

Unit 3
CHEMICAL TESTS
(based on STC Kit)

INTRODUCTION

Chemicals are all around us. They have properties that can be identified through the use of simple tests. We can learn about chemicals by adding water, heat or cool to them. We can also observe changes in chemicals as they interact with other chemicals.

Chemicals can be acidic, basic, or neutral. We use chemicals every day. Everything is made of chemicals.

SCIENCE STANDARDS AND INDICATORS

Content Standard 3.1: Materials have properties that can be identified and described through the use of simple tests.

B.1. Sort and classify materials based on properties such as dissolving in water, sinking and floating, conducting heat, and attracting to magnets.

B.2. Describe the effect of heating on melting, evaporation, condensation and freezing of water.

SCIENCE INQUIRY: Scientific inquiry is a thoughtful and coordinated attempt to search out describe, explain and predict natural phenomena.

SCIENCE LITERACY: Science literacy includes speaking listening, presenting, interpreting, reading and writing about science.

SCIENCE NUMERACY: Mathematics provides useful tool for the description, analysis and presentation of scientific data and ideas.

EXPECTED PERFORMANCES

BINQ.1 Make observations and ask questions about objects, organisms and the environment.

BINQ.3 Design and conduct simple investigations.

BINQ.4 Employ simple equipment and measuring tools to gather data and extend the senses.

BINQ.6 Analyze, critique and communicate investigations using words, graphs and drawings.

BINQ.9 Use mathematics to analyze, interpret and present data.

BIG IDEA: Chemicals have properties that can be tested and change form with heat or cold and exposure to water.

Key Vocabulary: chemical, solution, suspension, observation, data, mixture, separate, properties, dissolve, filtration, crystal, evaporation, control, chemical property, acid, base, neutral, indicators, neutralization, brainstorm, communication, compare, crystallization, fair test, filter.

LINKS TO OTHER STANDARDS

MATH

3.3.b. Determine and use different tools and units appropriate for specific measurement tasks.

4.1.a. Design surveys for the collection of data and justify conclusions drawn from the data.

ESSENTIAL KNOWLEDGE:

- Materials have properties that are directly observable; examples include state of matter, or its size, shape color or texture. Other properties can only be observed by doing something to the material (simple tests). Materials can be sorted and classified based on their testable properties.
- Some materials dissolve (disappear) when mixed in water; others accumulate on the top or at the bottom of the container. The temperature of water can effected whether and at what rate materials dissolve in it.
- Some materials, such as sponges, papers and fabrics, absorb water better than others.
- Some materials float when placed in water (or other liquids such as cooking oil or maple syrup); others sink to the bottom of the container.
- Some materials are attracted to magnets. Magnetic materials contain iron.
- The physical properties of material can be changed, but the materials remain the same. For example, a block can be cut, sanded or painted, but it is still wood.
- Heating and cooling cause materials to change from one state to another and back again. Adding heat can cause solids to melt into liquids (for example, chocolate, ice cream, butter or wax); removing heat (cooling) cab cause liquids to harden into solids (for example, hot candle wax hardens as cools).

- Adding heat can cause water to boil or evaporate into a gas in the air (for example, steam rises from heated water); removing heat (cooling) can cause water vapor to condense into liquid water (for example, warm steam hitting a cold mirror.) Water outdoors or in an open container evaporates without boiling (for example, puddles, ponds, fish tanks, etc.)
- Water may exist as a solid, liquid or gas, depending on its temperature. If water is turned into ice and then the ice is allowed to melt, the amount of water is the same as it was before freezing.
- Liquid water becomes solid water (ice) when its temperature cools to 0 degrees Celsius (32 degrees Fahrenheit). Warming ice to a temperature above 0 degrees Celsius causes it to melt into liquid water.

CONCEPTS

- Common household chemicals have different physical and chemical properties.
- Chemicals undergo changes in form, color or texture when they are mixed together, separated or heated.
- Some chemicals can be identified by their interaction with water, vinegar, iodine, red cabbage juice and heat.
- Different types of mixtures, such as solutions or suspensions, are created when solids are combined with water.
- Evaporation and filtration are methods for separating mixtures of solids and liquids.
- Some chemicals can be classified as acids, bases or neutral substances on the basis of their reactions with red cabbage juice.

SKILLS:

- Observing and describing properties of materials
- Learning to perform different physical and chemical tests
- Predicting, observing, describing, and recording results of tests
- Analyzing and drawing conclusions from the results of tests
- Comparing and contrasting test results to define the properties of household chemicals so they can be identified.
- Supporting conclusions with reasons based on experiences.
- Communicating results and reflecting on experiences through writing and discussion.
- Applying previously learned knowledge and skills to solve a problem.
- Reading to enhance understanding of chemistry concepts.
- Developing proper laboratory techniques to ensure safety and avoid contamination.

ESSENTIAL QUESTIONS TO GUIDE INSTRUCTION AND ASSESSMENT:

- What properties do various chemicals have?
- Can chemicals undergo changes?
- Can chemicals change their size and shape?
- What is evaporation?
- What is filtration?
- Can chemicals break down?
- What breaks chemicals down?
- What are the proper techniques that we can use to be safe when using chemicals?
- What is a solution and how is it different from a suspension?
- How can we classify chemicals?
- How can we test chemicals?

MATERIALS AND SUPPLIES

- STC Chemical Test Kit, Changes Kit

OBJECTIVES AND GOALS (as summarized from the STC Kit, “Chemical Tests”)

LESSON ONE

Pre-unit Assessment: Thinking About Chemicals

- Students set up a notebook to record their observations and data
- Students share their present thinking about chemicals and discuss what they would like to learn about them
- Students gain experience observing an unknown material and describing its properties.

LESSON TWO

Investigating Unknown Solids: Getting Ready

- Students assemble the tools and five unknown chemicals they will be investigating.
- Students learn about the importance of safety in science class.
- Students observe and describe the properties of common classroom objects.

LESSON THREE

Exploring the Five Unknown Solids

- Students observe the five unknowns using their unaided senses, as well as equipment that extends and enhances their senses.
- Students discuss the properties of the five unknowns.

- Students begin recording and organizing data in a systematic way.

LESSON FOUR

Testing Unknown Solids with Water

- Students predicting what they think might happen when they add a few drops of water to each unknown.
- Students investigate the effects of mixing each of the unknowns with water.
- Students record, organize and discuss their results.

LESSON FIVE

Exploring Water Mixtures

- Students predict and then investigate what will happen when a greater amount of water is mixed with the unknown solids.
- Students observe and record their results of the investigations.
- Students filter the mixtures to explore further the physical properties of the solids.
- Students discuss their observations after filtering the liquid mixtures.

LESSON SIX

Discovering Crystals

- Students predict, observe and discuss the filtration results of the mixtures they created in Lesson 5.
- Students record their observations on a test table of their own design.
- Students continue to explore the properties of two types of mixtures, solutions and suspensions.
- Students write about crystals.

LESSON SEVEN

Testing Unknown Solids with Vinegar

- Students predict the results of testing the five unknowns with vinegar.
- Students test the unknowns and record and discuss their observations of the different reactions.
- Students discuss how the use of a “compare circle,” or control, helps them interpret test results.
- Students write their own thoughts on what they have learned by testing the unknowns with vinegar.

LESSON EIGHT

Testing Unknown Solids with Iodine

- Students predict the results of testing the five unknown solids with iodine.
- Students test the unknowns and record/discuss their observations.
- Students continue to learn safety guidelines for working with chemicals.

LESSON NINE

Testing Unknown Solids with Red Cabbage Juice

- Students predict the results of testing the five unknowns with red cabbage juice.
- Students test the unknowns and discuss and record their observations.
- Through the individual writings and class discussion, students reflect on what they have learned about the unknowns from the tests they have conducted so far.
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LESSON TEN

Testing Unknown Solids with Heat

- Students predict the results of testing the five unknowns by heating them.
- Students test the unknowns and record and discuss their observations.
- Students discuss and use new safety guidelines when heating materials.

LESSON ELEVEN

Reviewing the Evidence

- Students create test summary tables that enable them to review the data they have collected on the unknowns.
- Students summarize and analyze their results in order to discriminate differences between the unknowns.
- Using all of their test results, students predict the identities of the unknowns and provide reasons that support their predictions.

LESSON TWELVE

Identifying the Unknown Solids

- Students use the process of comparing their test data with a reliable source of information to identify the unknowns.
- Students read about how the five chemicals they have been testing are used in everyday life.

LESSON THIRTEEN

Identifying the “Mystery Bag Chemical”

- Students review and discuss the processes they use to identify the unknown solids.
- Students develop and apply a testing strategy to identify the contents of the mystery bag introduced in Lesson 1.
- Using their test results, students analyze their recorded data, draw conclusions, and support those conclusions.

LESSON FOURTEEN

Testing Mixtures of Two Unknown Solids

- Students decide which tests to perform, and in which order to perform them, to identify two solids in a mixture.
- Students interpret their test results, draw conclusions, and support those conclusions with their data.

LESSON FIFTEEN

Testing Household Liquids with Red Cabbage Juice

- Students apply the red cabbage juice test from Lesson 9 to six household liquids.
- Students share test results and develop their own system on classification for the six liquids.
- Through a reading selection, students learn about acids, bases and neutrals.
- By comparing their test results with information in the reading selection, students classify the six household liquids (and their five powders) as acids, bases or neutrals.

LESSON SIXTEEN

Using the Known Solids to Identify Unknown Liquids

- Students decide which chemical tests they will perform and in what order they will perform them to solve a new problem.
- Students analyze their recorded data, draw conclusions, and support these conclusions with their test results.
- Students record their thoughts about the significance of negative results and about chemical properties as indicators.