Conservation of Energy Activity
Chicago State University Van Program

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Conservation of Energy Activity

Purpose: To apply the Law of Conservation of Energy.

Background: You will be rolling a Hot Wheels car (or some other object) down a hill and up a second hill. You will be studying the transformations of Gravitational Potential Energy (GPE) and Kinetic Energy (KE). You will need to know or look up the formulas for GPE and KE. You will measure GPE1 at the top of the first hill, KE at the bottom of the hill, and GPE2 at the highest height the car reaches on the second hill.

How do you think GPE1, KE, and GPE2 will compare to each other?

Equipment:

-Vernier LabPro
-2 Vernier Photogates
-TI Calculator
-Hot Wheels track with connectors (at least 3 sections)
-Hot Wheels car
-Ring stand with right angle clamp
-C-clamps or tape to attach photogates together

Procedure:

1. Set up the Hot Wheels track as demonstrated (it should make a U shape but with a more gradual slope). Make sure it is secured with tape or in some other fashion so that the track doesn't wobble.

2. Connect the Photogates to the DIG/SONIC 1 and DIG/SONIC 2 ports on the LabPro. Connect the power supply and the calculator to the Lab Pro.

3. Locate and open the **DATAGATE** program on your calculator.

4. You can test the photogates to see if thy are working by passing an object through the "beam". As the object blocks the beam the red LED on the back of the photogate should light up. If not, check your connections.

5. Choose **SETUP (1)** on the opening menu.

6. Choose **PULSE (4)** on the Photogate Setup menu.

7. Choose **TWO PHOTOGATES (2)** when asked how many.

8. Tape (or **lightly** clamp) the two photogate back to back. (You can separate the photogates to any distance for other labs but in this lab back to back seems to work the best.) The aluminum rods that hold the photogates will probably be pointing in opposite directions.

9. Measure the distance between the two photogate beams and enter the result here and on the calculator.

   Distance = _____

10. Choose **OK (1)** if the settings look good, otherwise use **(2)** to edit.

11. Choose **START (2)** to get ready to collect data. The calculator will beep four times and is now ready for data collection.

12. Measure the mass of the car. Mass = _____

13. Place the car at the top of the first hill (mark the location with tape) and measure the height of the car above the tabletop.

    Height of car on first hill = _____

14. Place the photogates across the track at the very bottom being careful to have the beam at the proper level for the car to pass through. The clamp(s) or other device can be used to make the adjustments.

15. Once the car is released, the photogates will time how long it takes for the car to pass from the first gate to the second. Repeat five times and record the results. Also measure the height the car achieves on the second hill and record this for each trial. Finally, calculate the velocity knowing the distance from step **9** and the time from the data table.

Data Table 1

Trial	Height of first hill (m)	Height of second hill (m)	Time through photogates (sec)	Average Velocity through photogates (m/s)
1				
2				
3				
4				
5				

16. Press **STO** to stop data collection.

17. Press **QUIT (4)** (Optional: L2 and L3 will have the times and velocities. If you had five clean trials you can check to see if this matches your data.)

18. Use the mass of the car from step 12 and the equations for GPE and KE to complete the following table.

Table 2

Trial	GPE1 (Joules)	KE bottom of hill (Joules)	GPE2 (Joules)
1			
2			
3			
4			
5			
Average			

19. Do the average values of GPE1, KE, and GPE2 compare as you predicted in the background discussion.

20. Do the average values of GPE1, KE, and GPE2 support the Law of Conservation of Energy? Explain.