

CHEMISTRY

GRADE 5

ASSESSMENT PACKET

Learn first-hand the fundamental principles of this essential science as you perform real chemistry experiments. Experiment with fuels and combustion, make your own hydrochloric acid, separate mixtures, produce oxygen gas, split the water molecule, fire copper ions across a solution, capture oxide gases, create a magnesium battery, and more with this section in chemistry.



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This curriculum is aligned with the California State Standards and STEM for Science.

Educational Goals

Learn first-hand the fundamental principles of this essential science as you perform real chemistry experiments. For example, you will experiment with fuels and combustion; make your own hydrochloric acid, separate mixtures, produce oxygen gas, and more.

You'll also split the water molecule, fire copper ions across a solution, capture oxide gases, create a magnesium battery, and more with this lesson in chemistry. You'll also be able to identify the elements in different chemical substances with dazzling colors in flame tests.

In doing these experiments, you will build a strong foundation in chemistry as you are exposed to a broad range of chemical phenomena and hands-on lab experience. As you gain experience with the tools and chemicals of the modern chemistry lab, you will also learn advanced topics such as chemical equations, atomic structures and the periodic table — concepts that are critical to continued study of chemistry.

Chemistry is chocked full of demonstrations and experiments for two big reasons. First, they're fun. But more importantly, the reason we do experiments in chemistry is to hone your observational skills. Chemistry experiments really speak for themselves, much better than I can ever put into words or show you on a video. And I'm going to hit you with a lot of these chemistry demonstrations to help you develop your observing techniques.

Here are the scientific concepts:

- Elements and their combinations account for all the varied types of matter in the world.
- During chemical reactions, the atoms in the reactants rearrange to form products with different properties.
- All matter is made of atoms, which may combine to form molecules.
- Metals have properties in common, such as electrical and thermal conductivity. Some metals, such as aluminum (Al), iron (Fe), nickel (Ni), copper (Cu), silver (Ag), gold (Au), are pure elements while others, such as steel and brass, are composed of a combination of elemental metals.
- Each element is made of one kind of atom. These elements are organized in the Periodic Table by their chemical properties.
- Scientists have developed instruments that can create images of atoms and molecules showing that they are discrete and often occur in well-ordered arrays.
- Differences in chemical and physical properties of substances are used to separate mixtures and identify compounds.
- Properties of solid, liquid, and gaseous substances, such as sugar (C₆H₁₂O₆), water (H₂O) helium (He), oxygen (O₂), nitrogen (N₂), and carbon dioxide (CO₂).
- Living organisms and most materials are composed of just a few elements.
- Common properties of salts, such as sodium chloride (NaCl).
- Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model shows that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon; the effects of air on larger particles or objects.
- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.

- Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.)
- When two or more different substances are mixed, a new substance with different properties may be formed.
- No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.)

By the end of the labs in this unit, students will be able to:

- Design and build a desalination experiment using everyday materials.
- Know how to demonstrate electroplating using ions and electrolytes.
- Understand how to determine a catalyst in a reaction.
- Differentiate observation from inference (interpretation) and know scientists' explanations come partly from what they observe and partly from how they interpret their observations.
- Measure and estimate the length and volume of objects.
- Formulate and justify predictions based on cause-and-effect relationships.
- Conduct multiple trials to test a prediction and draw conclusions about the relationships between predictions and results.
- Construct and interpret graphs from measurements.
- Follow a set of written instructions for a scientific investigation.

Chemistry Grade 5 Evaluation

Teacher Section

Overview: Kids will demonstrate how well they understand important key concepts from this section.

Suggested Time: 45-60 minutes

Objectives: Students will be tested on the key concepts:

- Chemical and physical reactions
- Molecules and atoms
- Acids and bases

Students will also demonstrate these principles:

1. How to use blue litmus paper to test for the presence of an acid
2. How to turn blue litmus paper into red litmus paper
3. How to make a saturated solution
4. How temperature and humidity may affect chemicals

Materials (one set for entire class)

- | | |
|--------------------------|------------------------|
| • goggles | • test tube stand |
| • teaspoon | • index card |
| • cobalt chloride | • hair dryer |
| • distilled water | • blue litmus paper |
| • cotton swab | • dropper |
| • test tube with stopper | • vinegar |
| • funnel | • baking soda solution |

Lab Preparation

1. Print out copies of the student worksheets, lab practical, and quiz.
2. Have a tub of the materials in front of you at your desk. Kids will come up when called and demonstrate their knowledge using these materials.

Lesson

The students are taking two tests today: the quiz and the lab practical. The quiz takes about 20 minutes, and you'll find the answer key to make it easy to grade.

Lab Practical

Students will demonstrate individually that they know how to use blue litmus paper to test for the presence of an acid, turn blue litmus paper red, make a saturated solution, and demonstrate the effects of temperature and humidity on cobalt chloride. While other kids are waiting for their turn, they will get started on their homework assignment. You get to decide whether they do their assignment individually or as a group.

Homework Assignment Find the assignment in the next section for students to complete.

Chemistry Grade 5 Evaluation

Student Worksheet

Overview: Today you're going to take two different tests: the quiz and the lab practical. You're going to take the written quiz first, and the lab practical at the end of this lab. The lab practical isn't a paper test – it's where you get to show your teacher that you know how to do something.

Lab Test & Homework

1. Your teacher will call you up so you can share how much you understand about Chemistry 2 and how it works. Since science is so much more than just reading a book or circling the right answer, this is an important part of the test to find out what you really understand.
2. While you are waiting for your turn to show your teacher how much of this stuff you already know, you get to get started on your homework assignment. The assignment is due next week, and half the credit is for creativity and the other half is for content, so really let your imagination fly as you work through it.

Read the following information about acid rain and choose one of these activities to complete:

1. Write an opinion piece stating your opinion about acid rain. Make sure to use information from the article to back up your claims.
2. Write a story about an animal living in an area affected by acid rain. What are some hardships your animal might face?
3. Pretend you have to teach a first-grade class about acid rain. How would you go about showing these 6- or 7-year-olds what acid rain is and some of the problems it can cause?

Here is some background information for your homework assignment:

What is Acid Rain? When certain pollutants come into contact with the water droplets found in clouds, the end result is acid rain. The pollutants, which are produced on earth by both natural and man-made processes, can be carried very long distances by the wind. When pollutant-laden clouds collect enough water, acid rain falls on buildings, cars, trees, lakes, and other formations. Pollutants from acid rain which exist in dry form can be inhaled by people and can cause serious health problems in some.

Sources of Acid Rain Acid rain is caused by a chemical reaction. One compound that causes acid rain is sulfur dioxide. Sulfur dioxide is naturally released in volcanic eruptions, but is also a product when coal and petroleum are burned. The other main chemical affecting acid rain is nitrogen oxide. Nitrogen oxides are naturally released in a lightning strike, but also occur in the combustion of coal and oil at electric power plants, and in gas-powered automobiles.

Air containing abnormal amounts of nitrogen oxide is sometimes found in large cities, where there is a high amount of automobile traffic. In the Los Angeles area, cars produce the main source of acid rain. In some national

parks such as Yosemite and Sequoia, automobile traffic is limited to lessen the amount of air pollution damage to the trees and plants.

Neutralization Reactions in the Environment Some rain is naturally acidic, with a pH around 5.0. When it falls, it comes into contact with some of the alkaline (basic) chemicals on earth. These non-acidic materials can be found in air, soil, rocks, lakes, and streams. The result is a reaction that neutralizes the acid. However, if the rain becomes too acidic, there are not enough basic materials to neutralize all the acid, and the result is damage to crops, trees, lakes, rivers and animals.

Acid Rain May Cause Health Problems in People Compounds like sulfur dioxide and nitrogen oxides can affect people with respiratory diseases such as asthma or chronic bronchitis. The pollution that causes acid rain can also create tiny particles that float around in the air. If people breathe these particles, their lungs may be affected. Swimming in an acidic lake or walking in an acidic puddle is not necessarily harmful, but breathing in polluted air may cause health problems.

Acid Rain Harms Forests Acid rain can cause harm to forests. When acid rain comes into contact with the forest soil, it can dissolve nutrients such as magnesium and calcium. These nutrients are essential for healthy trees and other greenery. Acid rain also causes the element aluminum to be released into the soil, which makes it difficult for trees to obtain water. Some trees, such as spruce and fir, live at higher elevations. These trees are constantly exposed to clouds and fog, which can hold more acid than rain or snow. When trees don't get the necessary nutrients, it makes them more susceptible to infection, insects, and damage from cold weather.

Acid Rain Damages Lakes and Streams Most lakes and streams have a natural pH level of about 6.5 (very slightly acidic). Acid rain has caused that level to drop, meaning some lakes and streams, especially in the northeast United States, are becoming more acidic. The aluminum that is released into the soil due to acid rain eventually washes into lakes and streams. The increase in both acidity and aluminum levels can be very harmful and even deadly to some aquatic wildlife. Some animals particularly affected are phytoplankton, mayflies, rainbow trout, smallmouth bass, frogs, spotted salamanders, and crayfish.

Acid Rain Damages Buildings and Objects Acid rain can also wreak havoc on objects such as buildings, statues, monuments, and cars. The chemicals present in acid rain can cause paint to peel and stone statues weather abnormally quickly, making them appear old before their time. The Statue of Liberty and the Egyptian pyramids are two treasures of the world that have been affected by acid rain.

Chemistry Grade 5 Quiz

Teacher's Answer Key

1. What is a saturated solution? (a solution in which the maximum amount of something has been dissolved)
2. What is the difference between a physical change and a chemical change? Name two examples of each.
(Answers may vary. A physical change happens when the molecules stay the same, but the volume and/or shape change, like wadding up tissue or cutting paper. A chemical change rearranges the molecules and atoms to create new molecule combinations, like a campfire or the formation of rust.)
3. How does soap work? (A soap molecule is like a snake. It has a head that loves water, called the hydrophilic end. It also has a tail that loves oil, fat, grease, and dirt, which is called the hydrophobic end. The hydrophilic end dissolves in water and the hydrophobic end wraps itself around fat and oil in the dirty water, cleaning it off your dishes.)
4. What is the difference between atoms, molecules, and polymers? (Atoms are the smallest bits of matter, made of a nucleus and its electrons. Molecules are groups of atoms. Polymers are long chains of molecules all stuck together.)
5. What does a catalyst do? (It speeds up the rate of a reaction.)
6. What does it mean if a compound is thermochromic? (It changes colors depending on the temperature.)
7. What is the difference between red and blue litmus paper? (Red tests for a base, and blue for an acid)
8. Think about the desalination experiment. Did this experiment involve a physical change or a chemical change? Explain. (A physical change. The water was boiled and then condensed, but it was still plain water. It just changed state and was separated from the salt, not altered into something different.)
9. What is chemiluminescence? Name one example of chemiluminescence. (When light is produced in a chemical reaction, but not heat. For example, a glow stick.)
10. Somebody wrote a secret message using phenolphthalein. Describe how you would read this message. (Swab it with a base, turning the phenolphthalein pink.)

Chemistry Grade 5 Quiz

Name _____

1. What is a saturated solution?
2. What is the difference between a physical change and a chemical change? Name two examples of each.
3. How does soap work?
4. What is the difference between atoms, molecules, and polymers?
5. What does a catalyst do?
6. What does it mean if a compound is thermochromic?
7. What is the difference between red and blue litmus paper?

8. Think about the desalination experiment. Did this experiment involve a physical change or a chemical change? Explain.

9. What is chemiluminescence? Name one example of chemiluminescence.

10. Somebody wrote a secret message using phenolphthalein. Describe how you would read this message.

Chemistry Grade 5 Lab Practical

Teacher's Answer Key

This is your chance to see how well your students have picked up on important key concepts, and if there are any holes. Your students also will be working on their homework assignment as you do this test individually with the students.

Materials:

- goggles
- teaspoon
- cobalt chloride
- distilled water
- cotton swab
- test tube with stopper
- funnel
- test tube stand
- index card
- hair dryer
- blue litmus paper
- dropper
- vinegar
- baking soda solution

Lab Practical: Ask the student *Note: Answers given in italics!*

1. Give student blue litmus paper and a dropper. Have two unlabeled flasks on the table, one with an acid (such as vinegar) and one with a base (such as a baking soda solution). Ask student to first demonstrate how to determine if a solution is an acid or a base. Then, follow the correct procedure to make red litmus paper. He or she should do the following:
 - a. Use the dropper to drop a sample from each flask onto the blue litmus paper.*
 - b. Student should identify the acid because the blue litmus paper turns red in the presence of an acid.*
 - c. To make red litmus paper, the student should use the acid to turn the blue litmus paper completely red, then rinse in cold water and set aside to dry.*
2. Give student a test tube with stopper, test tube stand, funnel, teaspoon, distilled water, and cobalt chloride. Ask him or her to make a saturated solution of cobalt chloride. *(Student should pour water into the test tube and add cobalt chloride, a little bit at a time. Between each addition they should cap and shake the test tube. The solution is saturated when they cannot dissolve any more cobalt chloride into the water.)*
3. Ask student to demonstrate the effect of temperature and humidity on the chemical cobalt chloride by writing a message (perhaps their favorite thing about chemistry class!) on an index card using a cobalt chloride solution, then making it appear. Students should do the following:
 - a. Using the cotton swab, dip into the cobalt chloride solution and write on the index card. Use a hair dryer to blow across the solution and reveal the message.*

Chemistry Grade 5 Lab Practical

Student Worksheet

This is your chance to show how much you have picked up on important key concepts, and if there are any holes. You also will be working on a homework assignment as you do this test individually with a teacher.

Materials:

- goggles
- teaspoon
- cobalt chloride
- distilled water
- cotton swab
- test tube with stopper
- funnel
- test tube stand
- index card
- hair dryer
- blue litmus paper
- dropper
- vinegar
- baking soda solution

Lab Practical: Ask the student

1. Find blue litmus paper, a dropper, and two unlabeled flasks. Can you demonstrate how to determine if a solution is an acid or a base? Do this now.

Next, follow the correct procedure to make red litmus paper.

2. Find a test tube with stopper, test tube stand, funnel, teaspoon, distilled water, and cobalt chloride. Make a saturated solution of cobalt chloride.
3. Demonstrate the effect of temperature and humidity on the chemical cobalt chloride by writing a message (perhaps their favorite thing about chemistry class!) on an index card, and then making it appear.