



Demos, Labs, & Science Stations Feature:

- Hands-on Investigations
- STEM Challenge
- Scientific Literacy
- Inquiry Process Skills

PHYSICAL SCIENCE - 5E **NGSS · TEKS**

FORCE & MOTION

INVESTIGATION STATION

IMAGINATION STATION

SERVATION STATION

CALCULATION STATION

Crash Test Teddy

FORCE & MOTION

I understand inertia and why it's important to wear a seatbelt.

I, or something to make a

- teddy bear or action figure
- toy car or cart
- brick, or object to stop car

I plane in front of room using the board and a stack of books.

I figure in the toy car and let the car roll down the ramp. Talk about me placing a brick at the end of ramp. Have students make observations.

me securing bear with rubber bands. Allow students to make

Iation stats an object moving at a constant velocity will

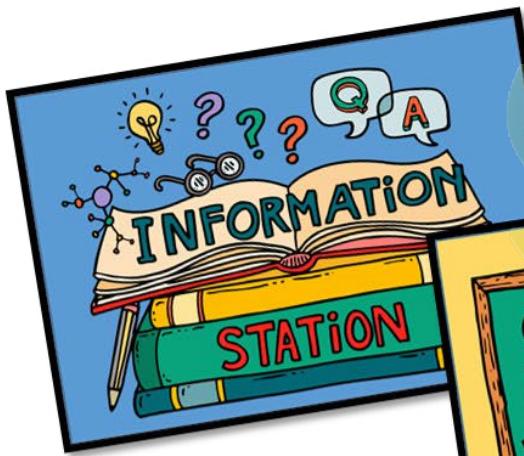
it. Inertia is the tendency of an ob...

it is to stop an object in motion. Friction is the force that acts...

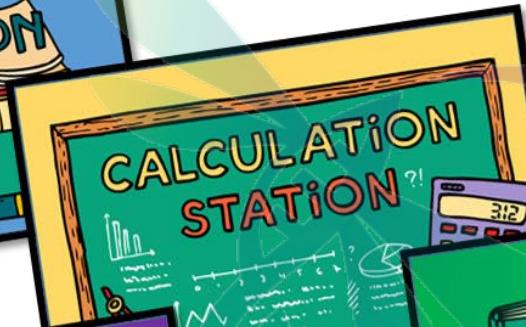
DEMONSTRATIONS, LABS, & SCIENCE STATIONS

HANDS-ON · STEM · CRITICAL THINKING

ENGAGING
READING!



GRAPHING,
WORD
PROBLEMS &
MEASUREMENT!



INQUIRY
SKILLS &
PROCESSES!

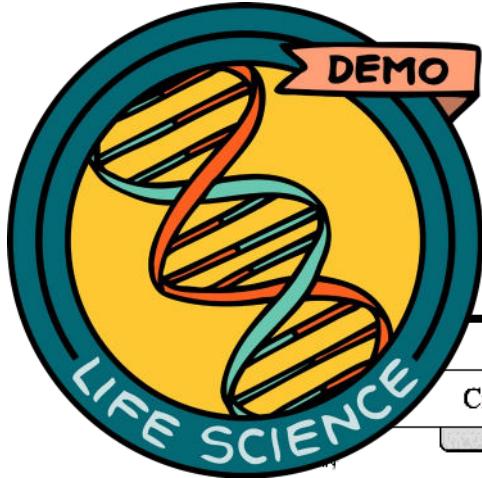


HANDS-ON
INVESTIGATIONS!



STEM CHALLENGES!





Crash Test Teddy

PROCEDURES

Students will understand inertia, and why it's important to wear a seatbelt.

Materials:

- foam or something to make a ramp
- books
- teddy bear or action figure
- toy car or cart
- ruler, or object to stop car

Procedure:

Part A: Before class

1. Build an inclined plane in front of room using the foam and a stack of books.

Part B: During class

2. Place bear or action figure in the toy car and let the car roll down the ramp. Tell about Newton's 1st Law.
3. Repeat step 1. This time placing a ruler at the end of ramp. Have students make observations.
4. Repeat step 2. This time securing ruler with rubber bands. Allow students to make observations.

What is Happening?

Newton's First Law of motion states an object moving at a constant velocity will continue moving until another force acts on it. Inertia is the tendency of an object to resist change in its motion.

When a car moves at a certain speed and collides with a solid object, the car will stop, but the passengers will continue to move forward until their seatbelts stop them. If that passenger is not wearing a seatbelt, they will not stop until the next one eighth, which is usually two doors down or another car behind.

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Discussion questions and teacher set-up included!

Teacher guide and answer key offered for every lab!

Easy-to-get materials!



Newton's Racers

PROCEDURES

Overviews Newton's First Law of motion states an object will move when a force acts on it. Newton's second law states that the object will accelerate in the direction of the force, but the rate or which the object accelerates depends on its mass and the amount of force acting on it. Newton's third law states that for every action there is an equal and opposite reaction force.

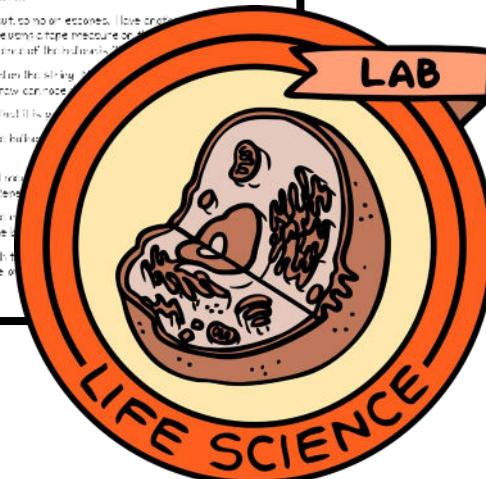
Materials:

- Balloon
- string (10 feet)
- slope
- tape measure (cloth)
- tape
- stopwatch

Procedure:

Part A: Speed

1. Tie one end of the string to a stationary object in the room. Be careful not to block walkways or roadway/tripping hazards.
2. Thread the string onto the nose end of the slope.
3. Blow up the balloon and hold the end tightly shut, come on slopes. Have one member measure the balloon circumference using a tape measure or a balloon. Add an extra 10 cm to the circumference of the balloon.
4. Tape the balloon to the slope so that it is tied onto the string.
5. Blow up the balloon and hold the end tightly shut, come on slopes. Have one member measure the balloon circumference using a tape measure or a balloon. Add an extra 10 cm to the circumference of the balloon.
6. On the end of the slope, one person releases the balloon and stops it.
7. Mark the place where the balloon stopped and record how far distance in your data table. Repeat steps 3-7 for two trials for the circumference of 30 cm. For the final set, the circumference of 40 cm.
8. Using data in table, calculate speed (ft) for each time of travel. Once done, calculate the average time of travel.





Group members will read a passage and then complete a task to help increase science literacy and deepen their understanding of the science concept.

A Floating Runway

Typically, airplanes require long runways of about 2,300 feet to gather enough speed to take off successfully. So, what do you do if you're a pilot on an aircraft carrier with only about 800 to 900 feet of runway in front of you and nothing but the Pacific Ocean below you? This is a typical situation aboard the aircraft carriers of the United States Navy in which engineers have had to design effective launching and landing systems for planes about 100 feet above the water.

Taking OFF

Technical engineers have designed a takeoff mechanism that uses massive steam-powered catapults. The catapult requires a two-system operation - one system is above deck, the other below.

Above deck, the flight deck crew positions the plane at the end of the catapult and hook the aircraft's nose gear (front wheel) to the catapult using a bar. The bowser (the catapult during the launch). At this time, the pilot begins the plane doesn't move forward since a holdback bar is in place.

Below the deck, steam is building up pressure into catapults on a pulley system. When ready, the bowser, or bowser's holdback bar, to release the plane while the crew in two seconds. Now the easy part is over. The pilot begins the plane's takeoff.

Landing

Planes come in for a landing using a light system to determine the distance to the deck. If the plane is too far, during landing, the tailhook, which is exactly that - an extended hook attached to the plane's tail. The end of the tailhook is to wrap one of the oncoming wires that are strung across the deck. The oncoming wires are sturdy cables on a pulley system that be set to a specific setting depending on the aircraft to be caught and slowed down.

Information Station

A. _____

B. _____

C. _____

D. _____

Information Station

Information Station

A

What is the major challenge of a runway on an aircraft carrier?

B

What system is in place to give airplanes the speed they need for takeoff?

D

What do you think engineers could look at in terms of new designs for more efficient launching and catching systems?

A

Observation Station

B

Observation Station

C

Name: _____ Date: _____

Information Station

A1. _____

A2. _____

B1. _____

B2. _____

C1. _____

C2. _____

Information Station

Information Station

1. In the picture above, identify and describe the force that allows riders on this rollercoaster to complete this loop without falling.

2. Knowing what you know about rollercoasters and centripetal force, would you swing a large bucket of water above your head? Why or why not?

Information Station

Group members will have images, illustrations, or actual samples at this station that show applications or processes of the science topic.



Group members will work with one another to explore the concept through hands-on activities, so they may practice specific inquiry process skills as they learn.

Effects of Air Resistance

Problem Does the shape of paper make a difference when it comes to air resistance?

Materials

- stopwatch (2)
- sheets of scrap paper (2)
- measuring tape

Procedure

Part A:

- Measure a height of 1.5 m with measuring tape.
- Have one group member drop a sheet of scrap paper (flat) from the height.
- Do two more trials.
- Repeat steps 2-3 with the crumpled paper.

Part B:

- Have a group member jump. Have two members use the stopwatch and measure the time it takes for the person to land.
- Do two more trials.
- Place a flat sheet of paper under the book with flat paper.

Analyze and Conclude:

- In Part A, which piece of paper fell faster?
- In Part B, describe your observations.
- How did using the book in Part B affect the time it took for the paper to fall?

Data and Observations

Effects of Air Resistance						
Paper Shape:	Trial 1			Trial 2		
	Flat	Crumpled	Flat	Crumpled	Flat	Crumpled
Step 1 (flat book)						
Step 2 (with book)						

A

Define gravity and identify two things that the gravitational force between two objects depend on?

B

State Newton's Laws of Motion.

A

A: Gravity is a force that every object in the universe exerts on every other object.

B

1st: Objects in motion stay in motion, objects at rest stay at rest until acted upon by a force. 2nd: Objects move in the direction of the force applied. 3rd: For every action there is an equal and opposite reaction.

C

Interview, video, or group essay.

D

Mass is the measure of the amount of matter in an object. Weight is a measure of the force of gravity on an object's mass.

There are three different options for this station: interviews, videos, or group essay. Depending on the option you choose, group members will communicate what they know by answering questions in creative ways.



Group members use their math skills to complete the station challenge. Skills may include graphing, analyzing data, using models, measurement, and calculating formulas or word problems.

Domino Derby

Materials:

- Dominoes (30)
- Meterstick
- Stopwatch

Procedure:

- Set up 30 dominoes in a straight line. Trim dominoes.
- Use the meterstick to measure the total distance in the data table on your answer sheet.
- Have one group member knock dominoes over. At the same time have another group member knock dominoes over. Repeat steps 1-3, except the second time, if your first set of dominoes fell over. At the same time have another group member knock dominoes over. Repeat steps 1-3 again.
- Calculate the average speed for each trial (by the average time it took for the row to fall over).
- Answer any questions found on your answer sheet.

Set Up 1

Trial	Distance (cm)	Time (s)	Avg Speed (cm/s)
1			
2			
3			
Average			

Set Up 2

Trial	Distance (cm)	Time (s)	Avg Speed (cm/s)
1			
2			
3			
Average			

Set Up 3

Trial	Distance (cm)	Time (s)	Avg Speed (cm/s)
1			
2			
3			
Average			

How did the distance affect the speed?

Source: www.achieve.org

Design a Tire Tread Pattern

Challenge: Design a tire tread pattern that will reduce hydroplaning by forcing water out the sides of tread when driving while raining.

Materials (per group):

- Playdough
- Cardboard (4x6")
- Carving tools
 - plastic knife
 - plastic spoon
 - various art/sculpting tools
- Water

System requirements:

Part A:

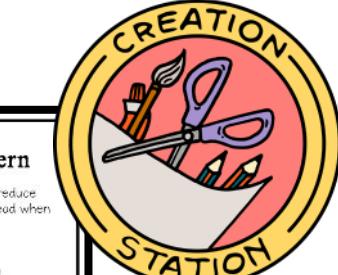
- As a group, use the playdough sheet to create a new tire. The objective is to make sure the tire surface touches the surface of the road and the tire does not roll.
- No more than 50% of playdough must include a water center for water to be no.

Part B:

- Shape dough into a 4x6" rectangular block. Place playdough on top of the cardboard.
- Carefully cut out the design using cardboard as possible to ensure accuracy.
- Wait for the teacher's instructions on the table on your answer sheet and repeat.

Testing:

When time allows, test the tire tread pattern (instructor). Pour two cups of water in a container and continuous pour. Measure the amount of water collected in the container. Record data in the table and percentage of water collected in the container.



Design a Tire Tread Pattern

Challenge: Design a tire tread pattern that will reduce hydroplaning by forcing water out the sides of tread when driving while raining.

Tire tread patterns to inspire your design:

Source: www.achieve.org

Group members will work together to solve a STEM (Science, Technology, Engineering, Math) challenge by creating models or designs that demonstrate their understanding of the science topic being taught.



This station makes science concepts relevant for students by asking them to imagine scenarios that will bring about discussion and critical thinking.

Nervous Newton

Directions: Use your imagination to answer the statement below.

IMAGINE you took a time travel machine to 1680 and ran into Isaac Newton six years before he presented his three laws of motion in the "Principia Mathematica Philosophiae Naturalis" (a fancy title Newton used for his three-book series). He told you about his ideas on motion.

Describe help

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USER-FRIENDLY PAGES:
Students easily recognize which answer sheet to use at each station by matching station icons located on each page!

Drip, Drop, Splat!

Problem: How does the density of a liquid and drop height effect the size and shape of liquid splatters?

Materials:

- colored water (graduated cylinder A)
- colored syrup (graduated cylinder B)
- eye dropper
- paper
- metric ruler
- meter stick

Procedure:

1. Make a hypothesis of how density of a liquid will effect splatter size on your lab sheet.
2. Place the piece of paper down on the lab table in order to catch splatters.
3. Measure the heights listed in the data table using a meter stick. Place meter stick with end starting at zero on paper and move up stick with increasing height of drop.
4. Use the eye dropper to drop ONE drop of colored water and ONE drop of colored syrup. Make sure to drop in different places on paper.
5. Measure the size of the splatter in MILLIMETERS. Record in data table on answer sheet.
6. Repeat for each height.
7. Use the collected data to graph the splatter size versus drop height for each liquid.

Analyze and Conclude:

1. Was your hypothesis correct? Explain.
2. What were two controls in your experiment that helped you collect the most accurate data possible?

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Height of Drop vs. Splat Size

Drop Height (cm)	Water	Syrup
2		
25		
50		
100		

Legend:
 Water
 Syrup

Analyze and Conclude:

1. _____
2. _____

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TEACHERS SAVE TIME:
Laminate station pages and reuse for each class and for years to follow!

Inquiry and Process Skills

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Demo

Guided Inquiry Lab

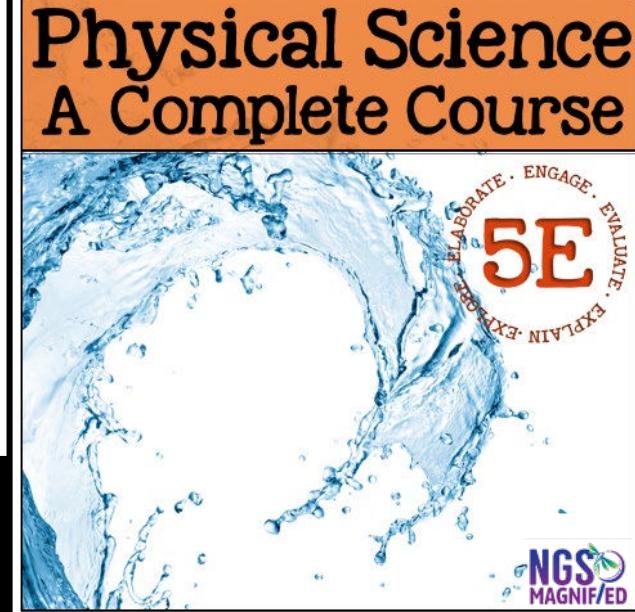
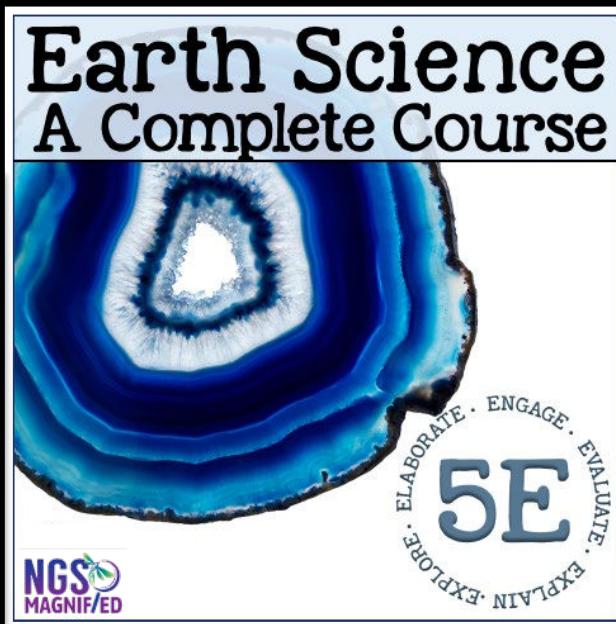
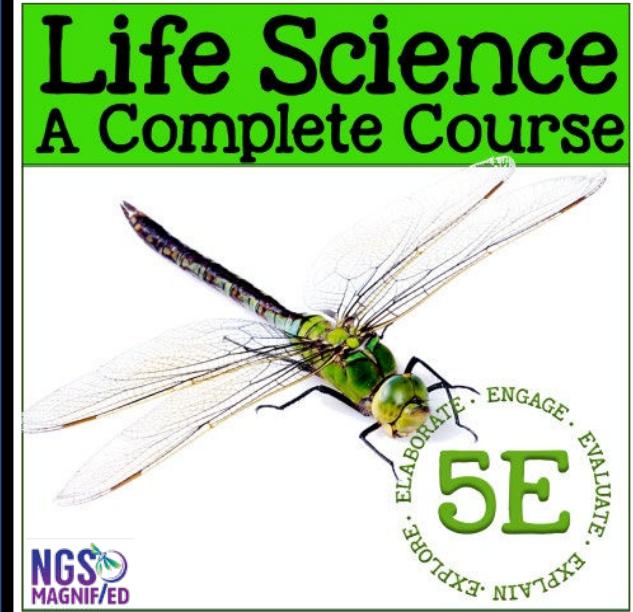
Science Stations

Inquiry-Based Science Unit: Force and Motion	Classifying	Communicating	Compare & Contrast	Creating Models	Gather/Organize Data	Generalizing	Identifying Variables	Inferring	Interpreting Data and Graphs	Making Decisions	Manipulating Materials	Measuring / Calculating	Observing	Predicting
Crash Test Teddy	X	X	X			X		X		X	X		X	
Force and Momentum		X	X			X	X			X		X		
Newton's Racers		X	X	X	X		X		X		X	X		X
Information Station: A Floating Runway					X	X		X						
Observation Station: Images & Questions	X		X		X	X		X					X	
Investigation Station: Effects of Air Resistance	X		X		X		X		X		X	X	X	
Calculation Station: Domino Derby					X		X			X		X		
Communication Station: Questions	X	X				X				X				
Creation Station: Tire Tread Patterns		X		X	X				X	X	X	X	X	X
Imagination Station: Nervous Newton		X		X					X					X

NGS Magnified promotes scientific inquiry throughout the curriculum. Students become more confident and effective learners while developing problem-solving and critical thinking skills.

Process skills, such as planning, organizing, and evaluating, help students to complete projects and assignments. These skills allow students to independently gather information, analyze it, and draw their own conclusions.

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