

NATIONAL GEOGRAPHIC EDUCATOR'S GUIDE

COMMON CORE ALIGNMENTS AND CLASSROOM ACTIVITIES



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AN ENGLISH-LANGUAGE ARTS TEACHING GUIDE

INTRODUCTION

At first glance, it might seem odd to have an English/Language Arts educator's guide for a book of science experiments. Yet, the communication of methods, outcomes, and conclusions is a key aspect of science investigation. Indeed, the Common Core State Standards even include a section for grades 6+ focusing on ELA for disciplines including science and history.

Learning and practicing good communication—specifically writing and presenting skills—is necessary across all disciplines, including science. This teacher’s guide focuses on applying Common Core standards to discipline-specific communication.

As you conduct each activity, you may wish to consult the differentiation suggestions within the activity and the grade-specific standards found on pages 3-5 of this guide to tailor the activities to your students' specific needs.

Note: See pages 150-153 in the book for science standards correlations.

PLANTS

RAINBOW ROSE

Color a white rose in rainbow shades.

CONCEPTS
PLANT STRUCTURES AND PROCESSES

WHAT YOU NEED
One white rose, including stem
Food coloring
Sharp object, such as a needle or sharp object, such as a pin
Water
A plate or shallow dish

WHAT'S IT LIKE?
It's the system of cells inside a plant's roots and stem that transports water from ground or vase to the top of the plant. This project lets you discover what parts of the xylem feed what parts of a blossom.

10 TRY THIS!

1 Cut the stem of the rose to about 12 inches long. Remove the leaves. Cut the stem into four equal parts. Label each part 1, 2, 3, and 4.

2 Take a small amount of food coloring and mix it with water in a small cup. Add a few drops of food coloring to each of the four cups. Use a different color for each cup.

3 Place the rose in the cup with the food coloring. Make sure the stem is in the water. Wait for about 24 hours. The rose will change color. The color will be different in each part of the rose.

4 Place the rose in a new cup of water. Wait for about 24 hours. The rose will change color again. The color will be different in each part of the rose.

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BUGS AND MICROBES

BUG AMBULANCE

Good rescue, good ride, good observation opportunity

CONCEPTS
OBSERVATION, INSECT BEHAVIOR

WHAT YOU NEED
A small, clear plastic bag
A small, clear plastic cup
A small, clear plastic bottle
A small, clear plastic container
A small, clear plastic bag
A small, clear plastic cup
A small, clear plastic bottle
A small, clear plastic container

1 Fill the plastic bag with water. Add a few drops of food coloring. Mix well.

2 Place the plastic bag in the plastic cup. Make sure the bag is fully submerged.

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Ready, Set, Investigate!

Divide students into small groups, and invite students to choose an experiment from the book, such as the Ghost Glove experiment on page 88. You may wish to preview the activities in the book and give students a list of which activities they can choose from.

Differentiation suggestion: For younger readers, you may wish to assign the same experiment to all small groups. For more advanced readers, you may wish to allow students to work in pairs or individually.

PREVIEW THE EXPERIMENT

Once students have decided on the experiment they would like to conduct, have students preview the activity. Encourage students to :

- preview the photos in the activity
- read the activity introduction, including the *CONCEPTS* and the introduction text
- read the *HOW LONG IT TAKES*, *WHAT YOU NEED*, and *WHAT TO DO* sections
- review the photos and reread *WHAT TO DO* text to note which steps are illustrated
- read the *WHAT TO EXPECT* and *WHAT'S GOING ON?* sections
- read any sidebars, quotes, or questions on the activity pages

You may also wish to encourage students to:

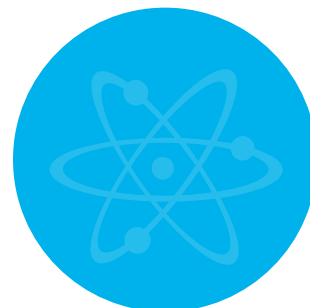
- identify words or terms in the *WHAT TO DO*, *WHAT TO EXPECT*, and *WHAT'S GOING ON* sections that are unfamiliar. Have students discuss the terms in their groups or look up the definitions. For more difficult words, you may wish to open the discussion to the class or consult individually with each group.
- discuss the *WHAT TO EXPECT* and *WHAT'S GOING ON* sections in their groups. Have students share what they already know about the topic, about previous experiences with the topic or outcome.
- summarize the *WHAT TO EXPECT* and *WHAT'S GOING ON* sections in their own words.

Remind students that they may not yet understand the information in the *WHAT'S GOING ON* section, and that's ok!

PREPARE FOR THE EXPERIMENT

In their groups, have students each prepare their lab notebook. If you don't use an established lab notebook in your classroom, have your students set up a document or photocopy the lab sheet on page 7 of this guide. You may wish to have students refer to pages 142-145 in the book for tips on setting up and using a lab notebook.

When students have finished preparing their lab book, be sure they have filled in everything except for the *RESULTS* and *CONCLUSION* sections. If students will need to bring materials from home, discuss with them what they will need to bring in and what you will supply. If you wish, photocopy the letter on page 11 of this guide and have students fill it out and bring it home to their parents.



NAME OF THE EXPERIMENT: Tell what the experiment is.

PEOPLE IN MY GROUP: Tell who will be working on the experiment with you. Don't forget your own name!

HYPOTHESIS: What I expect will happen when I do the experiment, such as what I will see or hear.

BACKGROUND: What I already know about this topic. Be sure it's relevant to the experiment!

MATERIALS: What I need for this experiment. Note that some of the materials are already listed in the book. Think about what other materials or workspaces you might need: a flat table? a sink?

PROCEDURE: What the steps are that I need to do. Most are listed already in the book. Make notes about what steps might take more than one person, need to happen at the same time, or any other special information.

RESULTS: Leave this area blank to fill in what you observe.

CONCLUSION: Tell what actually happened and why you think it happened. It's ok if your experiment doesn't have the same results the book said will happen! Take an educated guess as to why your experiment turned out as it did.



CONDUCT THE EXPERIMENT

Have students conduct their experiment in their groups. Be sure students follow all proper safety precautions, such as wearing goggles and gloves.

Remind students to take careful notes as to what they did and what they observed. You may also wish to invite students to take photos of each step and the results as they work with a digital camera to be used in their write-up. Older students may wish to take a digital video of their results.

If you wish, invite students to conduct their experiment three times, noting their method and observations each time.

DRAW CONCLUSIONS

After students have finished their experiment, encourage them to discuss their observations in their group. Have them refer again to the *WHAT TO EXPECT* and *WHAT'S GOING ON* sections in their book. Did students get the same results? Why or why not? As a group, have students write a conclusion for their experiment.

Differentiation suggestion: For younger readers, you may wish to join each group as they discuss their results to lead the discussion and help them understand the information in the *WHAT'S GOING ON* section. Encourage especially struggling students to rephrase the group's conclusion in their own words to ensure understanding or clarify questions. For more advanced readers, have students write their own conclusion after their group discussion, and then share their conclusions with the group. Did everyone have the same response? Encourage groups to address any misconceptions or misunderstandings that come to light.

If more than one group did the same experiment, invite those groups to join together to discuss their observations and conclusions



Write It Up!

Remind students that an essential part of science research is communicating results with other scientists, news organizations, and the public. Scientists often submit papers to scientific journals to share their results and conclusions. Sometimes they share their results online or in a news article. For each different audience, scientists must be sure to present information that is appropriate and useful for the readers.

In any write-up, topics should include: a title, a short description of the experiment and the results, background information the reader should know to understand the experiment, the methods used, the observations, and the conclusions that were drawn from the

observations combined with the background knowledge.

To gather background information, invite students to write questions they have about what they observed. Be sure questions are direct and pointed so that they can be used as the basis for further research.

Give students time in the library or with other resources to further research the concepts behind their experiment. If needed, help students identify key words they can use as effective search terms on the Internet. Remind students to note their findings, including the source, carefully. They will need to cite their sources later on.

Differentiation suggestion: For younger readers, you may wish to have each student in the group research a different question related to their experiment. Then have students share their findings. For more advanced readers, have students research their questions individually. Then have students share and compare their findings.

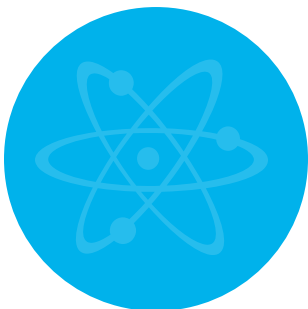
When students feel they have gathered enough information to add to their understanding of the experiment, give them time to do a full write-up. Depending on your classroom objectives, you may wish to:

- refer to the grade-level Writing and Language standards on pages 1-5 of this guide to provide students with a structure and rubric for their write-ups;
- use your established school or classroom lab write-up approach; or
- refer to page 146 in the book for a suggested write-up approach.

Be sure to clearly establish the audience and purpose for students' writing, such as a science night for parents or a science journal to be read by other students. If you wish, bring in examples of science journals to share with students.

As students write, remind them to use appropriate content vocabulary.

Encourage students to use multimedia as appropriate to aid their write-up, including any photos they took during the experiment or drawing diagrams. Remind students to use information from their additional research and to cite the information properly.



A sample grade 4 rubric might look like this:

	3 points The write-up has:	2 points The write-up has:	1 point The write-up has:
STRUCTURE	A clear introduction and conclusion, clear headings, and multimedia that adds to and clarifies information.	A clear introduction and conclusion, some headings, and multimedia that sometimes adds to and clarifies, but sometimes isn't needed.	An introduction and conclusion that aren't clear, no headings, and either no multimedia or multimedia that is confusing and unhelpful.
INFORMATION	Well-researched information that is clearly developed with facts, details, and examples.	Information that is related to the topic and somewhat researched with some or few facts, details, and examples.	Information mostly from prior knowledge, with few facts, details, and examples.
LANGUAGE	Appropriate and correctly used content vocabulary and language chosen carefully for the audience and purpose.	Somewhat related and sometimes correctly used content vocabulary. Language does not always communicate clearly to the audience and for the purpose.	Little to no content vocabulary. Language does not always communicate clearly to the audience and for the purpose.



Show and Tell!

Tell students that in addition to writing up their experiments, scientists often share their findings through presentations at conferences for other scientists, on TV or online for the general public, and through lectures sponsored by universities or other organizations. As with the write-up, the presentation style and information included needs to be appropriate for the audience.

With students, decide on a format for your presentations. As you discuss the options, be sure to talk about what kind of information would need to be presented for each audience. Possibilities include:

- a traveling lecture series to other classrooms
- TED Talk-style presentations for parents or other invited guests
- science conference-style presentations and panel discussions
- online videos to share information with the general public

When the class has decided on the format, lead a discussion about what information should be included in the presentation. Ask questions such as:

- What information do we want our audience to walk away with? How do we communicate that to them most effectively?
- How much background information will the audience already know? What background will we need to give them?
- What vocabulary does the audience already know? What words should we use, not use, or define for them?
- How much detail do we need to give the audience about our methods?
- What words can we use to describe our observations so that the audience can imagine what we saw, heard, smelled, etc.?

In their experiment small groups, give students time to prepare their presentations, including appropriate visuals and scripts. Encourage students to practice their presentations for other groups, making adjustments as necessary based on their test audience's feedback.

WEIRD PHYSICS

SWIMMING WITH CLOTHES ON

It's kind of a drag.

CONCEPTS
 DRAG, FLUID DYNAMICS, AERODYNAMICS

HOW LONG IT TAKES

- ▶ a swimming pool
- ▶ swim cap
- ▶ goggles
- ▶ a partner and adult supervision

If swimmers practice swimming in their clothes in order to be prepared for how that feels. They need to know how to adapt their swim to deal with the additional drag created by wet fabric. Go beyond "how it feels" by measuring the difference clothes and swimsuits make to the speed of your swim.

NOTE OF CAUTION
Never swim alone.



WHAT TO DO

1. HAVE YOUR PARTNER
Time your laps.

2. SWIM TEN LAPS, alternating between wearing each time. The first lap, swim in your swimsuit.

3. THE REACTION LAP: put on clothes. Decide what clothes you wear who can assess the effects of wearing shoes, pants, and a sweatshirt, or lighten up a little with shorts and a t-shirt.

4. CHALLENGE: try to go in swimming times with and without clothes.

5. TALK BACK AND PROVE IT: Swimmers you swim your laps. The last one around is a tie to have your energy about that.

6. YOUR FIRST LAP: It'll be overcast, and probably so fast. You said in clothes, slowed it down.

7. BY YOUR OWN FEELING: With water, they will weigh you down. This is important to do. What you wear your swimsuit, you have made your body more streamlined and more aerodynamic.

"That's 23 seconds with clothes on and 13 seconds with a swimsuit on."
—Doug

QUESTION THIS!

- Which fabrics create the most drag?
- What strokes are easier or harder when you're wearing clothes while swimming?

- 1**
- 2**
- 3**

112 TRY THIS!
TRY THIS! 113

Dear Parent,

On _____ your student will be conducting the *National*

Geographic Kids Try This! experiment _____.

For this experiment, your student will need to bring the following from home:

QUANTITY

ITEM

We can't wait to get experimenting!

MACHINES

BRUSHY-BOTS

Old brushes, new motion, new use!

CONCEPTS
ELECTRICITY, MOTORS, ENGINEERING, MOTOR DYNAMICS

HOW LONG IT TAKES
One hour

WHAT YOU NEED
A small motor, not too big
A small battery, not too big
A small square of electrical tape
A small square of paper
A small square of paper

Use a little motor to power something that has legs made of brushes, wires, or anything else that moves when vibrated over a surface. Experimentation and invention is the name of the game here.

132 TRY THIS!

WHAT TO DO

1. Use a small motor or wire cutter to cut the handle off the toothbrush or hairbrush so you can use just the head (the bristle part). You don't need to cut anything off the original brush.
2. Cut a small square of foam tape that will fit the back of the brush head. Stick it on.
3. Your brush should have two wire leads sticking out of it, one black (one wire) and one red (negative). Use a small square of electrical tape to affix the black (positive) wire lead to the battery.
4. Use a small square of electrical tape to affix the red (negative) wire lead onto the battery to make the connection and spin the motor, moving the toothbrush.
5. Use a small square of paper to place on your robot for stability or decorate it with googly eyes or whatever. For spin-dancing toothbrushes, make with the same figures, letting each other. Why not?

PEOPLE AND OTHER ANIMALS

CAT IQ TEST

Can your cat solve this problem?

CONCEPTS
BEHAVIOR, INTELLIGENCE, CAUSE AND EFFECT

HOW LONG IT TAKES
Ten to fifteen minutes, depending on your cat's intelligence and how much you want to test.

WHAT YOU NEED
A box with a lid
A cat tape or duct tape
Two plastic spoons
A small cat head or cat head

Here's one idea for checking a cat's IQ. Try this one—or make up your own puzzle for a cat to solve. A caution: A cat that doesn't pass your test may not be dumb. What else might be going on?

58 TRY THIS!

WHAT TO DO

1. MAKE THE TESTING APPARATUS.
a. Use the scissors or box cutter to cut a window out of the lid of the box. Cover the window with the mesh. This allows the cat to see in.
2. From one end of the box, cut a section out of the edge to allow the string and spoons to extend underneath.
3. MAKE THE STRING or plastic line to the spoon handles.
4. TIE THE SPOONS without food or treats and set them under the window so they are visible, with the ends of the string or line extending through the hole in the edge and beyond, on the floor.
5. BRING A CAT to the apparatus and let him explore. Observe the cat.

Some cats will make the string go through the hole in the box, but the string is too short to reach the spoon handles. The string is too short to reach the spoon handles. The string is too short to reach the spoon handles.

Jack used to wet his feet inside that why he tried to go through the door to get it. But he's a good boy anyway."

"One if he'll eat an ant."

QUESTION TIME!

- Is this experiment a good indicator of cat intelligence? Why or why not?
- Is there another problem that might be a better indicator of how smart a cat is?
- Would this test be a good indicator of dog or human intelligence? Why or why not?

TRY THIS! 59



Common Core Standards

The following Common Core standards are addressed in these teaching notes:

(W = Writing; SL = Speaking and Listening; L = Language; WHIST = Writing for Technical Subjects)

Grade 4

W.4.2:

- Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- a. Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
 - b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
 - c. Link ideas within categories of information using words and phrases (e.g., another, for example, also, because).
 - d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
 - e. Provide a concluding statement or section related to the information or explanation presented.

W.4.4:

Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

W.4.6:

With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of one page in a single sitting.

W.4.7:

Conduct short research projects that build knowledge through investigation of different aspects of a topic.

W.4.8:

Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

W.4.10:

Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

SL.4.4:

Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

.....

SL.4.5:

Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.

.....

L.4.3:

Use knowledge of language and its conventions when writing, speaking, reading, or listening.

- a. Choose words and phrases to convey ideas precisely.
 - b. Choose punctuation for effect.
 - c. Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion).
-

L.4.6:

Acquire and use accurately grade-appropriate general academic and domain specific words and phrases, including those that signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to a particular topic (e.g., wildlife, conservation, and endangered when discussing animal preservation).

.....

Grade 5**W.5.2:**

Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

- a. Introduce a topic clearly, provide a general observation and focus, and group related information logically; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
 - b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
 - c. Link ideas within and across categories of information using words, phrases, and clauses (e.g., in contrast, especially).
 - d. Use precise language and domain-specific vocabulary to inform about or explain the topic.
 - e. Provide a concluding statement or section related to the information or explanation presented.
-

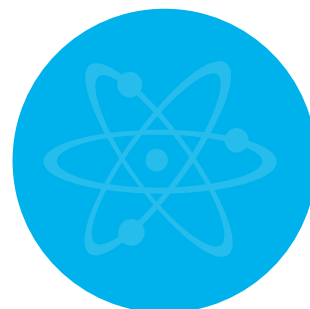
W.5.4:

Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

.....

W.5.6:

With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.



W.5.7:

Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

.....

W.5.8:

Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

.....

W.5.10:

Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

.....

SL.5.4:

Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

.....

SL.5.5:

Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.

.....

L.5.3:

Use knowledge of language and its conventions when writing, speaking, reading, or listening.
a. Expand, combine, and reduce sentences for meaning, reader/listener interest, and style.

.....

L.5.6:

Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal contrast, addition, and other logical relationships (e.g., however, although, nevertheless, similarly, moreover, in addition).

.....

The image shows a page from a science magazine titled "BUGS AND MICROBES". The page features two experiments. The first experiment, "BONUS: FEED THE BEES", includes a photograph of a glass jar with a red lid and a bee on it. The second experiment, "YEAST COLONY", includes a photograph of a person using a microscope. The page also contains text about the experiments and a "TRY THESE" section at the bottom.

BUGS AND MICROBES

BONUS: FEED THE BEES

A variation on this experiment focuses on bees. First figure out what colors your bees prefer by following the same steps you followed for butterflies. Then try feeding them using symbols. Use jars that are painted white, and use a black permanent marker to draw a symbol on each: a circle, a star, a triangle. Put nectar in one jar—the one in the middle, with the star, say. After bees have figured out where the nectar is, remove the bottom part of the jar, and just hang the lid there. Which lid draws visits from the most bees? Will it still be the one with the star?

YEAST COLONY

Compare the responses of "twin" yeast colonies to different conditions.

CONCEPTS
MICROBES, LABORATORY PROCEDURES

HOW LONG IT TAKES
Two to three days

WHAT YOU NEED
A teaspoon (5 ml) active baking yeast
A small jar
A small jar with a lid
A small jar with a lid
A small jar with a lid
A small jar with a lid

TRY THESE

Grade 6

SL.6.4:

Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

SL.6.5:

Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

L.6.3:

Use knowledge of language and its conventions when writing, speaking, reading, or listening.

- Vary sentence patterns for meaning, reader/listener interest, and style.
- Maintain consistency in style and tone.

Grade 7

SL.7.4:

Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.

SL.7.5:

Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

L.7.3:

Use knowledge of language and its conventions when writing, speaking, reading, or listening. Choose language that expresses ideas precisely and concisely, recognizing and eliminating wordiness and redundancy.

[illegible]

Grade 8

SL.8.4:

Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

.....

SL.8.5:

Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

.....

L.8.3:

Use knowledge of language and its conventions when writing, speaking, reading, or listening. Use verbs in the active and passive voice and in the conditional and subjunctive mood to achieve particular effects (e.g., emphasizing the actor or the action; expressing uncertainty or describing a state contrary to fact).

.....

Grades 6-8

WHIST.6-8.1:

Write arguments focused on discipline-specific content.

- Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
 - Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
 - Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
 - Establish and maintain a formal style.
 - Provide a concluding statement or section that follows from and supports the argument presented.
 - Provide a concluding statement or section that follows from and supports the information or explanation presented.
-

WHIST.6-8.2:

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

- Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
 - Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
 - Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
 - Use precise language and domain-specific vocabulary to inform about or explain the topic.
 - Establish and maintain a formal style and objective tone.
-





WHIST.6-8.4:

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHIST.6-8.6:

Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

W.6-8.7:

Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

W.6-8.8:

Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

WHIST.6-8.9:

Draw evidence from informational texts to support analysis reflection and research.

WHIST.6-8.10:

Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

REACTIONS

GHOST GLOVE

Making and splitting carbonic acid—and freaking out your friends.

CONCEPTS
CHEMICAL REACTIONS, ACIDS, BASES

WHAT YOU'LL NEED
vinegar
baking soda
a glove

THIS IS A MULTISTEP REACTION: Vinegar is acetic acid, and baking soda contains sodium bicarbonate, a base. They don't just mingle when mixed—their molecules rearrange into something else.

88 TRY THIS!

WHAT TO DO

- POUR THREE** tablespoons (45 mL) of vinegar into the glass.
- SPRINKLE TWO** teaspoons (10 mL) of baking soda into the glove. Hold the glove by the wrist and shake the baking soda down into the fingers.
- HOLDING THE FINGERS** of the glove shut, stretch the wrist of the glove over the mouth of the glass.
- PULL THE GLOVE UP** straight to let the baking soda fall into the vinegar.

OBSERVE what happens.

WHAT IS GOING ON? As the baking soda reacts with the vinegar, it forms carbon dioxide, that inflates the glove.

WHAT IS HAPPENING? When the sodium bicarbonate (base) reacts with the acetic acid (acid), they form carbon dioxide gas, which inflates the glove. The carbon dioxide bubbles up, inflating the glove. The gas and what's left in the jar is sodium acetate.

Write the chemical notation:

$$\text{NaHCO}_3 + \text{CH}_3\text{COOH} \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) + \text{CH}_3\text{COONa}(\text{s})$$
 baking soda + vinegar → carbon dioxide + water + sodium acetate (sodium acetate)

QUESTION THIS!
• Will this work with a balloon?
How big a balloon?

TRY THIS! 89



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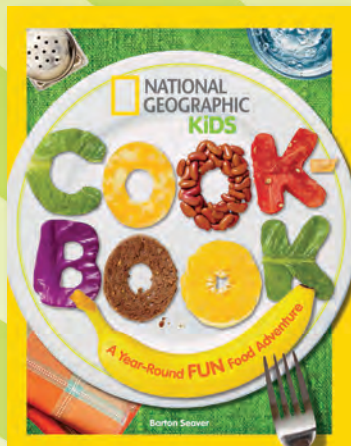


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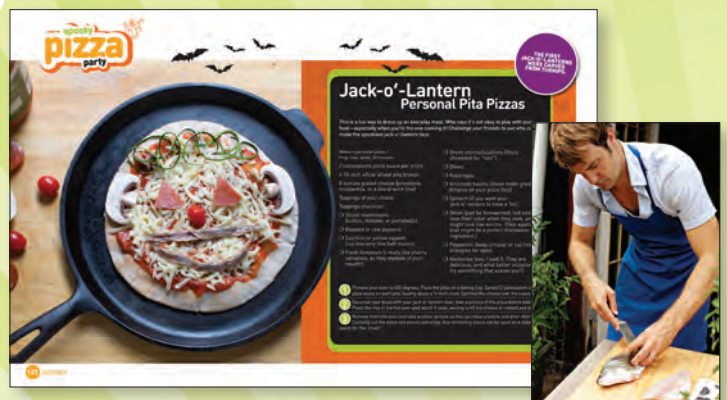
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