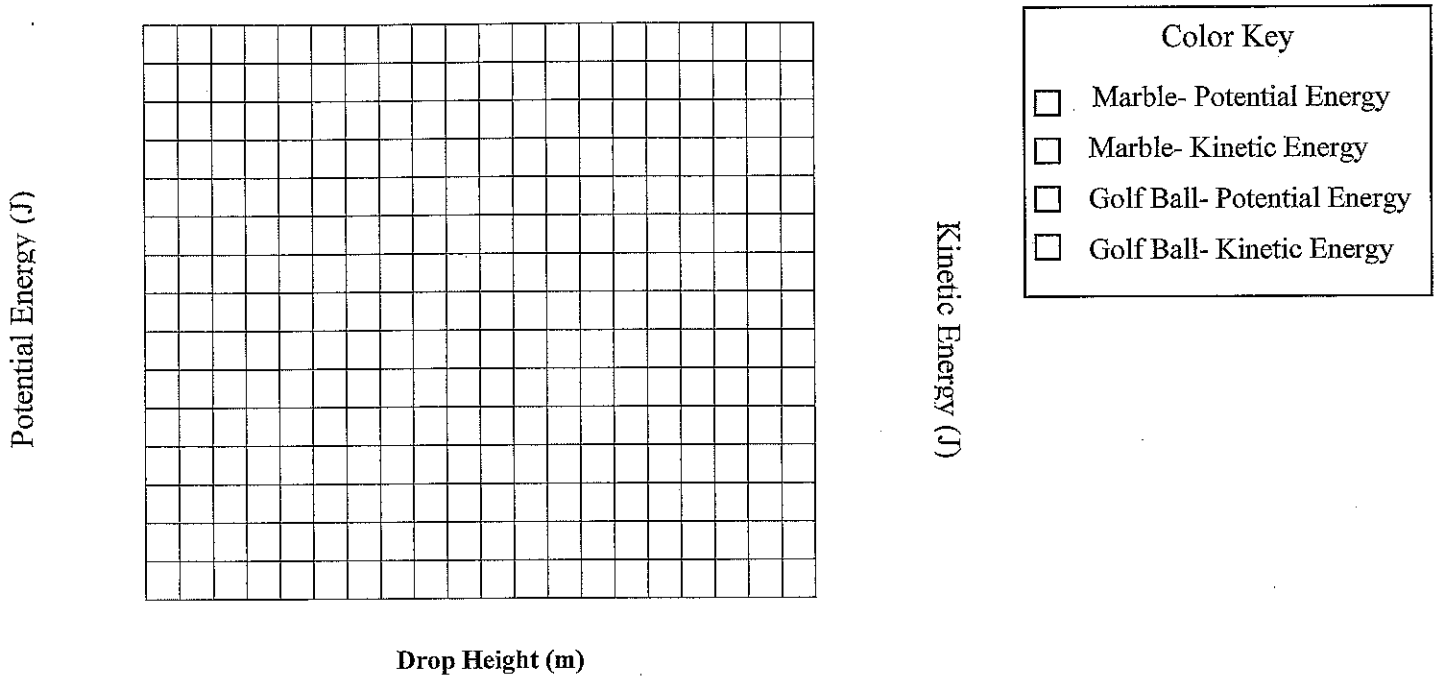
Mass (kg)	Distance of Drop (m)	Time Trials (s) 1	2	3	Avg.	Velocity (m/s)	Potential Energy (J)	Kinetic Energy (J)

TENNIS BALL

Mass (kg)	Distance of Drop (m)	Time Trials (s) 1	2	3	Avg.	Velocity (m/s)	Potential Energy (J)	Kinetic Energy (J)

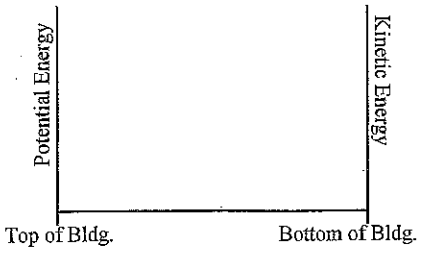
GRAPH

Construct a line graph for the marble and golf ball in the space provided. This graph should contain four lines with a color-coded key. Don't forget to label the x-axis and y-axis with an appropriate scale and give the graph a descriptive title.



ANALYSIS: Answer these questions on a separate sheet of paper and staple it to your lab sheet.

1. When was the potential energy the highest in this experiment and why?
2. When was the kinetic energy the highest in this experiment and why?
3. In theory, the potential energy at the top of the drop should match the kinetic energy at the bottom of the drop for each trial. Did all of the potential energy transfer to kinetic energy in your test? Does this mean you lost/gained any energy? Explain using the law of conservation of energy.
4. Was this experiment perfect? Explain some possible sources of error.
5. Which has a greater effect on the kinetic energy of an object…mass or velocity? Why?
6. Would the golf ball have more or less potential energy on the moon than it does on earth? Why?
7. Sketch a graph that shows how the energy transfers from potential to kinetic energy as a ball falls from the top of a building. Draw and label three lines (one for kinetic, one for potential, and one for total mechanical energy).



EXPERIMENT

In this lab we will explore the effect of the height of a ramp and the mass of an object on the potential and kinetic energy.

Hypothesis

As the height of a ramp increases, potential and kinetic energy will.....
As the mass increases, potential and kinetic energy will.....

Materials

- 3 balls (different mass) ramp (a piece of plywood)
- meter stick
- balance
- stop watch

Procedure

1. Weigh each ball on the balance to determine its mass (in grams). Record the mass in the data table.
2. Draw a starting line from the top of the plywood.
3. Place one block of wood (1 book) under the end of the plywood to make a ramp. Measure the height of the ramp (m) and record it.
4. Place one of the balls on the starting line.
5. Release the ball and start the stop watch.
6. When the ball has used all its energy, i.e., when it comes to a complete stop, record the time.
7. Measure and record the distance (in meters) that the ball traveled.
8. Repeat steps 4-7 with the other two balls.
9. Place one additional block (2 books) under the end of the plywood. Measure the new height of the ramp and record it on the data table.
10. Repeat steps 4-7 with each of the three balls.
11. Using the third block of wood (3 books), raise the plywood ramp still higher. Measure the new height and record it on the data table.
12. Repeat steps 4-7 with each ball.

Observations

1. Height of the ramp (m) = ...

	Mass (g)	Distance (m)	Time (sec)	Velocity (m/s)
Ball 1				
Ball 2				
Ball 3				

2. Height of the ramp (m) = ...

	Mass (g)	Distance (m)	Time (sec)	Velocity (m/s)
Ball 1				
Ball 2				
Ball 3				

3. Height of the ramp (m) = ...

	Mass (g)	Distance (m)	Time (sec)	Velocity (m/s)
Ball 1				
Ball 2				
Ball 3				

Questions

1. When in this investigation did each ball have potential energy?

_____

2. When did each ball have kinetic energy?

3. What is the relationship between energy, mass and height (potential and kinetic)?

5. What evidence do you have that supports your hypothesis?

6. The velocity of an object (V) is calculated by dividing the distance (d) traveled by time (t). Using the formula $V = d/t$, calculate the velocity of each ball traveled down the ramp.

7. As the mass of the ball increased, did the balls speed up or slow down?

Why/Why not?

8. As the height of the ramp increased, did the balls speed up or slow down?

Why/Why not?

9. Calculate the potential energy of the ball at the starting line.
Calculate the kinetic energy of each ball traveling down the ramp elevated with one block of wood.

Ball 1 _____
Ball 2 _____
Ball 3 _____

10. When a car is going downhill, the driver must apply more pressure on the brakes to stop than if the car was on ground level. Why?

11. Why is it harder to stop a four-person bobsled than a three-person bobsled?