Lesson 2.6: Physical Science – Chemical Reactions

Weekly Focus: Vocabulary
Weekly Skill: Comprehension

Lesson Summary: This week students will work on understanding the basics about chemical reactions. They will conduct simple experiments with solutions to determine their pH level. Remind students that the next unit will include a review of Unit 2.1 – 2.6.

Materials Needed:

- Reading for Comprehension **Unit 2.6 Handout 1** (Spectrum Science, Grade 6, pages 42-43)
- Experiment Instructions **Unit 2.6 Handout 2, pages 2 - 3**
- Materials to conduct experiment: see **Unit 2.6 Handout 2 (first page for teachers)**
- Extended Work **Unit 2.6 Handout 3** (6-way Paragraphs, Middle Level, pages 96-97)
- Further Reading **Unit 2.6 Handout 4**

Objectives: Students will be able to…

- Read for comprehension regarding chemical reactions and the pH scale
- Identify acids and bases by using the pH scale

College and Career Readiness Standards: RI, RST, WHST, SL

ACES Skills Addressed: EC, LS, ALS, CT, SM, N, DFP

Notes: Please review and be familiar with classroom routine notes for: reading for fluency strategies (**Routine 2**), summarizing techniques (**Routine 4**), self-management skills (**Routine 4**), and 6-way Paragraphs Reading Techniques (**Routine 3**). The notes will help with making a smooth transition to each activity.

GED 2014 Science Test Overview – For Teachers and Students

The GED Science Test will be 90 minutes long and include approximately 34 questions with a total score value of 40. The questions will have focus on three content areas: life science (~40%), physical science (~40%), and Earth and space science (~20%). Students may be asked to read, analyze, understand, and extract information from a scientific reading, a news brief, a diagram, graph, table, or other material with scientific data and concepts or ideas.

The online test may consist of multiple choice, drop down menu, and fill-in-the-blank questions. There will also be a short answer portion (suggested 10 minutes) where students may have to summarize, find evidence (supporting details), and reason or make a conclusion from the information (data) presented.

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The work students are doing in class will help them with the GED Science Test. They are also learning skills that will help in many other areas of their lives.

Activities:

Warm-Up: KWL Chart	Time: 10 - 15 minutes

- As students enter the class, have the following written on the board or overhead **"The pH scale measures how acidic or basic a substance is."** Have students create a **"KWL"** chart on a piece of notebook paper (below). This helps to activate students' prior knowledge by asking them what they already **K**now (column 1); students (collaborating as a classroom unit or within small groups) set goals specifying what they **W**ant to learn (column 2); and after reading students discuss what they have **L**earned (column 3).
- Students apply higher-order thinking strategies which help them construct meaning from what they read and help them monitor their progress toward their goals.

KWL Chart:

K - What (else) do I KNOW?	W - What do I WANT to know?	L - What did I LEARN?

Activity 1: Reading (Unit 2.6 Handout 1)	Time: 40 - 45 minutes

1) Distribute **Unit 2.6: Handout 1** to students.
2) Discuss with students that when reading for comprehension, there are many strategies to use: read the title to predict what the reading is about; look at the words in bold and their definitions on the left side of page; if there are images, look at them to get a better understanding; while reading remember to ask "What is this all about?"
3) Have students read the passage and answer the questions independently.
4) Circulate class while they are reading to make sure they understand the information presented and see if there are any questions.
5) Review answers as a whole class – note: some answers may vary – ask students with different answers to discuss theirs with the class.
6) Have students fill in the "**L**" part of their KWL chart to reinforce what was learned from the passage.
7) If there is extra time, have students read the passage in pairs to promote reading fluency.

Break: 10 minutes

Activity 2: Conduct Experiment	Time: 45 - 50 minutes

1) Hand out **Unit 2.6 Handout 2 (pages for students (2-3) only)** to students.
2) Explain to students they will conduct an experiment and they need to read the directions carefully.
3) Use the teacher information on **Unit 2.6 Handout 2 (page 1)** to give students background with the

experiment.
4) Have students set up the experiment according to the instructions; circulate to make sure they are setting it up correctly.
5) Remind students to record the information on their data sheet (predictions and results).
6) If there is time, have a class discussion on the importance of knowing the pH of substances. You can even discuss which careers use the pH scale (healthcare, food science, etc.)
7) Enlist the help of students for experiment cleanup.

Wrap-Up: Summarize	**Time: 5 minutes**
Have students turn to a partner (or write in their journals) about what they have learned today about the pH scale, acids, and bases. Ask them to tell a partner what the pH scale, acids and bases are in one or two sentences. *Note: Use Classroom Routine 4 Handout*	

Extra Work/Homework: Unit 2.6 handout 3	**Time: 30 minutes outside of class**
Students can review compounds with the extra work. Print **Unit 2.6 Handout 3** or print directly from 6-way Paragraphs, Middle Level #48: pages 96-97. Remind students this is from material previously covered, but it is a good review. If able, they should try to summarize the reading passages in 3-5 sentences.	

Differentiated Instruction/ELL Accommodation Suggestions	**Activity**
If some student groups finish early, they can turn their paper over and summarize the reading passage.	**Handout 1**

Online Resources:

Quia online quiz: - http://www.quia.com/rd/1975.html

(Students can put substances in order of high – low based on their pH levels.)

Aces & Bases Are Everywhere: http://www.chem4kids.com/files/react_acidbase.html

Suggested Teacher Readings:

- GED Testing Service – GED Science Item Sample (to get an idea of what the test *may* be like)

  http://www.gedtestingservice.com/itemsamplerscience/

- Assessment Guide for Educators: A guide to the 2014 assessment content from GED Testing Service:

  http://www.riaepdc.org/Documents/ALALBAASSESSMENT%20GUIDE%20CHAPTER%203.pdf

- Minnesota is getting ready for the 2014 GED test! – Check out the website with updated information on the professional development in Minnesota regarding the 2014 GED.

  http://abe.mpls.k12.mn.us/ged_2014_2

Unit 2.6 Handout 1 ANSWER KEY

1. **C**
2. **B**
3. **A**
4. **Answers may vary but should be similar to: The baking soda is basic, or alkaline.**
5. **Answers may vary but should be similar to: Most bacteria can't live in it, and bacteria are needed to make nutrients available to the plants.**
6. **acidic; less**
7. **Answers may vary but should be similar to: Each unit represents a tenfold change, or a change by the power of 10.**

Lesson 2.6: Physical Science – Chemical Reactions

Unit 2.6 Handout 2 (first page for teacher use only) TEACHER INSTRUCTIONS

Discuss with students: This activity is designed for students to identify the pH level of compounds. By testing common household substances, they will understand how the pH determines why a compound reacts with other substances and for what purpose. Students will understand the property of acid and base, and how to test the pH of a liquid. It is important to know the acidic or basic nature of a liquid because the nature of the liquid often determines its use. Our stomach liquids are acidic so that specific enzymes can aid in digestion. Bathroom toilet bowl cleaners are strongly acidic or basic so that they can effectively clean. Automobile battery fluids are acidic so that electrical energy can be produced. The examples are all positive uses for acidity and/or basicity. Sometimes, however, there is too much of one or the other and problems arise. For example, if our stomachs are too acidic, we get a stomachache. We also need to know if a substance is acidic or basic in order to know how it works.

Remind students of the rules that include: no tasting, keep area clear of other materials, place used materials on paper towel, self-monitor movement between lab stations. Skills used and developed are pH testing method, observation of strip color, comparison of test strip to pH scale and recording data on a continuum.

Contamination of strips occurs when students touch the area used to test liquid creating a testing error. pH strips which show a range is critical.

Materials Needed:

**pH strips which indicate an acid-base range from 1-14 (available online or at Lakeshore Learning Store)

**pH scale in color (to check the strips against)
**common household substances in liquid form such as (choose about 10 from the list):

- antacid (i.e. Milk of Magnesia)
- Mountain Dew
- milk
- glass cleaner with ammonia
- shampoo
- orange juice
- Coke
- vinegar
- distilled water
- lemon juice
- mouthwash
- apple juice
- black coffee
- tomato juice
- Red Bull or Monster
- soapy water
- baking soda & water
- what students drink!

**clear plastic cups for station (one for each liquid used
**eye droppers, optional (can be purchased at Lakeshore Learning Store or similar)
**paper towels
**water, for cleanup and safety procedure

Assign students to different roles for experiment:

****recorder** of data ****scientist** to prepare lab station ****scientist** to use pH strips in different liquids

Lesson 2.6: Physical Science – Chemical Reactions

Unit 2.6 Handout 2 (two pages)

This activity is designed for students to identify the pH level of compounds. By testing common household substances, you will understand how the pH determines why a compound reacts with other substances and for what purpose. Students will understand the property of acid and base, and how to test the pH of a liquid.

Rules of the experiment include: no tasting, keep area clear of other materials, place used materials on paper towel, and self-monitor movement. Skills used and developed are pH testing method, observation of strip color, comparison of test strip to pH scale and recording data on a continuum.

Contamination of strips occurs when students touch the area used to test liquid creating a testing error. pH strips which show a range is critical, so try to touch only the top of the test strip.

Litmus paper is an indicator used to test whether a substance is acidic or basic. You simply dip the paper (pH test strips) in your substance and it will change color depending on whether it is acidic or basic. It will turn red in an acid and blue in a base.

Instructions:

1. Label glasses with names of liquids to be tested
2. Place paper towel under each glass
3. Have data sheet ready to record reactions
4. Make a prediction if the liquid is a base or acid
5. Dip a strip of litmus paper into the substance
6. Use the color pH scale to check results and pH level
7. Record results on data sheet
8. Clean up experiment area when finished

Information to Remember

- If it turns red, that substance is an acid. Very strong Acids are around 1-2 on the pH Scale. Weaker acids are 3-6 on the pH scale.
- If it turns blue, that substance is a base. Weak bases are 8-9 on the pH scale. Very strong bases are 10-12 on the pH scale
- If it stays the same, that substance is neutral. Neutral (neither acidic or basic) are 7

Acid or Base Data Sheet

Substance	**Prediction** (acid, base, or neutral)	**pH** (test color of test strip against pH scale)	**Acid or Base?**

Were your predictions accurate? Why or Why not?

_____

_____

_____

Why do you think it is important to know if a substance is an acid or a base?

_____

_____

_____

Unit 2.6 Handout 3 ANSWER KEY

1. a. N (narrow)
   b. M (main)
   c. B (broad)
2. c
3. b
4. c
5. b
6. c

Lesson 2.6: Physical Science – Chemical Reactions

Unit 2.6 Handout 4 (two pages total) (if you can't find pH test strips, can make your own solution)

Today's chemical reaction:

- A purplish colored molecule in cabbage juice + **acids =** a **red/pink** colored molecule
- Also the molecule in cabbage juice + **bases = blue/green** colored molecule
- The molecule in cabbage juice does not react with **neutral molecules = no color change**
- Therefore cabbage juice can be used to indicate if a solution is acidic or basic so it is called an indicator.

Demonstration (10 min)

- Show how the cabbage juice strips change color in different solutions showing examples of the colors.
- Explain how to perform experiment and fill in work sheet and safety concerns
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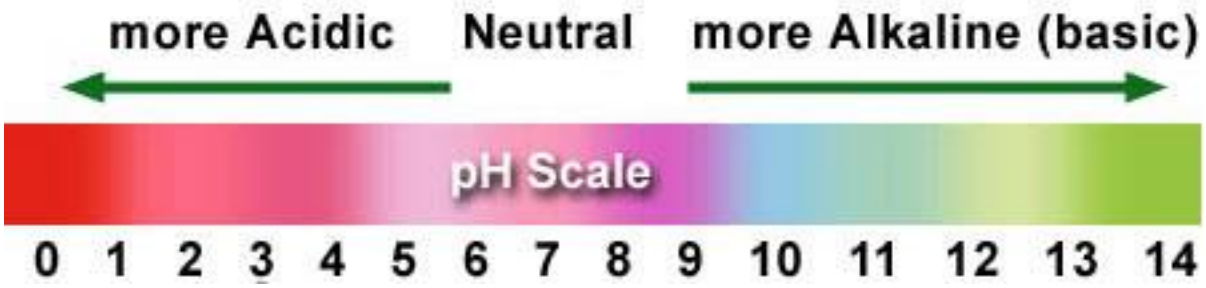

Hands-on Experience (30 min)

Will have prepared cabbage juice paper strips and solutions of common household acids and bases: sprite, vinegar, water, lemon juice, laundry detergent, windex, and alka seltzer.

Students will pair up and drop the solutions on the strips. The color change will indicate to them whether the solution is acidic, basic, or neutral. They can even try to approximate the pH by looking at the pH color scale or just say whether the pH is 0-6, 7, or 8-14.

They will fill in the table with their observations.

Directions for Preparing Cabbage Juice Indicator
Source: Center of Science and Industry (COSI) www.cosi.org

Materials for Cabbage Juice Indicator:

- Red cabbage
- Knife
- Boiling water
- Filter paper (coffee filters work well)
- One large glass container

For pH Testing:

- Small glass containers
- Household ammonia
- Baking soda
- Washing soda
- Lemon juice
- Vinegar

Instructions:

1. Chop the cabbage into small pieces until you have about 2 cups of chopped cabbage. Place the cabbage in a large glass container and add boiling water to cover the cabbage. Allow at least ten minutes for the color to leach out of the cabbage.

2. Filter out the plant material to obtain a red-purple-bluish colored liquid. This liquid is at about pH 7.

3. Pour about 50 - 100 mL of your red cabbage indicator into each small glass container. Use separate containers for each chemical. Add the chemicals to the indicator until a color change is obtained. (Chemicals used in this demo may be safely washed down the drain with water.)

Optional: You can also make pH test strips by soaking filter papers in a very concentrated red cabbage juice and then hanging the papers to dry.

What's Going On:

Red cabbage contains a pigment molecule called flavin. This is a water-soluble pigment that is also found in some fruits and flowers. Very acidic solutions will turn the solution a red color. Neutral solutions result in a purplish color. Basic solutions appear in greenish-yellow. Different types of indicators will have different pH color scales.

The color of the juice changes in response to changes in its hydrogen ion concentration. pH is the -log[H+]. Acids will donate hydrogen ions in an aqueous solution and have a low pH (pH < 7). Bases accept hydrogen ions and have a high pH (pH > 7).

A neutralization experiment could be performed using cabbage juice indicator. First add an acidic solution such as vinegar or lemon juice until a reddish color is obtained. Then add washing soda or vinegar until the solution neutralizes turning a bluish color. The color change that you see is a physical change but the loss or addition of Hydrogen ions is a chemical change.