

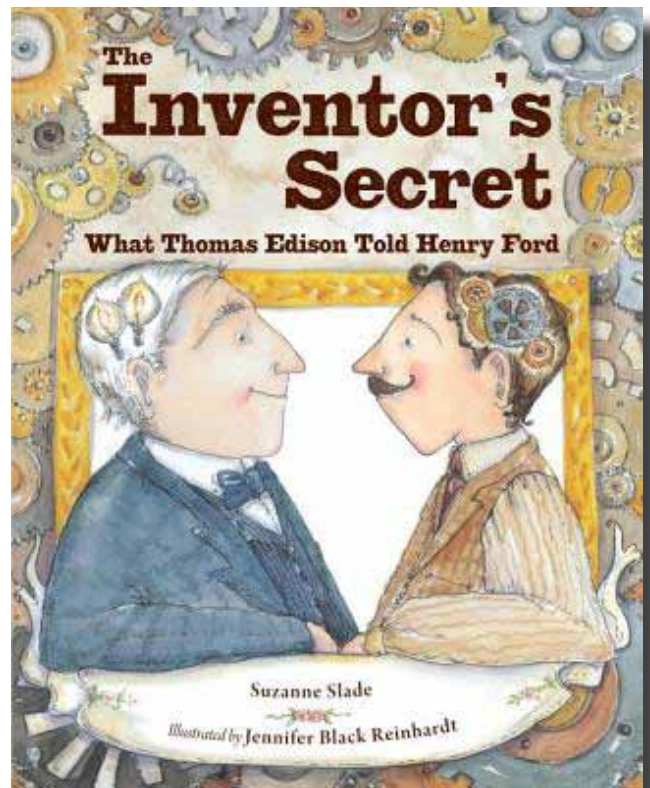
A STEM & Common Core
State Standards–Aligned
Activity and Project Guide for

The Inventor's Secret

What Thomas Edison Told Henry Ford

ISBN: 9781580896672

Grades: K-2



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Illustrated by Jennifer Black Reinhardt

 **Charlesbridge**

Synopsis: Both Thomas Edison and Henry Ford started off as insatiably curious tinkerers. That curiosity led them to become inventors—with very different results. As Edison invented hit after commercial hit, gaining fame and fortune, Henry struggled to make a single invention (an affordable car) work. Witnessing Thomas's glorious career from afar, a frustrated Henry wondered about the secret to his success.

Guide Created by Debbie Gonzales





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The Scientific Method - Go Fish

Objective: To comprehend the sequential steps of the Scientific Method.

Materials:

- Scientific Method Game Cards (Guide, pgs. 4-5)
- Scientific Method Game Cards Answer Guide (Guide, pg. 6)
- Cardstock
- Scissors

Procedure:

- Print Game Cards on cardstock. Use scissors to trim around the Game Card borders.
- Discuss the steps of the Scientific Method. Use Game Cards as references while doing so. Explain the Scientific Method is a way inventors like Ford and Edison conduct the necessary research required to engineer their ideas.
- Define and discuss each step of the Scientific Method. Use Game Cards as references while doing so.

Step 1 – Make an Observation: Discover a need or problem.

Step 2 – Ask a Question: Define the problem or issue you wish to resolve.

Step 3 – State a Hypothesis: Determine how you think your questions should be answered.

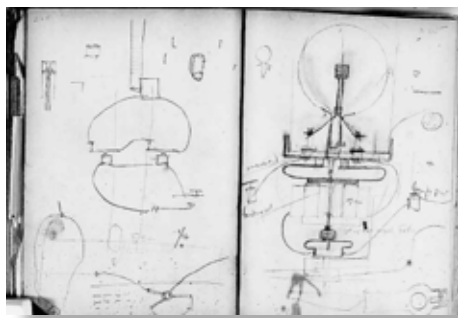
Step 4 – Conduct an Experiment: Test your hypothesis through experimentation.

Step 5 – Analyze the Results: Analyze the data you have collected during the experiment.

Step 6 – Make a Conclusion: Accept or reject your hypothesis.

To Play the Game:

- Note that there are 6 cards labeled by Scientific Method steps and 6 cards labeled with the definitions of each step.
- Place all cards face down on a table top.
- Instruct child to turn over two cards. The intent is to match a Scientific Method label with the corresponding definition card.
- If a match has been made, the child may keep the cards and have another turn.
- If no match has been made, the child must return the cards face down on the table top.
- The game is over when all cards have been matched, the winner being the child who has made the most matches.



Drawings from Edison's notebook. Predict which step of the Scientific Method he was considering. Explain your answer.



The Scientific Method - Go Fish Game Cards



Scientific
Method
Card

Step One

Scientific
Method
Card

Step Two

Scientific
Method
Card

Step Three

Scientific
Method
Card

Step Four

Scientific
Method
Card

Step Five

Scientific
Method
Card

Step Six





Make an Observation

Discover a need or a problem.




Ask a Question

Define a problem.



Make a Hypothesis

Determine how question will be answered.




Conduct an Experiment

Test your hypothesis through experimentation.



Analyze the Results

Analyze data collected during the experiment.









Make a Conclusion

Accept or reject your hypothesis.





The Scientific Method - Go Fish Game Cards Answers

<p>Scientific Method Card</p> <p>Step One</p>	<p>Make an Observation</p> <p><i>Discover a need or a problem.</i></p> 
<p>Scientific Method Card</p> <p>Step Two</p>	<p>Ask a Question</p> <p><i>Define a problem.</i></p> 
<p>Scientific Method Card</p> <p>Step Three</p>	<p>Make a Hypothesis</p> <p><i>Determine how question will be answered.</i></p> 
<p>Scientific Method Card</p> <p>Step Four</p>	<p>Conduct an Experiment</p> <p><i>Test your hypothesis through experimentation.</i></p> 
<p>Scientific Method Card</p> <p>Step Five</p>	<p>Analyze the Results</p> <p><i>Analyze data collected during the experiment.</i></p> 
<p>Scientific Method Card</p> <p>Step Six</p>	<p>Make a Conclusion</p> <p><i>Accept or reject your hypothesis.</i></p> 





Flashlight Brightness - An Experiment

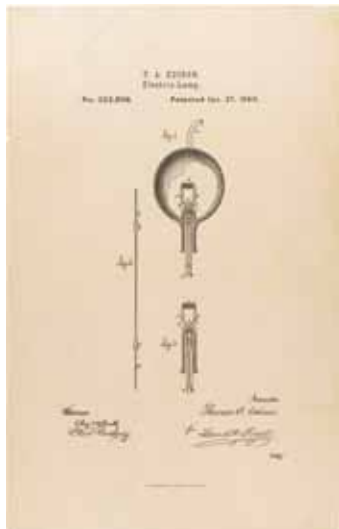
Objective: To apply the Scientific Method as a basis for observation and experimentation with energy transfer.

Materials:

- Step-by-Step Experiment Set Up Procedure (Guide, pg. 8-9)
- Flashlight Brightness Experimentation Documentation Form (Guide, pg. 10)
- index card
- two brass brads
- one metal paper clip
- tape
- 22 gauge solid hookup wire
- 9 volt battery
- piece of cardstock
- flashlight bulbs
- flashlight base
- needle-nose pliers
- writing materials

Procedure:

- Follow the instructions listed on the **Step-by-Step Experiment Set Up Procedure**. These steps serve as a foundation for the students' observation and experimentation.
- Instruct students to follow the steps and answer the questions listed on the **Flashlight Brightness Experimentation Documentation Form** on a separate sheet of paper. Students are required to answer all of the questions as they work through the experiment.
- Instruct students to present their findings orally and/or by writing an informative paper.



Observe this drawing of Edison's incandescent lightbulb.

Compare it with the flashlight bulbs used in the experiment. State ways that the two are the same.

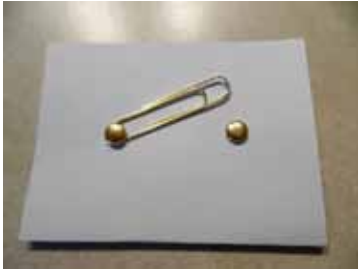
Contrast the drawing with the bulbs used in the experiment. List ways that the two are different.





Step-By-Step Experiment Set-Up Procedure - Flashlight Brightness

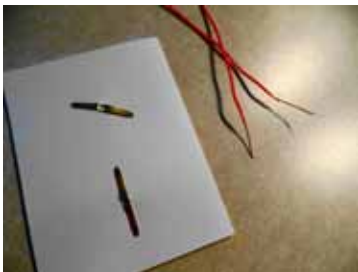
Make an Index Card Switch



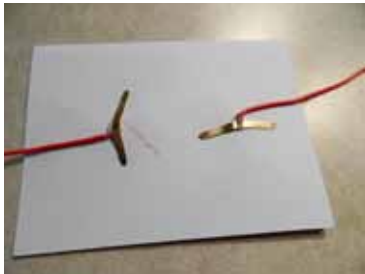
Step 1) Fold index card in half lengthwise.

Step 2) Measure length of paper clip.

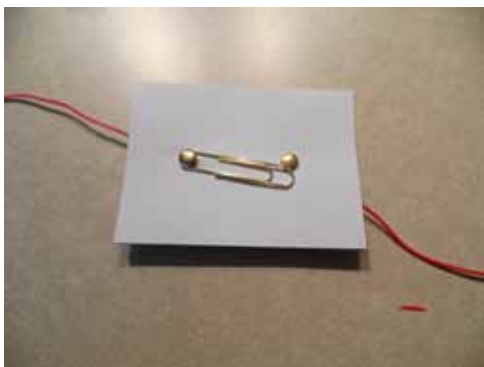
Step 3) Insert brads at each point as shown.



Step 4) Strip rubber coating from two pieces of wire.



Step 5) On the back of the index card, attach wire to brad fasteners.

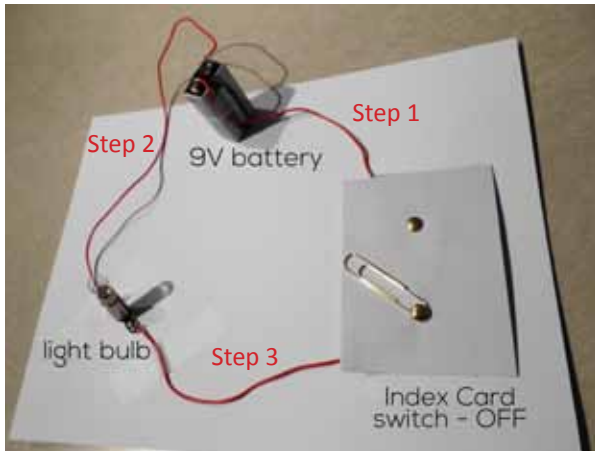


Your index card switch is ready to be placed on the cardstock switch board.





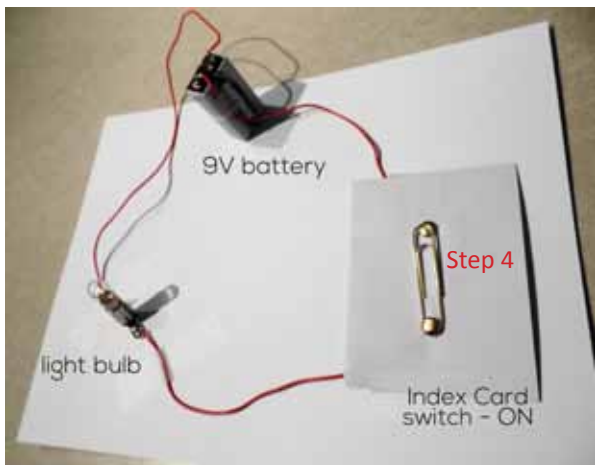
Make a Cardstock Switch Board



Step 1) Connect one piece of wire from the brad fastener on the **Index Card Switch** to one 9V battery clip.

Step 2) Connect a separate piece of wire from the other battery clip to one arm of the flashlight base.

Step 3) Connect a separate piece of wire from the other arm of the flashlight base to the alternate brad fastener on the **Index Card Switch**.



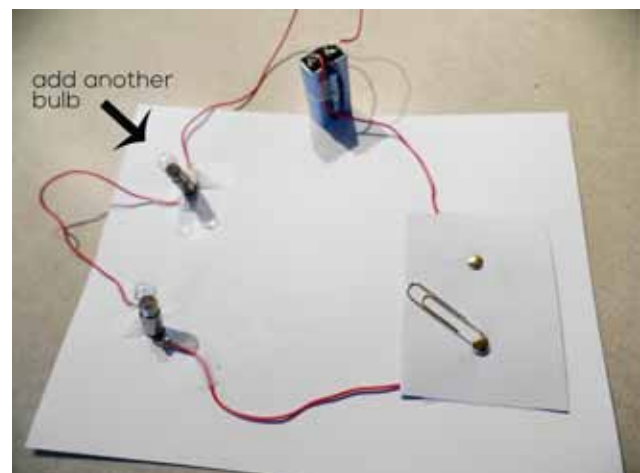
Step 4) Cause lightbulb to glow by moving paper clip switch to connect brads.

At this point, respond to Step One on the **Flashlight Brightness Experiment Documentation Form**. Record your observations. Describe the process of creating light. Explain how electric energy travels through the connections you have created.

Based on your observations made during the first phase of experiment, how do you think that wiring an additional flashlight bulb in the series would effect the brightness of the light in both bulbs?

Would the bulbs glow brighter? Dimmer? Or would the quality of light remain the same?

Use this consideration to formulate a hypothesis and test it using the Scientific Method!





Flashlight Brightness Experiment Documentation

Note: Record your findings on a separate sheet of paper or in your science journal.

Step One - Observation Notes:

List details observed when connecting the switch and the single flashlight bulb.
Describe the process of creating light. Explain how you think it works.

Step Two - Question: Does wiring an additional flashlight bulb in the series affect the brightness of the light?

This question is the basis for the experiment.
Consider this question. Use it to formulate your hypothesis.

Step Three - Hypothesis:

Make a prediction. Tell what you think will happen when additional lightlight bulbs are wired together in a series. State your prediction clearly in a complete sentence.

Step Four - Conduct Experiment:

Test your hypothesis through experimentation.
Make notes of your observations as you proceed through the experiment.

Step Five - Analyze Results:

Describe what you noticed or observed.
Explain how you think it works.
Justify your reasoning. Describe the evidence for the observable results.
Consider any aspects of the experiment that could be altered, thus causing a different

Step Six - Make a Conclusion:

Return to your hypothesis. Accept it or reject it.
Explain the basis of your conclusion.





A Slingshot Car - An Experiment

Objective: Through observation and discovery, consider how best to optimize a design solution.

Materials:

- Step-by-Step Experiment Set Up Procedure - Slingshot Car (Guide, pgs. 12-13)
- A Slingshot Car Experimentation Documentation Form (Guide, pg. 14)
- small and large wooden craft sticks
- four wheels (removed from old toy car)
- two plastic drinking straws
- 2 pieces of wooden dowel (the diameter must be small enough to fit loosely inside the drinking straws)
- craft glue or hot glue gun (adult supervision advised)
- 1 small paper clip
- duct or masking tape
- 2 rubber bands (one short one and one long one)
- needle-nose pliers
- writing materials



Procedure:

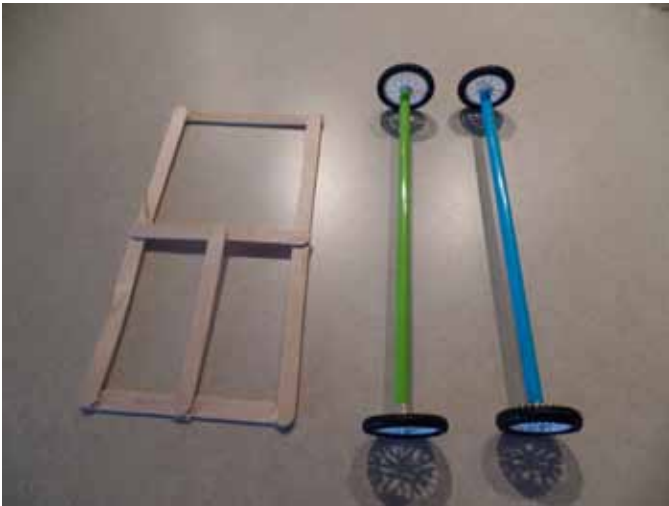
- Follow the instructions listed on the **Step-by-Step Experiment Set Up Procedure**. These steps serve as a foundation for the students' observation and experimentation.
- Instruct students to follow the steps and answer the questions listed on the **Slingshot Car Experimentation Documentation Form** and a separate sheet of paper. Students are required to answer all of the questions as they work through the experiment.
- Instruct students to present their findings orally and/or by writing an informative paper.

Reference: "Slingshot Cars." [Instructables.com](http://www.instructables.com/id/Slingshot-Cars/). Web. 30 Mar. 2015. <http://www.instructables.com/id/Slingshot-Cars/>





Step-By-Step Experiment Set Up Procedure - The Slingshot Car



Step 1) Construct rectangular chassis frame by gluing the ends of 6 craft sticks together.

Step 2) Secure frame by gluing a craft stick across the center of the rectangular chassis.

Step 3) Glue a craft stick at the middle of one half of the frame.

Step 4) Secure one end of the dowel to one wheel.

Step 5) Slip straw over dowel, forming an axel.

Step 6) Secure wheel to the end of the dowel axel.



Step 7) Use needle-nosed pliers to create a paperclip slingshot hook.

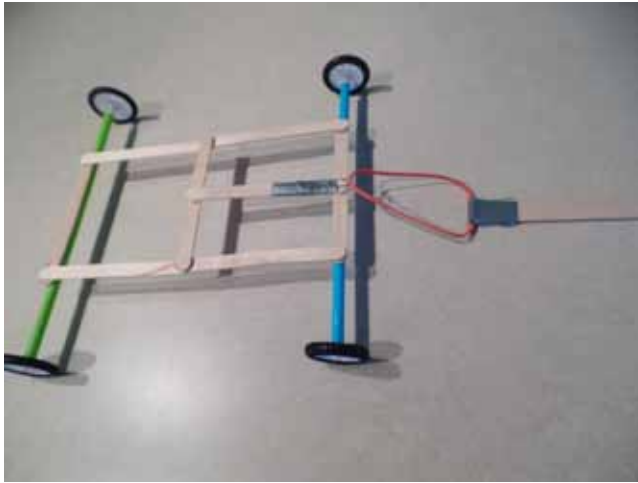


Step 8) Use tape to secure clip slingshot hook to frame.



Step 9) To make the slingshot, secure a piece of tape cut the width of a large craft stick the the of the stick. Place rubber band at tip of stickstick. Fold tape over rubber band to affix to craft stick.



**To send Slingshot Car in motion:**

- 1) Hold the back axel with thumb and forefinger-tip.
- 2) Hold the slingshot with the other hand and gently stretch the rubber band.
- 3) Carefully stretch the slingshot stick and release the axel.
- 4) Watch that Slingshot Car go!

.....

Question: Does the length of the rubber band secured to the sling shot affect the distance and speed that the Slingshot Car travels?



What do you think would happen when either of these slingshots are used to propel the car?

Which will cause the car to go faster?

Slower?

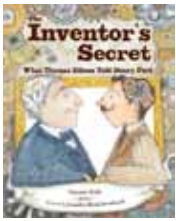
Farthest?

Or, do you think that the length of the rubber band will not optimize the design of the Slingshot Car at all?

Use your observations to create a hypothesis. Test your hypothesis using the Scientific Method.

Ready? Get set! Go, go , GO!





The Slingshot Car Experiment Documentation

Note: Record your findings on a separate sheet of paper or in your science journal.

Step One - Observation Notes:

List details observed when constructing the Slingshot Car.
Explain the process of creating motion. Describe how you think it works.

Step Two - Question: Does the length of the rubber band secured to the slingshot affect the distance and speed that the Slingshot Car travels?

This question is the basis for the experiment.
Consider this question. Use it to formulate your hypothesis.

Step Three - Hypothesis:

Make a prediction. Tell what you think will happen when rubberbands of different lengths are used to propel the slingshot. State your prediction clearly in a full sentence.

Step Four - Conduct Experiment:

Test your hypothesis through experimentation.
Make notes of your observations as you proceed through the experiment.

Step Five - Analyze Results:

Describe what you noticed or observed.
Explain how you think it works.
Justify your reasoning. Describe the evidence for the observable results.
Consider any aspects of the experiment that could be altered, thus causing a different

Step Six - Make a Conclusion:

Return to your hypothesis. Accept it or reject it.
Explain the basis of your conclusion.





A Four Stroke Cylinder Flip Book

Objective: To illustrate the connection between scientific ideas and technical procedures in the text.

Materials:

- The Four Stroke Cylinder Flip Book print out (Guide, pgs. 16-17)
- scissors
- stapler

Procedure:

- Print **The Four Stroke Cylinder Flip Book** print out pages.
- Use scissors to trim around the borders of each flip book page.

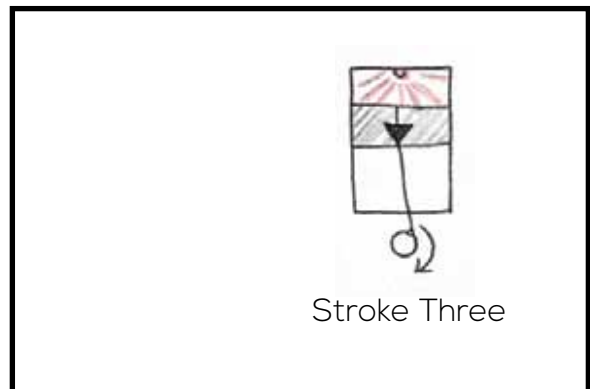
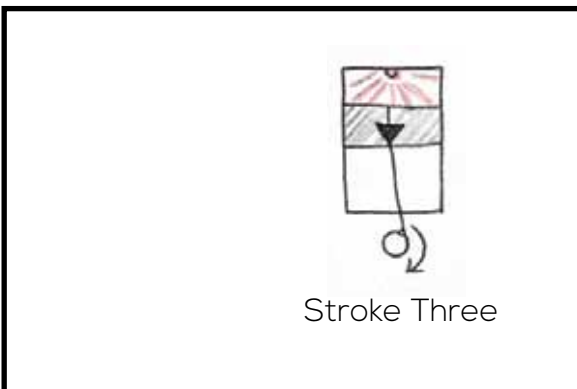
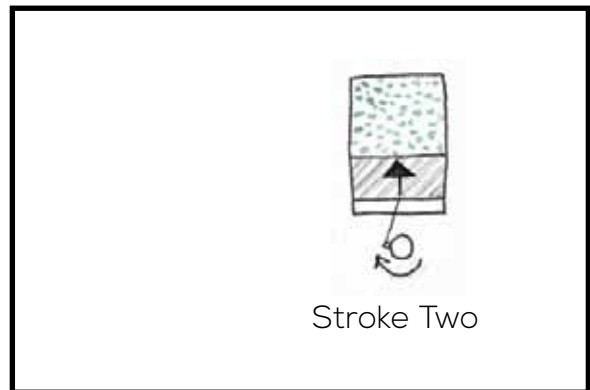
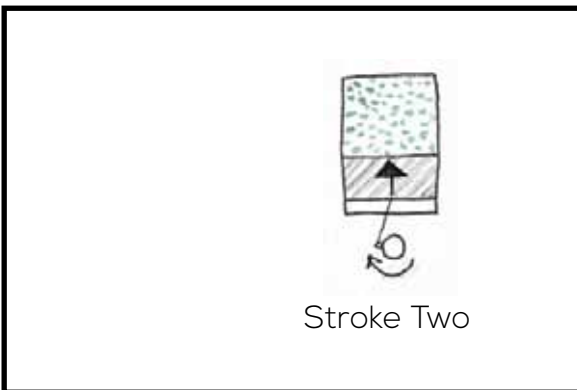
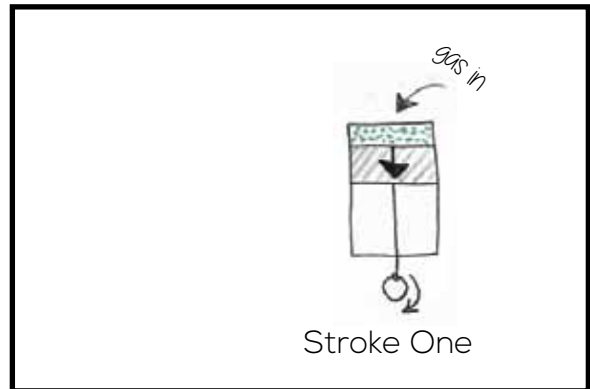
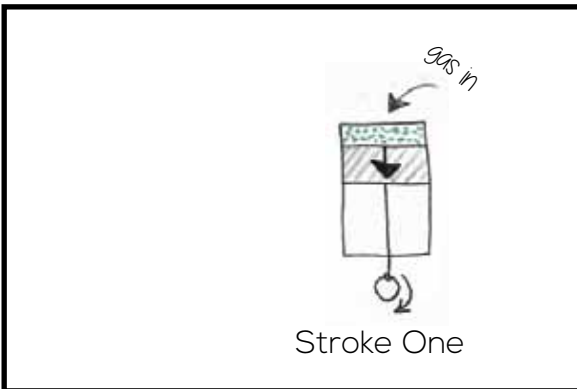
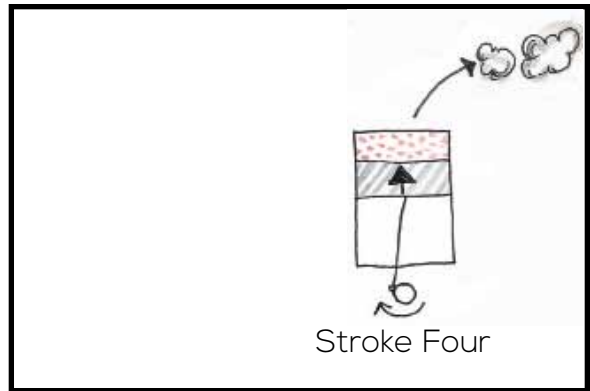
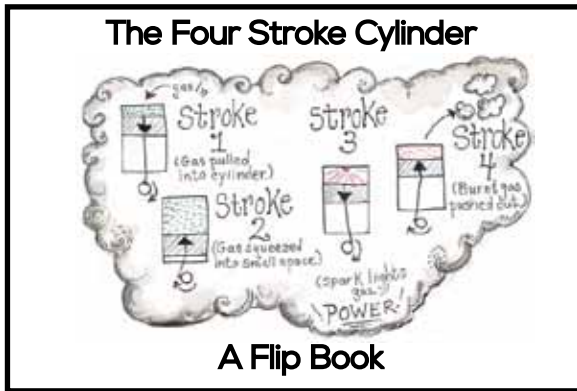


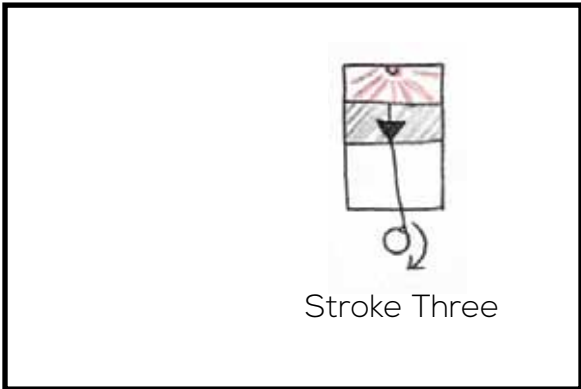
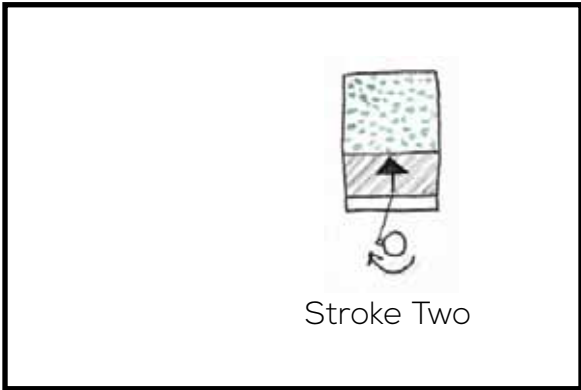
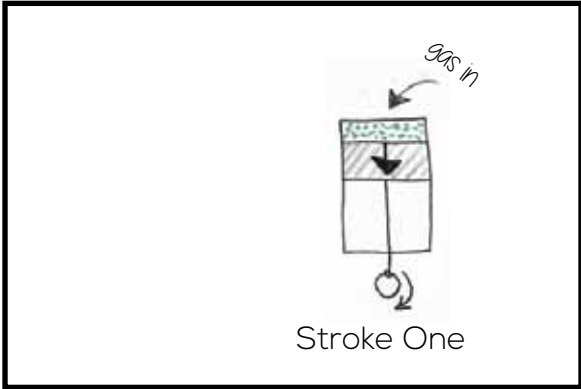
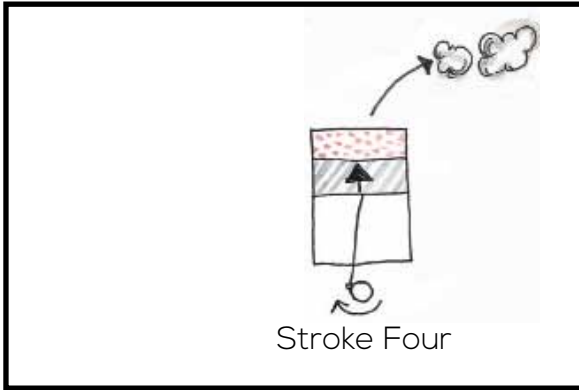
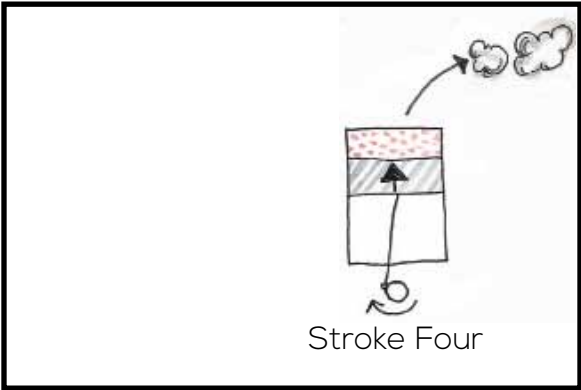
- Layout flip book pages in the four stroke numeric sequence.



- Create book by stacking pages in the four stroke numeric sequence. Place the Henry Ford picture at the end of the book.
- Use stapler to secure pages together at the far left of the book.
- Flip through the pages. Enjoy the piston action!









Inventor's Secret Bingo

Objective: To connect with the inventions and major events in the story in a game-like manner.

Materials:

- *The Inventor's Secret: What Thomas Edison Told Henry Ford*
- Cardstock
- Scissors
- Inventor's Secret Bingo Board (Guide, pg. 19)
- Inventor's Secret Game Cards (Guide, pg. 20)
- Inventor's Secret Answer Sheet (Guide, pg. 21)
- Nine game pieces (pennies, buttons, beans, etc) per player

Procedure:

- Depending on how many players will be competing, print 2 to 4 **Inventor's Secret Bingo Boards** on cardstock.
- Print double copies of **Inventor's Game Cards**.
- Use scissors to trim around the borders of the game board and the cards.
- To play the game, mix up game cards and stack them, face down.
- Each player manages their own game board and collection of game pieces. Players are also free to refer to the *Inventor's Secret: What Thomas Edison Told Henry Ford* for clarification.
- A player begins by choosing a card from the top of the stack. If the card matches a space on their board, they may mark the match with a game piece.
- Return card face down near original stack.
- As the game continues, a player loses a turn if they choose a card that has already been covered on their board.
- The winner has either blocked out 3 spaces in a row or covered all of the spaces, depending how the players decide they'd like to play.
- Description can be verified using the **Inventor's Secret: What Thomas Edison Told Henry Ford Bingo Answer Sheet**.





Inventor's Secret Bingo Game Board





Inventor's Secret Bingo Cards

Edison's Lightbulb	Keep at it!
The Electric Pen	The Four Stoke Cylinder
The Phonograph	The Model T
The Model A	The Model N
The Model B	





Inventor's Secret Bingo Answer Sheet



Keep at it!



The Four Stoke Cylinder



The Model T



The Model N



The Model B



The Model A



The Phonograph

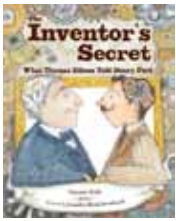


The Electric Pen



Edison's Lightbulb





Common Core State Standards Alignment

English Language Arts Standards › Reading: Informational Text

		Go Fish	Flashlight Brightness	Slingshot Car	Flip Book	Bingo
CCSS.ELA-Literacy.RI.K.1	With prompting and support, ask and answer questions about key details in a text.					✓
CCSS.ELA-Literacy.RI.K.3	With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.					✓
CCSS.ELA-Literacy.RI.K.7	With prompting and support, describe the relationship between illustrations and the text in which they appear (e.g., what person, place, thing, or idea in the text an illustration depicts).				✓	✓
CCSS.ELA-Literacy.RI.K.10	Actively engage in group reading activities with purpose and understanding.	✓	✓	✓	✓	✓
CCSS.ELA-Literacy.RI.1.1	Ask and answer questions about key details in a text.		✓	✓		✓
CCSS.ELA-Literacy.RI.1.3	Describe the connection between two individuals, events, ideas, or pieces of information in a text.					✓
CCSS.ELA-Literacy.RI.1.6	Distinguish between information provided by pictures or other illustrations and information provided by the words in a text.		✓	✓	✓	✓
CCSS.ELA-Literacy.RI.1.7	Use the illustrations and details in a text to describe its key ideas.		✓		✓	✓
CCSS.ELA-Literacy.RI.1.10	With prompting and support, read informational texts appropriately complex for grade 1.	✓	✓	✓	✓	✓
CCSS.ELA-Literacy.RI.2.3	Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.	✓	✓	✓	✓	
CCSS.ELA-Literacy.RI.2.7	Explain how specific images (e.g., a diagram showing how a machine works) contribute to and clarify a text.				✓	
CCSS.ELA-Literacy.RI.2.10	By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 2-3 text complexity band proficiently, with scaffolding as needed at the high end of the range.	✓	✓	✓	✓	✓





English Language Arts Standards › Writing

		Go Fish	Flashlight Brightness	Slingshot Car	Flip Book	Bingo
CCSS.ELA-Literacy.W.K.2	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.		✓	✓		
CCSS.ELA-Literacy.W.1.2	Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.		✓	✓		
CCSS.ELA-Literacy.W.1.7	Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).		✓	✓		
CCSS.ELA-Literacy.W.2.2	Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.		✓	✓		
CCSS.ELA-Literacy.W.2.8	Recall information from experiences or gather information from provided sources to answer a question.		✓	✓		

English Language Arts Standards › Speaking & Listening

CCSS.ELA-Literacy.SL.K.1	Participate in collaborative conversations with diverse partners about <i>kindergarten topics and texts</i> with peers and adults in small and larger groups.	✓	✓	✓	✓	✓
CCSS.ELA-Literacy.SL.K.2	Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood.	✓	✓	✓	✓	✓
CCSS.ELA-Literacy.SL.K.4	Describe familiar people, places, things, and events and, with prompting and support, provide additional detail.	✓	✓	✓	✓	✓
CCSS.ELA-Literacy.SL.K.5	Add drawings or other visual displays to descriptions as desired to provide additional detail.		✓	✓	✓	
CCSS.ELA-Literacy.SL.K.6	Speak audibly and express thoughts, feelings, and ideas clearly.	✓	✓	✓	✓	✓





English Language Arts Standards › Speaking & Listening (cont.)

		Go Fish	Flashlight Brightness	Slingshot Car	Flip Book	Bingo
CCSS.ELA-Literacy.SL.1.1	Participate in collaborative conversations with diverse partners about <i>grade 1 topics and texts</i> with peers and adults in small and larger groups.	✓	✓	✓	✓	✓
CCSS.ELA-Literacy.SL.1.2	Ask and answer questions about key details in a text read aloud or information presented orally or through other media.	✓	✓	✓	✓	✓
CCSS.ELA-Literacy.SL.1.4	Describe people, places, things, and events with relevant details, expressing ideas and feelings clearly.	✓	✓	✓	✓	✓
CCSS.ELA-Literacy.SL.1.5	Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.		✓	✓	✓	
CCSS.ELA-Literacy.SL.1.6	Produce complete sentences when appropriate to task and situation.	✓	✓	✓	✓	✓
CCSS.ELA-Literacy.SL.2.1	Participate in collaborative conversations with diverse partners about <i>grade 2 topics and texts</i> with peers and adults in small and larger groups.	✓	✓	✓	✓	✓
CCSS.ELA-Literacy.SL.2.2	Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.	✓	✓	✓	✓	✓





Next Generation Science Standards

Physical Science

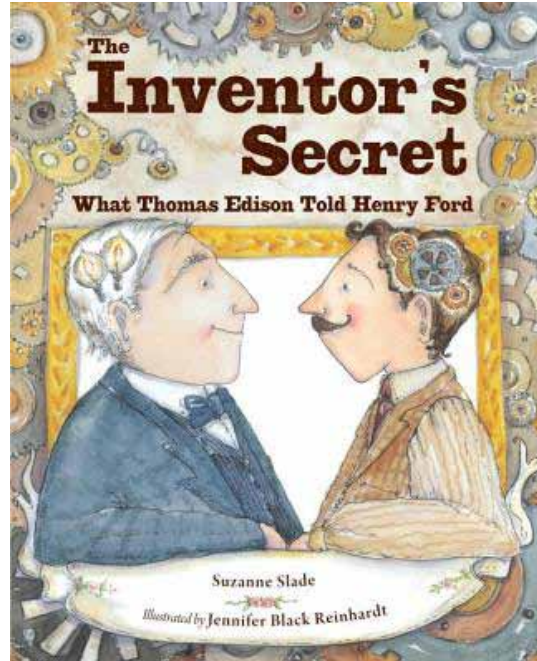
		Go Fish	Flashlight Brightness	Slingshot Car	Flip Book	Bingo
K.Forces and Interactions: Pushes and Pulls						
K-PS2-1.	Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object			✓		
K-PS2-2.	Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull			✓		
PS2.A: Forces and Motion	Pushing or pulling an object can change the speed or direction of its motion.			✓		
K-PS1-1, K-PS2-2: Cause & Effect	Simple test can be designed to gather evidence or refute student ideas about causes.		✓	✓		

Engineering, Technology, and Applications of Science

K-2.Engineering Design						
K-2-ETS1-1.	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	✓	✓	✓		
K-2-ETS1-3.	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	✓	✓	✓		
ETS1.A - Defining and Delimiting Engineering Problems						
K-2-ETS1-1.	A situation that people want to change or create can be approached as a problem to be solved through engineering.		✓	✓		
K-2-ETS1-1.	Asking questions, making observations, and gathering information are helpful in thinking about problems.	✓	✓	✓		
K-2-ETS1-1.	Before beginning to design a solution, it is important to clearly understand the problem.	✓	✓	✓		
ETS1.B - Developing Possible Solutions						
K-2-ETS1-2	Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.		✓	✓	✓	
ETS1.C - Optimizing the Design Solution						
K-2-ETS1-3.	Because there is always more than one possible solution to a problem, it is useful to compare and test designs.		✓	✓		



Acknowledgements



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