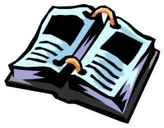


AP Physics Class Calendar: Chapter 5

Date	Location	Activities & Textbook References	Teacher Initials	Homework
Oct 5	Classroom	Demo: *Work on a Brick*	__________	C #11, 5
	Any Computer	Lecture 5-1: *Work*		*P #2, B
		(Textbook Sections 5.1 and 5.8)		**P #4, A
	Any	Complete Ch 5 HW Assignment #1		***P #5
Oct 6	Any Computer	Lecture 5-2: *Work-Kinetic Energy Theorem*		C #6
		(Textbook Section 5.2)		*P #C, 9
	Any	Complete Ch 5 HW Assignment #2		**P #15, 17, 68
	Classroom	**Quiz 5-A**		***P #13, 40
Oct 7 & 10	Any Computer	Lecture 5-3: *Potential Energy*		C #16, 4, 8
		(Textbook Section 5.3)		*P #20, 27, 28
	Any Computer	Lecture 5-4: *Conservation of Energy*		**P #29, D, E, 42
		(Textbook Section 5.5)		***P #63, F
	School Computers	Short Lab 5-A: *Graphs of Energy*		
	Any	Complete Ch 5 HW Assignment #3		
Oct 11	Classroom	Demo: *Energy of Marbles & Hot Wheels Cars*	__________	C #3
	Any Computer	Lecture 5-5: *Conservation of Energy and Work*		*P #G, H
		(Textbook Sections 5.4 and 5.6)		**P #I, 39
	Classroom	Short Lab 5-B: *Velocity of a Dart Gun*	__________	***P #J, 46
	Any	Complete Ch 5 HW Assignment #4		
	Classroom	**Quiz 5-B**		
Oct 12	Any Computer	Lecture 5-6: *Power*		*P #49, 65
		(Textbook Section 5.7)		**P #48
	Classroom	Short Lab 5-C: *Muscle Up*	__________	***P #50
	Any	Complete Ch 5 HW Assignment #5		
Oct 13 & 14	Classroom	Review & Work Days		- - - - - -
		HOMEWORK DUE: AP Review Questions		
Oct 17	Classroom	Review: *AP Question Presentations*		- - - - - -
Oct 18	Classroom	**TEST: Chapters 4 & 5**		- - - - - -
		FORMAL LABS DUE: Chapters 4 & 5		
		SHORT LABS & DEMOS DUE: Chapter 5		
		HOMEWORK DUE: Chapter 5		
		(<u>All</u> Conceptual due)		
		(<u>14</u> Problems due)		

* Problems with *<u>Lowest</u>* difficulty level
** Problems with *<u>Medium</u>* difficulty level
*** Problems with *<u>Highest</u>* difficulty level

~ "Numbered" Homework in Textbook (pg 145 – 153)
~ "Lettered" Homework on Worksheet

IMPORTANT NOTE REGARDING *INTERACTIVE PHYSICS* FILES:

The program "*Interactive Physics*" has been purchased by the Sioux Falls School District and should run on most school computers. However, the program is not installed directly on most computers and will require a few special procedures to run as intended! Therefore, students should follow the steps below when opening *Interactive Physics* files.

First, locate the *Interactive Physics* file you wish to open from the "Assignments" tab of the class web site (www.student.PhysicsVodcasts.com). Right-click on the link for the file and select "*Save Target As*" to download a copy of the file to your home folder.

Then, open the *Interactive Physics* program by going to the "*RHS Software*" folder on the computer and choosing "*Science*".

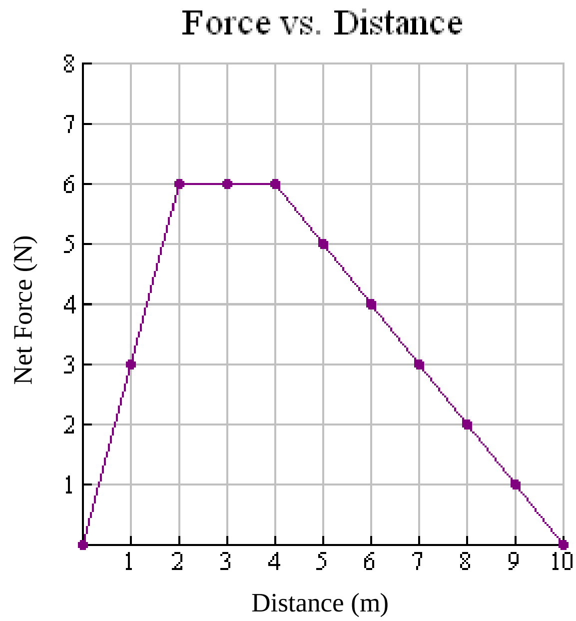
Finally, use the "*File*" and "*Open*" commands in the *Interactive Physics* program to locate the downloaded file in your home folder and open it.

Name ______________________

Hour ______

AP Physics: Chapter 5
Work and Energy

The Force vs. Distance graph below shows the *net force* acting on a 1.0 kg object as an applied force causes it to start from rest and move along a straight-line path. The coefficient of friction between the object and the surface it travels on is .30. Use *g* = -10 m/s^2.



Question A:

Consider the movement of the object at a distance of $d = 5$:

a) Calculate the force of friction acting on the object.
b) Draw a free body diagram of the forces acting on the object. Label each force with its type and amount.
c) Calculate the acceleration of the object.

Question B:

What is the work done by the net force . . .

a) from $d = 0$ to $d = 2$?
b) from $d = 2$ to $d = 4$?
c) from $d = 4$ to $d = 10$?
d) over the entire 10 second time period?

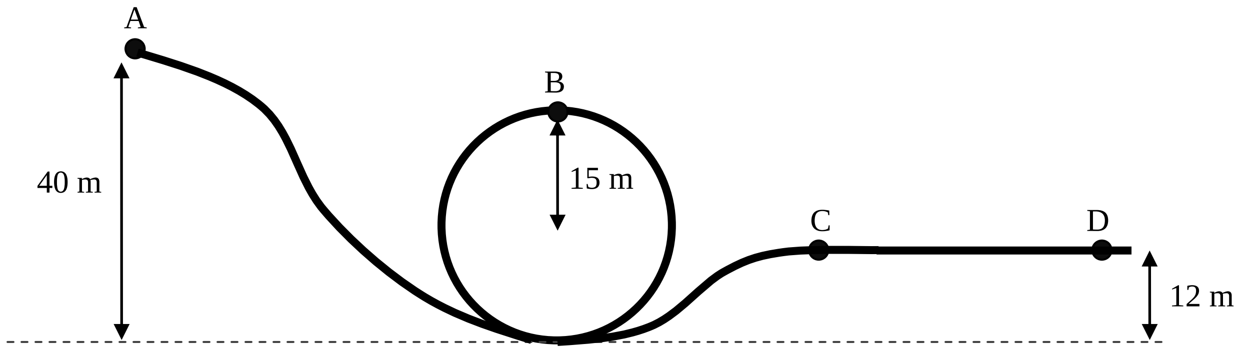
Question C:

Determine the velocity of the object at . . .

a) $d = 2$.
b) $d = 4$.
c) $d = 10$.

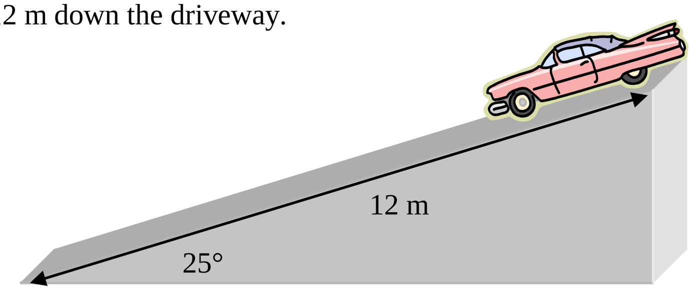
Question D:

A portion of the path of a roller coaster is shown below. The roller coaster car begins from rest at Point *A* and travels down a smooth track with no friction from Point *A* to Point *C*. Point *B* is located at the top of a circular loop of radius 15 m as shown. Determine the velocity of the roller coaster car at Point *B*.

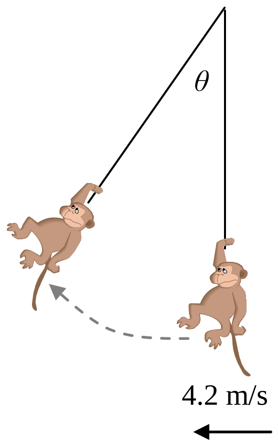


Question E:

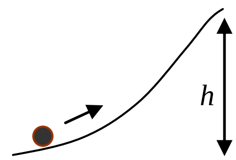
A 1500 kg car begins at rest at the top of a smooth driveway sloped at an angle of 25°. Determine the velocity of the car at the bottom of the driveway if it travels a distance of 12 m down the driveway.

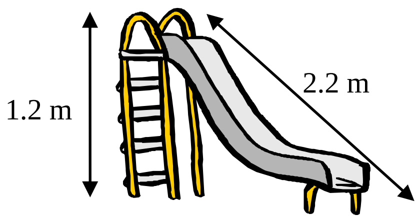


Question F:
A monkey begins with a running start and grabs on to a 2.5 m vine to swing himself upwards. Determine the maximum angle θ that the vine will reach from the horizontal if the monkey begins with an initial velocity of 4.2 m/s.



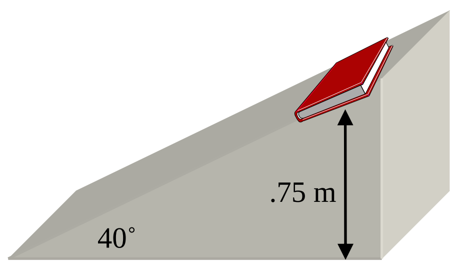
Question G:
A marble shooter is used to aim a .05 kg marble up a marble track. The marble leaves the shooter with a velocity of 3.5 m/s. As the marble shoots up the track, friction does .238 J of work on the marble. How high on the marble track does the marble travel?





Question H:
Little Johnny has a mass of 35 kg and begins at rest at a height of 1.2 m on a slide. When he reaches the bottom of the 2.2 m slide, his velocity is 3.85 m/s. Calculate the force of friction acting on Johnny.

Question I:
A .30 kg book begins at rest at a height of .75 m on a ramp inclined at 40˚. The force of friction as the book slides down the ramp is .80 N. Determine the velocity of the book when it reaches the bottom of the ramp.



Question J:
A roller coaster travels along a track as described in Question #D. From Point C to Point D, the track is horizontal and has a coefficient of friction of .70. Determine the distance from Point C to Point D if the car comes to a complete stop at Point D.

AP Physics: Short Lab 5-A

Graphs of Energy

Name ________________________ Hour ______

Lab Partners ______________________________________

Purpose:

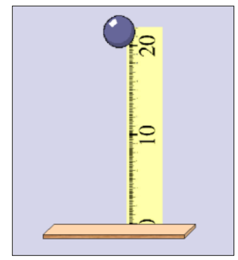
Analyze relationships between potential energy, kinetic energy, and total energy.

Equipment:

- Interactive Physics computer software

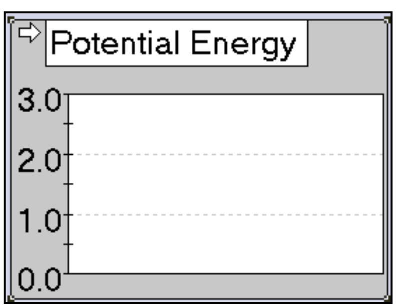
Procedures: Dropping Ball

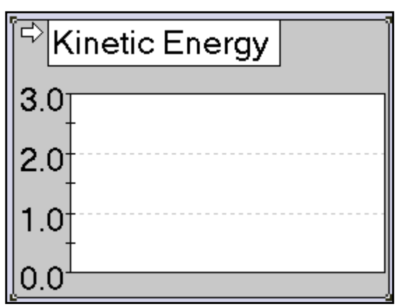
1. In the situation at right, a ball begins at a height of .20 meters above the surface of a table and is dropped to the table below. Use conservation of energy to calculate the final velocity of the ball when it reaches the surface of the table. Show your work in the space below.

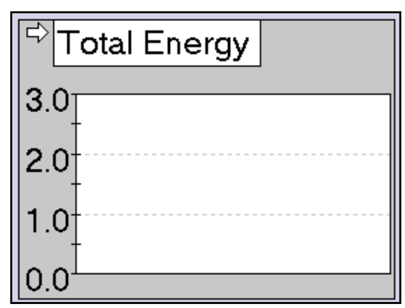


2. Open the Interactive Physics file "*Graphs of Energy (I)*". Run the simulation and observe the final velocity of the ball as it hits the table. Were your calculations for the ball's final velocity in Question #1 correct? If not, correct your calculations.

3. Run the simulation in "*Graphs of Energy (I)*" again and observe the changes in the ball's height and velocity as it falls. What do you think a graph of **Potential Energy vs. Time** would look like for the ball as it falls to the table? Sketch your prediction on the graph below. Sketch predictions for graphs of **Kinetic Energy vs. Time** and **Total Energy vs. Time** for the ball as it falls on the graphs below as well.







4. Open the Interactive Physics file "*Graphs of Energy (II)*". Run the simulation and study the graphs of **Potential Energy, Kinetic Energy, and Total Energy vs. Time**. *(NOTE: All 3 graphs are shown on the same axis. Potential Energy is shown in red, Kinetic Energy is shown in blue, and Total Energy is shown in green.)* How do the graphs compare to your predictions in Question #3? If the graphs are significantly different from your predictions, add a sketch of the actual graphs to your predictions on the graphs above.

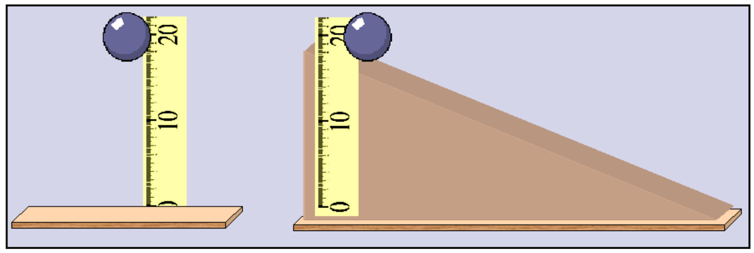
5. Use the changing height of the ball as it falls to explain the shape of the **Potential Energy vs. Time** graph. Why is the graph curved? *(HINT: You may want to use the equation* $d = d_o + v_o \cdot t + \frac{1}{2} \cdot a \cdot t^2$ *in your answer.)*

6. Use the changing velocity of the ball as it falls to explain the shape of the **Kinetic Energy vs. Time** graph. Why is the graph curved? *(HINT: You may want to use the equations* $v_f = v_o + a \cdot t$ *and* $KE = \frac{1}{2} \cdot m \cdot v^2$ *in your answer.)*

7. What is important about the shape of the **Total Energy vs. Time** graph?

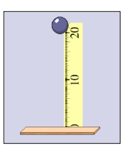
Procedures: Ball Rolling Down a Ramp

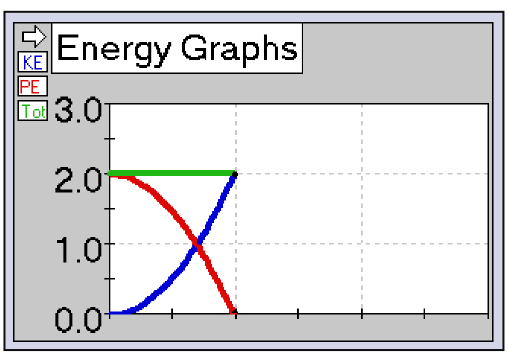
1. In the situation at right, another ball begins at a height of .20 meters above the surface of a table and rolls down a ramp to the table below. How should the ball's final velocity rolling down the ramp compare to the ball's final velocity when it is dropped from the same height?

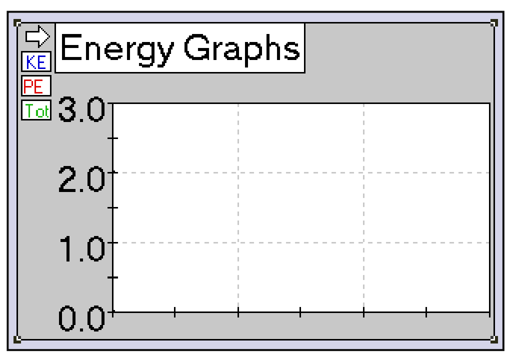


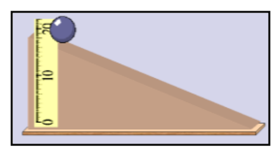
2. Open the Interactive Physics file "*Graphs of Energy (III)*". Run the simulation and observe the final velocity of both balls as they reach the table. Was your prediction in Question #1 correct? *(NOTE: The simulation will pause when the dropped ball reaches the table. Click "Run" again to continue the simulation and allow the rolling ball to finish down the ramp.)*

3. The graphs of **Potential Energy, Kinetic Energy, and Total Energy vs. Time** for the dropping ball are shown on the axis below. How do you think the graphs of **Potential Energy, Kinetic Energy, and Total Energy vs. Time** for the rolling ball on the ramp will compare? Sketch your predictions on the axis below. *(NOTE: Use different colors to show all 3 graphs together on the same axis.)*







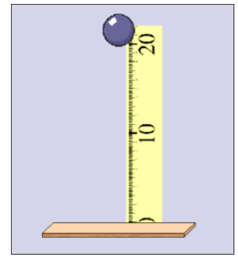


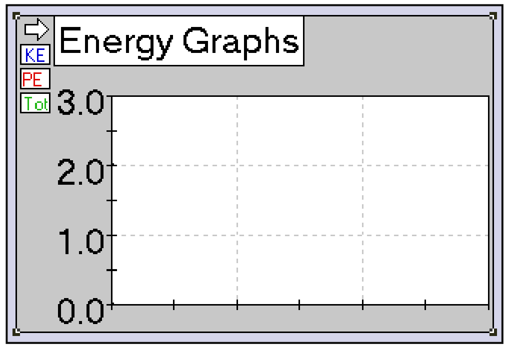
4. Open the Interactive Physics file "*Graphs of Energy (IV)*". Run the simulation and study the graphs of **Potential Energy, Kinetic Energy, and Total Energy vs. Time**. *(NOTE: All 3 graphs are shown on the same axis. Potential Energy is shown in red, Kinetic Energy is shown in blue, and Total Energy is shown in green.)* How do the graphs compare to your predictions in Question #3? If the graphs are significantly different from your predictions, add a sketch of the actual graphs to your predictions on the graphs above.

5. How does the addition of the ramp affect the shape of the **Potential Energy, Kinetic Energy, and Total Energy vs. Time** graphs?

Procedures: Bouncing Ball and Other Graphs

1. In the situation at right, a ball begins at a height of .20 meters above the surface of a table and is dropped to the table below. Then it bounces off of the table without any loss of energy (which would be a highly unlikely situation in reality.) What do you think the graphs of **Potential Energy, Kinetic Energy, and Total Energy vs. Time** for the bouncing ball will look like? Sketch your predictions on the axis below. *(NOTE: Use different colors to show all 3 graphs together on the same axis.)*





2. Open the Interactive Physics file "*Graphs of Energy (V)*". Run the simulation and study the graphs of **Potential Energy, Kinetic Energy, and Total Energy vs. Time**. *(NOTE: All 3 graphs are shown on the same axis. Potential Energy is shown in red, Kinetic Energy is shown in blue, and Total Energy is shown in green.)* How do the graphs compare to your predictions in Question #1? If the graphs are significantly different from your predictions, add a sketch of the actual graphs to your predictions on the graphs above.

3. The Interactive Physics file "*Graphs of Energy (VI)*" shows graphs of **Potential Energy, Kinetic Energy, and Total Energy vs. Time** for a variety of situations. Open the file and run the simulation. How are all of the graphs similar to each other? How are they different?

AP Physics: Short Lab 5-B

Velocity of a Dart Gun

Name ________________________ Hour _______

Lab Partners ____

Purpose:

Calculate the initial velocity of a dart, using conservation of energy.

Equipment:

Dart gun & corresponding dart
Meter stick or 2-meter stick

Procedures:

1. If possible, obtain the same dart gun used in Lab 2-B and 3-A. Shoot the dart straight up into the air, using the stairwell for additional height if needed. Measure the maximum height achieved by the dart.

2. Use conservation of energy to calculate the initial velocity of the dart.

3. Calculate the velocity of the dart when it is at a height of .50 m.

Summary:

1. Why is the mass of the dart not required to complete this lab?

2. Do any outside forces do work on the dart as it is in flight? Do you think any such forces affect your answers? Explain.

AP Physics: Short Lab 5-C

Muscle Up

Name ________________________ Hour ______

Lab Partners ____

Purpose:

To calculate the work done and power exerted while lifting weights.

Equipment:

Meter Stick
Weights
Stopwatch

Procedures:

1. Decide what measurements are required to determine the work that you do and power exerted as you complete 10 arm curls at a constant velocity. In the space below, record all measurements taken and show each step of your calculations, including any equations used. *(HINT: You may use the conversion factor 1 lb = 4.45 N)*

Summary:

1. Suppose you lifted weights at a faster rate. Would the work done be affected? Would the power exerted be affected? Explain your answers.

2. Suppose that Phil the Physics student lifts a mass of 5 kg. Calculate the net force required for Phil to accelerate the mass upwards at a rate of 1.0 m/s^2 as he does an arm curl. How much applied force would Phil need to provide in order to cause this acceleration? Draw a free body diagram to support your answer.

3. Use your calculations from Question #2 to explain why it is important to lift weights at a constant velocity when you measure work. How would your measurements for work be affected if you accelerated as you lifted weights?

![AP Physics Demos:]

Chapter 5

Name ______________________________

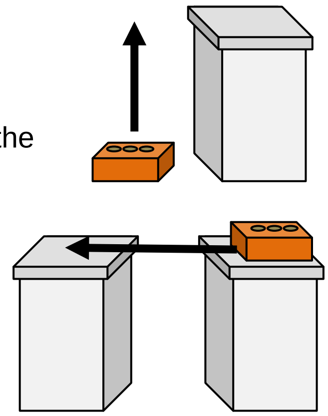
Hour _________

Demo: *Work on a Brick*

Equipment:

Brick

Procedures/Analysis:



1. Set the brick on the floor near a lab table. Have one member of your group lift the brick from the floor directly upwards to the top of the lab table.

2. Leave the brick on top of the lab table. Have another member of your group carry the brick from the top of the lab table to the top of another lab table. Who do you think did more work carrying the brick? Explain your answer.

3. What do you think it means to "do work" in Physics?

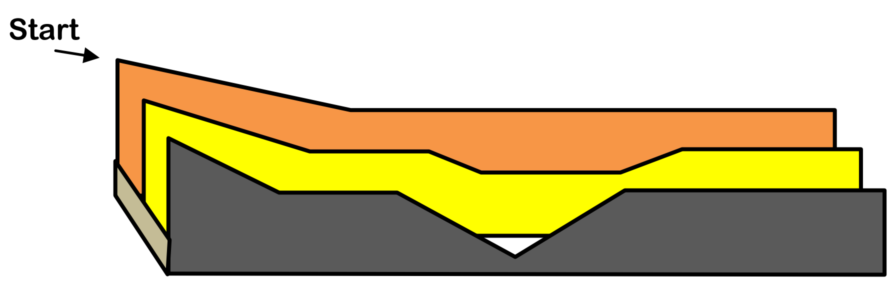
Demo: *Energy of Marbles and Hot Wheels Cars*

Equipment:

Hot Wheels Track
Marbles
Hot Wheels Cars

Procedures/Analysis:

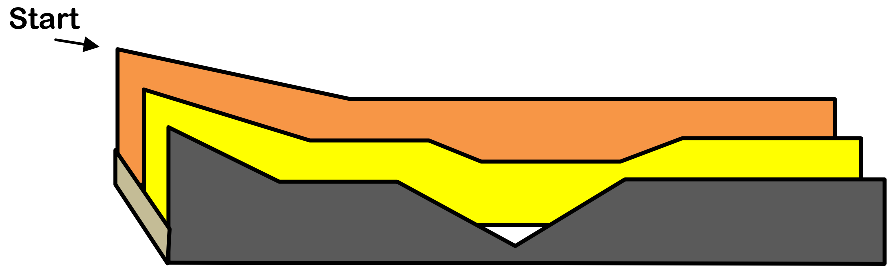
1. Position 3 marbles at the top of each of the 3 tracks, as shown at right. Release the marbles and observe their final positions on or off of the tracks. Do any of the marbles make it to the end of the tracks? If so, which ones? If not, mark the final position of the marbles on the diagram at right.



2. Should the marbles reach the ends of the tracks if potential energy and kinetic energy only are considered in conservation of energy? Why or why not?

Demo: *Energy of Marbles and Hot Wheels Cars (cont)*

3. Position 3 Hot Wheels cars at the top of each of the 3 tracks, as shown at right. Release the cars and observe their final positions on or off of the tracks. Do any of the cars make it to the end of the tracks? If so, which ones? If not, mark the final position of the cars on the diagram at right.



4. Should the cars reach the ends of the tracks if potential energy and kinetic energy only are considered in conservation of energy? Why or why not?

5. Can potential and kinetic energy only explain the behavior of the Hot Wheels cars? How does the presence of friction on the Hot Wheels cars cause them to behave differently on the tracks than the marbles?