



Demos, Labs, & Science Stations Feature:

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

PHYSICAL SCIENCE - 5E NGSS · TEKS

A collage of educational materials for a solutions, acids, and bases unit. It includes a book cover titled "SOLUTIONS ACIDS, & BASES" with a blue background and white text. Below the title are several colorful circular icons representing different science stations: "INVESTIGATION STATION" (test tubes), "IMAGINATION STATION" (molecular model), "OBSERVATION STATION" (microscope), and "CULTIVATION STATION" (plant). To the right is a worksheet titled "pH Indicators" with a clipboard. The worksheet includes a table for "Cabbage Indicator" and a table for testing substances.

**SOLUTIONS  
ACIDS, & BASES**

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**INVESTIGATION STATION**

**IMAGINATION STATION**

**OBSERVATION STATION**

**CULTIVATION STATION**

**pH Indicators**  
SOLUTIONS, ACIDS AND BASES

How do different pH indicators compare when testing solutions?

Cabbage juice indicator strips (labeled)

- 7 test tubes - labeled A-G
- test tube rack
- graduated cylinder

Cabbage Indicator

Substance Color	pH
red	2
orange	4
yellow	6
green	8
blue	10
purple	12

on whether each substance to be tested will be acidic, basic, or neutral. Mark with a check mark in the table below.

Substance	Acidic	Basic	Neutral
lemon juice			
ammonia			
ginger ale			
vinegar			
bleach			
soapy water			
distilled water			

**DEMOS, LABS, & SCIENCE STATIONS**

HANDS-ON · STEM · CRITICAL THINKING



**ENGAGING READING!**

**GRAPHING,  
WORD PROBLEMS &  
MEASUREMENT!**

**INQUIRY SKILLS &  
PROCESSES!**

**HANDS-ON INVESTIGATIONS!**

**STEM CHALLENGES!**

**ALL Station Signage Included!!**

Color & Black and White



## Effects of Solute Particles

SOLUTIONS, ACIDS AND BASES

Students will begin to recognize that all solute particles affect the physical properties of the solvent - in this case lowering the freezing point.

### Materials:

- water
- ice (crushed)
- 2- test tube
- beaker
- 25 g NaCl
- thermometer
- plastic spoon

### Procedure:

1. Pour 100 mL of water into each test tube. (Ask for two student volunteers to hold test tubes)
2. Add 5 g of NaCl to one test tube and mix well.
3. Prepare an ice bath consisting of crushed ice, 500 mL of water, and 20 g NaCl.
4. Set a thermometer inside the ice bath and record the temperature.
5. Have students hold each test tube in the ice bath, being careful not to let ice water enter test tube.
6. Use a plastic spoon to gently stir the ice bath, meanwhile noting any temperature changes to the students.
7. After a few minutes, have the students remove the test tubes - have students record their observations.

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Teacher guide and answer key offered for every lab!

Easy-to-get materials!



Name \_\_\_\_\_ Date \_\_\_\_\_



## pH Indicators

SOLUTIONS, ACIDS AND BASES

**Problem:** How do different pH indicators compare when testing solutions?

### Materials:

- cabbage juice
- pH indicator strips
- 7 solutions (labeled)
- 7 test tubes - labeled A-G
- test tube rack
- graduated cylinder

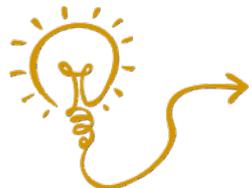
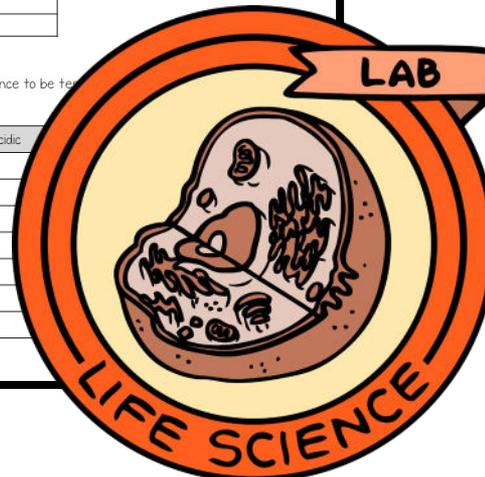
Reference: Cabbage Indicator

Cabbage Juice Color	pH
red	2
purple	4
violet	6
blue	8
blue-green	10
greenish-yellow	12

### Pre-lab:

1. Make a prediction on whether each substance to be tested is acidic or basic by placing a checkmark in the table below.

	Substance	Acidic
A	ammonia	
B	baking soda	
C	lemon juice	
D	water	
E	vinegar	
F	bleach	
G	soda (clear)	



Discussion questions and teacher set-up included!



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



**INFORMATION STATION**

### This Will Leave a Sour Taste

We are constantly being warned about the effects of sugar on our teeth from candy. However, another culprit at work is destroying the enamel on your poorly whites when you eat your favorite sweets — acid. Enamel, or the hard outer surface layer of your teeth that protects against tooth decay, can be destroyed by the combination of sugar and acid.

Acids are substances that produce hydrogen ions. Acidity is measured by the pH scale. Solutions with a pH lower than 7 are considered acidic. A pH of 7 is neutral, and a pH higher than 7 is basic. A healthy level for our teeth is a pH of 6.5.

To put things into perspective, the pH of lemon juice is 2.0, which is highly acidic. An alkaline solution, such as baking soda, has a pH of 9.0. Strokes of tooth enamel begin to occur at pH levels of 5.5 and below.

Candy companies try to develop candies that are sour but not too sour. To match the sourness of many ingredients, they include the same acids found in fruits, which contain citric acid, malic acid, and tartaric acid. However, candy makers use more intense flavors by increasing the intensity of the flavor and the amount of sugar. There are many candies that contain natural amounts of naturally occurring acids that erode the enamel of your teeth.

Other characteristics of your teeth than others. For example, they are stickier and tend to be sour hard candy. These candies are more susceptible to acids and sugars.

There are several ways to protect your teeth. If you are having a hard time adjusting, you can do the following: brush your teeth twice a day, use fluoride toothpaste, and drink water. If you are having a hard time adjusting, you can do the following: brush your teeth twice a day, use fluoride toothpaste, and drink water.

**INFORMATION STATION**

**A**

Explain the purpose of enamel on your teeth.

**B**

At what pH levels does loss of tooth enamel begin to occur?

**C**

Do you think you start doing your dental hygiene habits to prevent enamel erosion?

**D**

Do you think you eat some worse for your teeth than others?

**OBSERVATION STATION**

**A**



**B**



**C**



Name: \_\_\_\_\_ Date: \_\_\_\_\_

AL \_\_\_\_\_

A2 \_\_\_\_\_

BL \_\_\_\_\_

B2 \_\_\_\_\_

CL \_\_\_\_\_

C2 \_\_\_\_\_

- Describe advantages and disadvantages of using ice roads and planes.
- Water Freezes at 0°C. Why don't oceans freeze at that temperature?

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.



**Saturated Solutions**

Problem: Which is more soluble in water – sodium chloride or sucrose?

**Materials:**

- 2–250 mL beakers
- sodium chloride (salt)
- sucrose (sugar)
- 2 plastic spoons
- water (room temperature)
- 2–disposable paper cups
- digital scale

**Procedure:**

- Label each beaker A and B. Pour 100 mL mass of water in grams as this value is equal to the volume.
- Place an empty cup on the digital scale.
- Measure 20 g of sodium chloride into beaker A.
- Keep track of how much you add to Beaker A while stirring until you no longer add the total mass of sodium chloride.
- Use Beaker B and repeat steps 2–4 adding an additional 2 grams at a time.
- Answer the following questions on your own.

**Analyze and Conclude:**

- Use your data to compare and discuss solubility in water.
- Sodium chloride has a solubility of 36 g/100 g of H<sub>2</sub>O. Does this compare to your data?
- Why did the water need to be at room temperature?

Name \_\_\_\_\_ Date \_\_\_\_\_

**Directions:** Complete the data table below.

	Sodium Chloride	Sucrose
Mass of water (g)		
Mass of solute (g)		
Solubility (g/100 g of H <sub>2</sub> O)		

**Analyze and Conclude:**

- Use your data to compare and describe the relative solubilities of sodium chloride and sucrose in water.
- Sodium chloride has a solubility of 36.0 g/100 g of H<sub>2</sub>O at room temperature. How does this compare to your data?
- Why did the water need to be at room temperature for this investigation?

**A**

When forming a solution, describe three ways to speed up the rate of dissolving.

**B**

Identify and

**A**

A: Stirring – solute has more contact with solvent; increase surface area; increase

**B**

A: Saturated – contains solute it can hold at given temp. Saturated – able to hold more solute, unsaturated – more solute (in saturated solution)

Name \_\_\_\_\_ Date \_\_\_\_\_

Dis \_\_\_\_\_

of \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

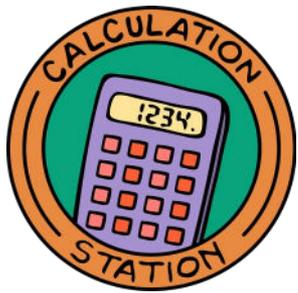
\_\_\_\_\_

\_\_\_\_\_

How much acid or base is in solution.

acid in water, crystals in solid state, slippery, bitter taste, corrosive, reactive with indicators

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.



**Solubility Curve**

**Materials:**

- Colored pencils
- Data table

**Procedure:**

1. Create a group on your answer sheet corresponding to the data for
2. Use a different colored pencil for each compound on your answer sheet

Compound	D <sup>o</sup> C
KCl	
PbCl <sub>2</sub>	
NaNO <sub>3</sub>	
KBr	

**Solubility Curves**

Solubility (g/100g H<sub>2</sub>O)

**Key**

- KCl
- PbCl<sub>2</sub>
- NaNO<sub>3</sub>
- KBr

**Blending Bubble Formulas**

Challenge: Create a bubble solution that allows your bubble to stay suspended the longest before bursting.

**Materials:**

- Equal dish soap (different brands)
- cornstarch
- baking powder
- salt
- water
- corn syrup
- bubble wand
- string (not used, but ok)

**System Requirements:**

1. Each group will not last the longest on
2. Challenge requirement
  - Groups do not
  - Groups must
  - Materials are
  - Groups will
  - at 100% (1)
3. Once all members are done with their
4. Place the final solutions instructed by

**Testing:**

Your teacher will determine the steps to determine the best

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Bubble solution recipe:

Directions on how to make bubble solution:

1. How did your bubble solution compare to the other groups during testing?
2. Would you change anything in your bubble solution? Explain your answer.

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.



## Inquiry and Process Skills

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Demo
  Guided Inquiry Lab
  Science Stations

Inquiry-Based Science Unit: Solutions, Acids, and Bases	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
<b>Effects of Solute Particles</b>	X	X	X			X		X	X	X			X	
<b>pH Indicators</b>		X	X	X	X		X		X		X	X		X
<b>Information Station: Sour Taste</b>			X		X	X		X						
<b>Observation Station: Images &amp; Questions</b>	X		X		X	X		X					X	
<b>Investigation Station: Saturated Solutions</b>	X		X		X		X		X		X	X	X	
<b>Calculation Station: Solubility Curve</b>					X		X		X	X		X		
<b>Communication Station: Questions</b>	X	X				X				X				
<b>Creation Station: Blending Bubble Formulas</b>		X	X	X	X				X	X	X	X	X	X
<b>Imagination Station: Flat No More</b>		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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