Thomas Haney Secondary School

23000 116 Ave, Maple Ridge, B.C. V2X 0T8

Telephone: (604)463-2001

Science 10: LG 9 Kinetic and Potential Energy Lab

Name: _____

Law of Conservation of Energy

Purpose:

To verify the Law of Conservation of Energy by seeing if all of the gravitational potential energy of a toy car at the top of a track is converted into kinetic energy at the bottom of the track.

Introduction:

When an object is at rest (above the surface of the ground) it has potential energy. This stored potential energy due to the objects position above ground is known as gravitational potential energy, or E_g. This stored energy can be converted into kinetic energy or E_k if the object is allowed to fall.

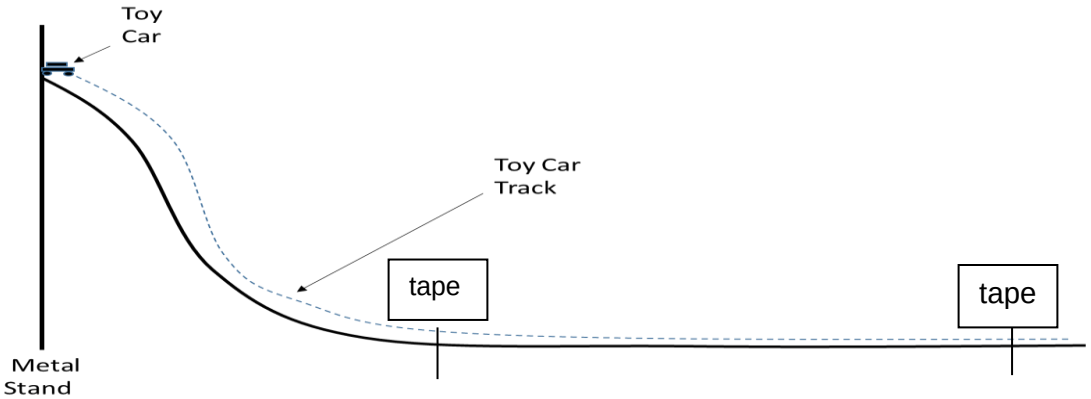
YOUR JOB is to take an object at rest (the toy car) and let it drop down the race track on an incline and see/record the energy conversions that take place as the car moves down the track. In the course of this lab you will do this five times at five different heights of your choice.

Hypothesis (how do you think the kinetic energy at the bottom will compare to the gravitational potential energy at the top?):

Materials:

- A metal stand
- Toy car
- Measuring tape
- balance
- Lengths of toy race car track (7)
- Stop Watch
- Masking Tape

Diagram of Setup:



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Procedure:

1) Setup the above diagram using the metal stand, race car track pieces, and toy car provided.
2) Using the masking tape mark the spot on the bottom of the track where the car is moving the fastest (ie. the start of the flat part at the bottom of the ramp).
3) Using the masking tape mark the spot on the end of the track.
4) Measure and record the distance (in m) between the two pieces of tape. This is the distance that the car will travel on the flat bottom portion of the track that you will use to calculate its velocity.
5) Measure and record (in kg) the mass of your toy car using the balance.
6) Place the car at the top of the track. Measure and record the height of your car.
7) Let the car go and using a "timer" (phone), record how long it takes the car to move between the two points at the bottom of the track.
8) Repeat steps 6 and 7 four more times using lower starting heights of the car.

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Observations:

Reminders:

1kg = 1000g so to convert from g to kg, divide by 1000

1m = 100cm so to convert from cm to m, divide by 100

Constants:

Mass of car (kg)	
Distance between two pieces of tape (m)	

Release height of car (m)	Time for car to travel between two pieces of tape (s)

Analysis:

To calculate the initial gravitational potential energy of the car, use the equation Eg = mgh, where m is the mass of your car (in kg), g, the gravitational field strength, is 9.8N/kg and h is the release height of your car (in m).

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Show your work for one of your Eg calculations here:

In order to calculate the kinetic energy of your car at the bottom of the track, you will first have to calculate the speed of the car at the bottom of the track by using the speed formula V = d/t where d is the distance between the two pieces of tape (in m) and t is the time for the car to travel between the two pieces of tape (in s).

Show your work for one of the speed calculations here:

Now to calculate the kinetic energy of the car at the bottom use the equation $E_k = (1/2)mv^2$ where v is the speed you calculated above and m is the mass of the car.

Show your work for one of the kinetic energy calculations here:

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Now display your calculated Eg and Ek values for all trials in the table below:

Gravitational Potential Energy of the car at the top of track (J)	Kinetic Energy of the car at the bottom of the track (J)

Plot the data from the above table on a sheet of graph paper. Include a title, be sure to label the axes (Eg on the x-axis, Ek on the y-axis) including the units.

Using a ruler, draw a line of best fit through your data points. Pick two points on the line of best fit and calculate the slope of your line. Write the formula for your line in y = mx + b form.

Conclusion:

1. Was the Law of Conservation of Energy verified? In other words did all of the gravitational potential at the top of the track get converted into kinetic energy at the bottom? If the Law was not verified, why not? Where did the "missing" energy go?

2. Describe the meaning of the slope of your line. If more of the gravitational potential energy were converted into kinetic energy, what would have happened to the slope?

3. Which measurements were mostly affected by error in this lab? What caused the error? If you were to do the lab again, what could you do to reduce these sources of error?