



Science Log – 5th

Topic: Force Motion Energy

Learning Goals:

1. Identify the forces that cause an object's motion.
2. Plan and conduct an investigation to determine the effect of friction on a moving object.
3. Construct a roller coaster model that allows you to identify points of kinetic and potential energy.

Topic: _____

K What do you already know about the topic?	W What do you want to know about the topic?	L What did you learn about the topic?

Vocabulary

Qualitative Data	Data that can be observed—descriptions.
Quantitative Data	Data that can be measured—numbers.
Speed	Describes how fast an object is moving.
Kinetic Energy	Energy of motion.
Potential Energy	Energy of position.
Force	Any push or pull that causes an object to move, stop, or change speed or direction.
Friction	The resistance to motion created by two objects moving against each other.
Inertia	Resistance to a change in motion.
Newton's First Law	An object at rest will remain at rest, and an object moving at a constant velocity will continue moving at a constant velocity, unless it is acted upon by an unbalanced force.
Equilibrium	When the net force on an object is zero. An object is in equilibrium if it is at rest or moving at a constant velocity.



Science Log – 5th

Roller Coaster

Supplies: roller coaster pieces printout, tape, scissors, marble, pencil, (optional: corrugated cardboard, ruler)

Prep Work:

- I. Before you try building an entire roller coaster, practice building the individual track segments. If you have the colored printouts, cut out the pieces and follow the folding instructions. If you do not have the colored printouts, follow the instructions below to draw, cut, and fold your pieces.

To build a straight segment (**Pink Paper**):

- a. Cut a 7.5 cm (3 inch) wide strip of paper.
- b. Draw two parallel lines that divide it into three 2.5 cm-wide strips.
- c. Fold the two sides up 90 degrees along those lines to form walls.

To build a loop or a hill (**Green & Blue Paper**):

- a. Cut a 7.5 cm (3 inch) wide strip of paper.
- b. Draw two parallel lines that divide it into three 2.5 cm-wide strips.
- c. Make marks every 2.5 cm along the long edges of the paper.
- d. Cut inward 2.5 cm from these marks to form tabs.
- e. Fold the tabs up 90 degrees.
- f. Bend the track into the shape you want, and tape the tabs together to hold it in place. This step is easier with two people, one to hold the track in place and one to do the taping.

To build a curve (**Orange Paper**):

- a. Cut a 7.5 cm (3 inch) wide strip of paper.
- b. Draw two parallel lines that divide it into three 2.5 cm-wide strips.
- c. Make marks every 2.5 cm along one long edge of the paper.
- d. Cut inward 5 cm (2 inches) from these marks.
- e. Fold up the uncut side of the paper 90 degrees to form a wall.
- f. Fold up the tabs on the other side to form the other wall.
- g. Since the bottom portion of the track is cut into segments, you can bend it horizontally to form a curve. Tape the tabs together to hold the curve in place.

To build a support strut (**Yellow Paper**):

- a. Cut a 6.25 cm (2.5 inch) wide strip of paper.
- b. Draw four parallel lines that divide it into five 1.25 cm (0.5 inch) wide strips.
- c. Cut inward 2.5 cm along these lines from one edge.
- d. Fold along the lines to form a square shape (so two of the segments overlap), and use tape to hold in place.
- e. Fold the tabs you cut at the end outward. This will allow you to tape the tabs flat to a piece of cardboard, so your strut can stand upright.



Science Log – 5th

Directions:

1. Before you start building, plan out a design for your roller coaster. Draw your design on paper. Figure out how many supports and pieces of track you will need.

First Coaster Design

Coaster Redesign



Science Log – 5th

- Using a piece of corrugated cardboard as a base, assemble your track according to your plan. Tape the track segments together end-to-end to connect them.
- Place the marble at the top of your track and let it go. Watch carefully.

What happens? Does it make it the whole way through the track?

- If the marble made it the whole way to the end, try making your track longer by adding more pieces. If the marble did not make it the end of track without falling off, make some redesign corrections to your track and try again.

How long can you make your track before the marble comes to a stop?

What changes did you make to your track? Why?

- Once you have a successful coaster, label the drawing of your roller coaster with the following scientific terms.

Maximum Kinetic Energy	Maximum Potential Energy
Friction	Force of Gravity (use arrow pointing in the direction)

- If your marble didn't make it to the end, try to figure out why. Is there a spot in your track where the marble got stuck? Was the marble going too slow to make it through a loop? If necessary, make changes to your design, like making the curves more gradual or the starting hill taller, and try again.



Science Log – 5th

Inertia Tower

Supplies: 3-4oz. paper cups, index cards (3x5), string, (optional: hole punch)

Set-up: Stack the cups upside down in a tower formation, placing a notecard in between each cup.

Directions:

1. Starting at the top, remove the first notecard with a swift pull directly backwards. Avoid pulling at an angle.
2. Continue removing the cards in this fashion from top to bottom one at a time without causing enough of a disturbance to the tower's equilibrium to cause it to tumble.
3. Observe how the cup's inertia keeps them in a stack. When done correctly, each cup will fall onto the one below.
4. If the tower falls before you are able to successfully pull each card out, reset the cups and cards and try again.

