NAME

Transformations of Energy Lab

Use this paper to record your data, but write conclusions, drawings, and graphs elsewhere!

A ball dropped from a height of 1 meter bounces, and then loses energy as it hits. At the top at one meter, it has its maximum gravitational potential energy, then the instant before it hits it has its maximum kinetic energy, then it deforms as the front stops and the back keeps going, giving it maximum elastic(spring) potential energy, then the floor pushes back on it giving it kinetic energy until it returns to the top of its bounce at gravitational potential energy again.

Before you start:

Draw a picture of the ball bouncing once, labeling the types of energy. Also, use this diagram to indicate places where the ball might lose energy (it is transformed into something other than a type of mechanical), and predict on the diagram the spot that you think the ball will return to.

A) Find the average height of a normal ball bounce and use that to calculate its energy.

take a normal ball. be sure to mass it. Hold it at one meter. Let it drop. Avoid spinning the ball as you release it or it will not drop straight. Measure the height of its bounce. Wait at least 20 seconds. Repeat 9 times. Average the height.

Beginning room temperature in deg C:_____ Starting height _____ (in m)

Ball Mass_____(in kg) Average height (after 10)_____ (in m)

Use this to calculate the:

Starting Gravitational potential Energy_____= mgh=GPE

Maximum Kinetic Energy_____ (= GPE start?)

Speed at bottom _____ KE = ½ mv^2

Ending Gravitational Potential Energy _____=mgh

Energy Lost _____ in Joules

Coefficient of Restitution _____ (% height bounce)

Conclusions:

How did the results came out to what you expected? How did the results show conservation or transformation of energy? Draw a graph showing change in GPE and KE over time with your actual results.

B) You predicted that the ball would lose some energy due to heat. Find out how much in this part.
Have a cup of just enough water (make sure to measure it!!) to cover the ball standing by, with a thermometer or temperature probe already in it.

Bounce the ball from 1 meter again. This time do not wait at all in between bounces, catch it and quickly drop it from one meter again. Do this at least 50-100 times quickly in a row. the ball should feel slightly warmer.

Note at least the first bounce height, and the final bounce height. If they are different, mention in your conclusions a possible explanation why.

After bouncing the ball rapidly, place it in the water and observe the temperature change. If the water reaches a maximum, record this as the final temperature.

Ball mass_____ (in kg)
1st Bounce height_____ (in m) last bounce height_____ (in m) # bounces_____

Water Volume/Mass_____ (in kg… 1L=1kg)
Starting Temp _____ in deg C Final Temp _____ in deg C Change in Temp _____ in deg C

Calculate the amount of heat energy the ball transferred to the water: (in Calories)
*Heat = Q = MassWater * Change in T =_____*

*in Joules_____ (Joules = Cal * 4187)*

Divide by the number of bounces to calculate the heat energy gained by the ball on each bounce.

_____ Joules

How does this compare to the original calculation (from part A) of the energy lost on each bounce? Why are they different?

Conclusions: Why might the bounce height start changing as you drop it fast? Why might the ball get warmer? How does the heat energy gained on each bounce compare to Part A calculation of the energy lost on each bounce and why they are similar or different? Where might the rest of the energy have gone? How might the results be inaccurate and what could have changed to make them better? Draw a graph showing change in GPE and KE over time with your actual results. What are other factors that could have affected your results?

PART C)

Elastic Energy!

Set up a light ball on a string hanging off a ring stand. Make sure to find the mass of the ball and its original gravitational potential energy.

Set up an elastic or spring that will hit the ball horizontally.
Measure the force it takes to stretch/compress the elastic/spring and the distance from rest.

Pull/push the elastic/spring back and let it hit the ball. Measure the maximum height of the ball.

Repeat your measurements at least five times.

Try different elastics or balls.

Calculate: the spring constant ($k = F/x$), the starting elastic potential energy ($1/2\ k\ x^2$).

If the EPE at the beginning equals the KE when the ball was hit, what was the KE ($=1/2mv^2$) ?

What was the starting velocity?
What was the gravitational potential energy at the end? (GPE =mgh)

How much energy was lost?

Where was it lost? How could you tell? Where might the rest of the energy have gone? How might the results be inaccurate and what could have changed to make them better? Draw a graph showing change in GPE, EPE, KE over time with your actual results. What are other factors that could have affected your results? (include a drawing!)

D) Pop its? Try placing the pop it/or racquetball half on the floor and measure how far up it goes. Calculate the gravitational potential energy at the top, its kinetic energy at the bottom, and its speed at the bottom (using its mass). Try it several times and see if the increased temperature each time makes a difference in the time it takes to "pop", and the height it rises. Discuss your results and any conclusions you might have. Draw a graph showing change in GPE and KE over time with your actual results.

********* E for EXTRA!!!! (good lab students will do at least one!) Repeat any and all of parts A-D on a DIFFERENT FLOOR SURFACE (Carpet, paper, cloth, etc.....) OR WITH A DIFFERENT OBJECT!! to see if it makes a difference and discuss your results and conclusions!!*