

Unit 2 Summary

Topic 2.1: How do chemical reactions affect your daily life?

Key Concepts

- Chemical reactions support our lives and assist us at home and at work.
- Chemical compounds require safe handling to minimize their hazards.

Key Terms

- chemical reaction (page 112)
- product (page 112)
- reactant (page 112)
- dilute (page 113)



Big Ideas

- Chemicals react with one another in predictable ways.
- Chemical reactions are a necessary component of chemical products and processes used in the home and workplace.

Topic 2.2: How can we understand, describe, and name chemical compounds?

Key Concepts

- Chemical compounds are formed from elements in the periodic table.
- Chemical compounds are represented using chemical names and chemical formulas.
- Reactive elements can become more stable when they form compounds.
- Chemical compounds are described as either ionic or molecular.

- Ionic compounds are named with the metal ion first and then the non-metal ion ending in "ide."
- Molecular compounds are named using numerical prefixes.

Key Terms

- chemical formula (page 122)
- ion (page 124)

Big Ideas

- Chemicals react with one another in predictable ways.



Topic 2.3: What happens during a chemical reaction, and how can it be described?

Key Concepts

- During a chemical reaction, chemical compounds are changed into different compounds with different properties.
- The four types of chemical reactions can be described using word equations.
- Chemical reactions can be described using chemical equations.
- Atoms and mass are conserved during a chemical reaction.

Key Terms

- synthesis reaction (page 144)
- decomposition reaction (page 144)
- single displacement reaction (page 144)
- double displacement reaction (page 144)
- word equation (page 144)
- chemical equation (page 146)
- balanced chemical equation (page 148)
- law of conservation of mass (page 148)

Big Ideas

- Chemicals react with one another in predictable ways.
- Chemical reactions are a necessary component of chemical products and processes used in the home and workplace.



Topic 2.4: What are acids and bases, and how do they react?

Key Concepts

- Acids and bases are compounds with specific properties.
- An acid and a base react in a neutralization reaction to produce a salt and water.
- Chemical reactions involving acids, bases, and other compounds require safe handling to minimize hazards.

Key Terms

- acid (page 160)
- base (page 160)
- acid-base indicator (page 162)
- pH scale (page 162)
- neutralization reaction (page 164)
- antacid (page 165)

Big Ideas

- Chemicals react with one another in predictable ways.
- Chemical reactions are a necessary component of chemical products and processes used in the home and workplace.



Unit 2 Projects

Inquiry Project The pH of your “Pop”

Have you ever left the cap off a soft drink and then taken a gulp only to find that it has gone “flat”? What does flat mean? How does it connect to the pH of the initial soft drink?

Soft drinks are carbonated beverages, which means that carbon dioxide gas, CO_2 , has been dissolved into the liquid. When carbon dioxide dissolves in the soft drink, it reacts with the water in the drink to form carbonic acid, H_2CO_3 . Because an acid is produced, the pH of the soft drink is lower than it would be without the dissolved carbon dioxide. When the lid is left off the soft drink, the carbonic acid is then able to decompose, and the carbon dioxide is allowed to escape back into the air. What other substance must be produced when the carbonic acid breaks down? What happens to the pH of the soft drink?

Inquiry Question

How does the pH of a soft drink change as it goes flat?

Initiate and Plan

1. Write the word equation and the balanced chemical equation that describe how a carbonated beverage becomes flat.
2. Look at the products in the equations you have just written. Use these products to help you formulate a hypothesis. Explain your hypothesis.
3. Develop a procedure to determine what happens to the pH of a soft drink that has been left open to the air for at least two days. Include the equipment and materials you will need.
4. Create a data chart to record your observations.
5. Have your teacher approve your procedure.

Perform and Record

6. Conduct your investigation and record your observations in the table you have created.

Analyze and Interpret

1. How did the pH of the soft drink change over time?
2. Did your results support your hypothesis? If so, explain why. If not, describe why there are differences.
3. Based on your findings, do you think that fresh pop or flat pop is less damaging to your teeth? Support your opinion using the results of this investigation.

Communicate your Findings

4. Summarize your findings in a written report to your friends. Use the headings:
Title of Investigation
What I think
What I did
What I found out
What I have concluded

Assessment Checklist

Review your project. Did you...

- write the word equation for the reaction that makes a soft drink go flat? **K/U**
- write the chemical equation for the reaction that makes a soft drink go flat? **K/U**
- state a hypothesis that answers the inquiry question? **T/I**
- design an appropriate procedure? **T/I**
- record data daily in an organized chart? **T/I**
- state your findings and describe how they support or refute your hypothesis? **T/I**
- present a written report with the required headings? **C**
- express your opinion using the results of the investigation? **A**

An Issue to Analyze: Mining Gold from e-Waste

Jobs in “green” industries that help clean up the environment will be important for employment in the future. You are planning to start up a company that will recycle e-waste. One possibility would be to focus on recycling electronics, many of which contain gold.

Issue

Televisions, computers, cell phones, and other electronic devices contain a variety of elements, including gold. These elements can be harvested from devices after they have been discarded. Besides the gold, some of the other elements can be toxic. What are the safety implications for your employees and the benefits to the environment if you mine e-waste for gold?

Initiate and Plan

1. Brainstorm several questions that come to mind when thinking about the safety implications for employees of an e-waste recovery business.
2. Brainstorm several questions about how mining e-waste will affect the environment.
3. Decide on which research sources you want to use to answer your questions.

Perform and Record

4. Conduct research that can be used to answer your safety and environmental questions.
5. Use a graphic organizer to record the information you find.
6. As you are researching, you may think of some other questions. Write these questions down and record the information you find to answer them.

Analyze and Interpret

1. Analyze your research information for bias and accuracy.
2. What precautions can be taken to ensure your employees remain safe and healthy?
3. How will the environment be affected by the mining of e-waste?
4. What are some of the risks that your employees may be exposed to while mining e-waste for gold? Do the benefits of mining the e-waste outweigh the risks to your employees and the environment? Support your opinion with your research.

Communicate your Findings

5. Present your findings on this issue, using a format that allows for discussion and feedback, such as a podcast or a presentation. Use appropriate scientific language.

Assessment Checklist

Review your project. Did you...

- state the safety considerations that need to be addressed to make e-waste mining safe for employees? **K/U**
- explore ways the environment can be affected by the mining of e-waste? **K/U**
- create reasonable research questions about the safety implications for the mining of e-waste and the effects to the environment? **T/I**
- conduct research and record information using a graphic organizer? **T/I**
- analyze information for bias and accuracy? **T/I**
- present your information using a podcast or a presentation? **C**
- present your opinion about the safety of mining e-waste, considering both your employees and the environment? **A**

- 13.** Classify the following chemical reactions as one of synthesis, decomposition, single-displacement, or double-displacement.
- a)** $2 \text{Al}_2\text{F}_3 \rightarrow 4 \text{Al} + 3 \text{F}_2$
 - b)** $2 \text{Al} + 3 \text{SnCl}_2 \rightarrow 2 \text{AlCl}_3 + 3 \text{Sn}$
 - c)** $\text{N}_2 + 3\text{H}_2 \rightarrow 2 \text{NH}_3$
 - d)** $\text{KCl} + \text{AgNO}_3 \rightarrow \text{KNO}_3 + \text{AgCl}$
- 14.** What chemical is found in toothpaste that helps your teeth resist decay? How does it work?
- 15.** How does an indicator “indicate” the presence of an acid or base?
- 16.** What type of reaction is an acid-base neutralization reaction?
- 17.** What is produced in an acid-base neutralization reaction?

Thinking and Investigation T/I

- 18.** In a natural gas fireplace, the natural gas combines with oxygen gas to produce carbon dioxide and water.
- a)** Identify the reactants and products in this reaction.
 - b)** Provide chemical formulas for oxygen, carbon dioxide, and water.
- 19.** Describe how acetic acid, which is produced from a reaction involving yeast and fruit sugar, can be both extremely dangerous and very useful.
- 20.** You are given two white solids: one is ionic and one is molecular. Design an experiment that would allow you to determine which is which. Describe the results you would obtain for each.
- 21.** Name the following compounds:
- a)** NaI (ionic)
 - b)** MgF_2 (ionic)
 - c)** SiO_2 (molecular)
 - d)** PBr_3 (molecular)
 - e)** SCl_2
 - f)** Li_2O

- 22.** Provide chemical formulas for the following compounds:
- a)** aluminum oxide (ionic)
 - b)** sodium hydroxide (ionic)
 - c)** disulfur dinitride (molecular)
 - d)** nitrogen trihydride (molecular)
 - e)** potassium sulfide
 - f)** phosphorus trifluoride
- 23.** A chemical equation and an equation in math are both similar and different. Describe one similarity and one difference. Do you think they are more similar, or more different? Explain.
- 24.** Balance the following chemical reactions.
- a)** $\text{AgCl} \rightarrow \text{Ag} + \text{Cl}_2$
 - b)** $\text{Cl}_2 + \text{CsBr} \rightarrow \text{CsCl} + \text{Br}_2$
 - c)** $\text{Ca} + \text{N}_2 \rightarrow \text{Ca}_3\text{N}_2$
 - d)** $\text{AgNO}_3 + \text{Ba}(\text{OH})_2 \rightarrow \text{AgOH} + \text{Ba}(\text{NO}_3)_2$
- 25.** You are given three solutions, and are told that one is an acid, one is a base, and the third is neutral. Design an experiment to determine which is which. Include a data table to record your data. Explain how you will determine which solution is which from the data you collect.

Communication C

- 26.** Baking cookies is an example of a chemical reaction. Explain how baking is a chemical reaction by using a graphic organizer, writing a paragraph, or drawing pictures with captions.
- 27.** Using examples, illustrate the difference between HHPS (Hazardous Household Product Symbols) and WHMIS (Workplace Hazardous Materials Information System) symbols. Provide one example of where these symbols are found. Which set of symbols are more important for most people to recognize? Explain.

Unit 2 Review

- 28.** How does a chemical formula simplify the description of a chemical substance? Using a simple chemical substance, illustrate how it can be described using words (the chemical name), pictures (a drawing of a molecular model), or a chemical formula (a combination of chemical symbols). How do all three methods of describing a chemical substance provide the same information?
- 29.** Naming chemical compounds involves following several steps. Use an example to illustrate how to name a molecular compound from its chemical formula.
- 30.** Using diagrams, illustrate the difference between the four types of chemical reactions (synthesis, decomposition, single-displacement, and double-displacement).

Application **A**

- 31.** How is burning wood to produce heat and light similar to how we burn food in our bodies?
- 32.** Many household products have symbols on them to warn you of possible danger. Describe the type of danger associated with a product that has the following symbols on its label. How should you ensure that your family is kept safe around this product?

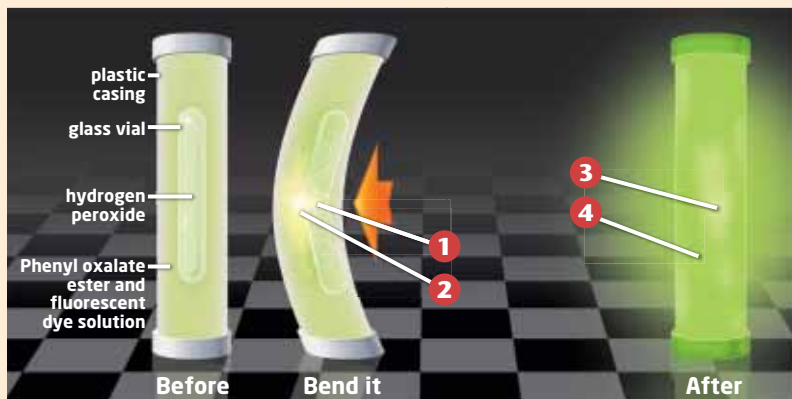


- 33.** Food labels for processed foods contain a list of ingredients. Do you think that this list provides enough information about the food additives that you are consuming? Explain why or why not.
- 34.** One of the properties of acids is that they are corrosive. This is both a benefit and a risk to using acids. Provide an example of how the corrosive properties of acids are useful, and an example where that property is destructive.
- 35.** People who produce too much acid in their stomachs may suffer from ulcers. Using your knowledge of acid-base chemistry, describe what is happening to a person's tissues if too much acid is produced. What is one way this problem can be treated?
- 36.** Acids are routinely transported across the country, from the place they are produced to where they are used. Unfortunately, sometimes acid spills, like the one in Figure 2.28 on page 165 occur. Are the benefits of acids like sulfuric acid worth the risk? What are some ways to reduce the likelihood of an acid spill?
- 37.** Chemical reactions can be used to solve crimes, as you saw in the *Strange Tales of Science* feature on pages 154 to 155. What are luminol, ninhydrin, and sodium rhodizonate used for in crime scene chemistry?

Literacy Test Prep

Read the selection below, and answer the questions that follow it.

Glow sticks are popular products that are used as light sources as well as for safety or entertainment purposes. Glow sticks use energy from a series of chemical reactions to produce light. The following diagram shows the series of chemical reactions that must occur to make glow sticks work.



1. The hydrogen peroxide reacts with the phenyl oxalate ester, producing phenol and an unstable peroxyacid ester.
2. The unstable peroxyacid ester decomposes, producing an additional phenol and a cyclic peroxy compound.
3. The cyclic peroxy compound decomposes to carbon dioxide, which provides energy to the dye.
4. The electrons in the dye release the energy in the form of light.

Multiple Choice

1. The hydrogen peroxide is in a glass vial to
 - a) keep people safe
 - b) react with the glass
 - c) prevent the chemicals from mixing
 - d) allow the chemicals to mix
2. The initial reaction that takes place in glow sticks is between
 - a) peroxyacid and phenol
 - b) hydrogen peroxide and phenyl oxalate ester
 - c) phenol and a cyclic peroxy compound
 - d) carbon dioxide and energy
3. The glow is produced by
 - a) breaking the glass vial
 - b) decomposition of the cyclic peroxy compound
 - c) energy provided to the dye
 - d) energy released by the electrons in the dye

Written Answer

1. Summarize this selection. Include a main idea and one relevant point that supports it.