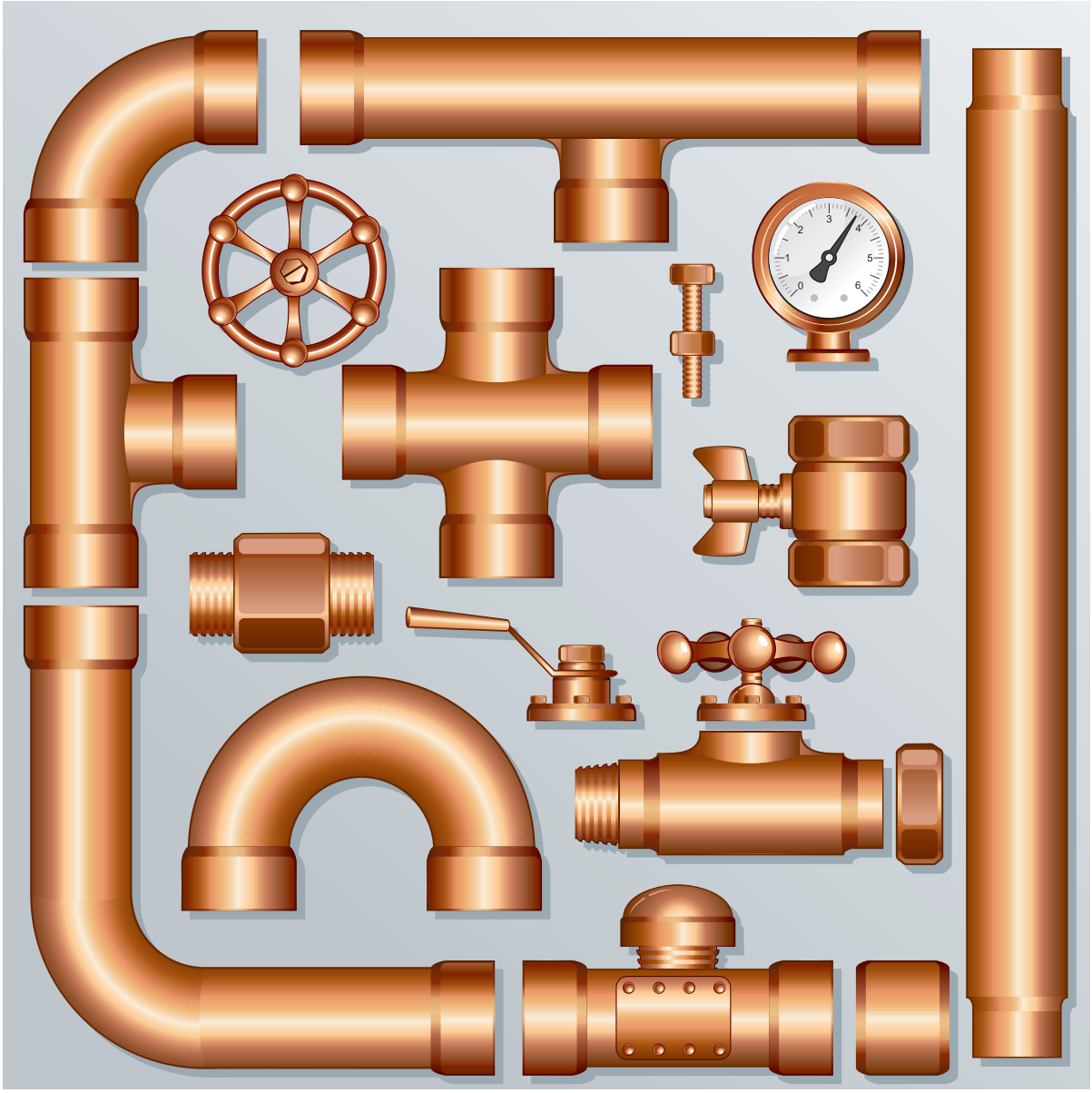
Activity 6

Copper

Part 1

Copper is a reddish metal that occurs naturally in rock, water and soils. Many copper compounds can be recognized by their blue or green color. When copper is found in tap water, it is usually through the corrosion of copper pipes and brass fittings, particularly in areas where the water is acidic. Copper can cause greenish stains on porcelain fixtures.

Copper is essential to certain aquatic organisms. Very small amounts of copper are necessary for good health; however, large amounts or long-term exposure can cause liver and kidney damage, and even death. Sometimes copper (in the form of blue copper sulfate) is added to a water supply reservoir for algae control or used in agriculture to treat plant diseases such as mildew. Copper is not known to cause cancer, but at higher concentrations, it may produce stomach upset, diarrhea and vomiting. Drinking water regulations limit copper to a maximum of 1.0 ppm.



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Activity 6

Copper

Part 2

OBJECTIVES:

1. Using test strips, determine the amount of copper in tap water and in a water sample exposed to copper.
2. Determine the pH of tap water that is most likely to result in corrosion of copper pipes.

VOCABULARY:

Mine tailings – Mine tailings are the discarded, crushed rock left over from mining operations.
Corrosion – Metals may be attacked by acids, bases, oxygen, moisture, or other metals. Corrosion is the name given to the process of attack.

MATERIALS:

School Test Kit materials:
Copper test strips
School Kit Color Chart and Instruction card
Data collection sheet
plastic droppers

Equipment:
Clean glass jars with lids
4 copper pennies
cleaned with steel wool or mild acid

Shopping list:
Distilled white vinegar
Tap water
Baking soda
Distilled water

SAMPLE PREPARATION:

Vinegar solution – Prepare a 1:1 solution of white vinegar: tap water, 10 ml per group.
Baking soda solution – Prepare 5g baking soda in 100 ml tap water, 10 ml per group.

PROCEDURE:

1. Label jars #1-5. To jar #1 and #2, add 50 ml distilled water. Add 50 ml tap water to jars #3-5.
2. To jar labeled #4, put 10 ml vinegar solution; in #5 put 10 ml baking soda solution.
3. Measure and record the pH of each solution.
4. Drop a clean copper penny into each jar #2-5. Cover and let sit overnight.
5. Using a clean copper test strip for each jar, test and record copper levels in solution.

ANALYSIS AND APPLICATION

1. Which jars are you certain contain NO copper? How can you be certain?
2. Use the formula Total chlorine = Free chlorine + combined chlorine (TC = FC + CC) to calculate the chloramine levels in each sample. Enter on the data table.

EXTENSION:

Copper sulfate can be purchased in aquarium and pond supply stores. Obtain a sample of algae-rich pond water. Using a microscope, view the microorganisms living in sample. Divide into 2 clean jars. Leave one jar as a control; to the second one add a few drops of copper sulfate. After 3-5 days, observe the difference between the 2 jars. View both samples under the microscope.

Activity 7

Iron

Part 1

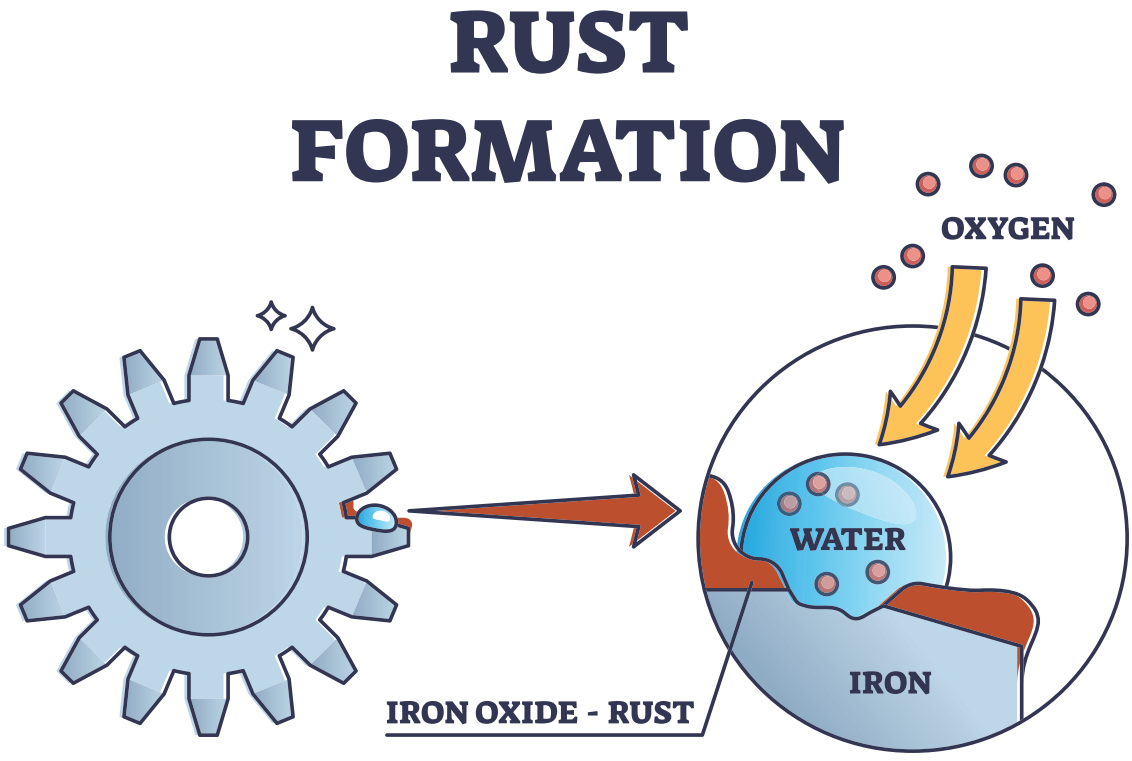
Iron is found naturally in many igneous rocks and clays. In the absence of oxygen, iron exists in the reduced state (Fe+2 or ferrous iron) and is colorless and very soluble. When exposed to oxygen (or chlorine) at the pH range of 7.0 to 8.5, iron becomes oxidized (Fe+3 or ferric iron) and is almost completely insoluble. Red clay soil is yellowish at first, but turns the red color as it becomes oxidized on exposure to oxygen in the air. The results of iron in water may be seen as rust deposits on toilets, sinks, and clothes. Current research does not associate iron levels in water with any adverse health effects. Because of the effect of oxidized iron on the taste, clarity and color of water, maximum levels for drinking water are set by the EPA at 0.3 ppm.

The tendency of oxidized iron to precipitate makes it relatively easy to remove during water treatment. Sodium hydroxide is used to cause soluble iron to precipitate and slowly settle out. A chemical flocculent is added and the clumps settle or are filtered out.

USING THE TEST STRIPS:

Please refer to the enclosed color chart for instructions on using the test strips.

Note: This test only measures reduced iron, because oxidized iron is mostly insoluble and therefore not able to react with chemical indicators in solution. Fresh drinking water samples that contain soluble (reduced) iron will also be oxygen poor. An aerator on the faucet or even standing open to the air will introduce oxygen which will oxidize iron, resulting in the precipitation of iron from the solution. To get an accurate reading of iron in drinking water, allow the tap to run for 1 minute before collecting the sample. Then test the collected sample immediately.



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