



# Royal Rangers

## Merit Requirements: Silver-Bordered Merit

### CHEMISTRY

Note: This merit may be completed by earning at least a grade of B for two semesters of high school chemistry OR by completing the following requirements.

#### Safety First!

Chemistry experiments should be done in a controlled, carefully supervised environment, such as a school lab (laboratory) or learning center lab, unless they are specifically designed as a home experiment. A responsible adult who is educated in lab safety must constantly supervise you. Never work alone.

If you plan to do any experiments, pay attention to all safety cautions. Have a charged fire extinguisher accessible at all times. Everyone in the lab should wear a certified lab apron, protective gloves, and safety goggles. Have water and paper towels available for cleanup. Keep your work area neat and clean at all times. Know and post your local fire, police, ambulance, and poison control phone numbers. Keep a detailed and dated lab notebook of your activities. Chemicals and even simple lab procedures can become dangerous quickly. Make safety considerations a first priority. If you are concerned about the safety of an experiment, don't do it. If you are unsure of the outcome of an experiment, do not perform it.

Dispose of all chemicals properly. If you don't know the proper chemical disposal procedure, ask the lab supervisor or do not do the experiment. Be careful and always know what the expected results are. You do not want any surprises. Remember, the reason for your effort is to observe the physical and chemical world, to learn more about how complicated it is, to learn how things work, and to wonder why.

1. Define the *science of chemistry*. Explain what chemists do and how their contributions have improved our standard of living.
2. Complete the following:
  - a. List at least five chemical products that you use at your home.
  - b. Examine the labels of the chemicals. List what the manufacturer puts on the container, including warnings, harmful effects, and medical aid.
  - c. Contact your community's solid waste management system for information listing the proper disposal of household chemicals. Circle the chemicals found in your home and include the printed information in your workbook.
3. Define the branches of chemistry listed below. Explain each branch's area of study and contributions.
  - a. Inorganic
  - b. Organic
  - c. Physical
  - d. Synthetic
  - e. Analytical
  - f. Biochemistry

g. Organometallic

4. Explain how and why organic and inorganic chemistry separated into two separate fields.
5. Describe the important scientific contribution Friedrich Wohler made to organic chemistry.
6. Describe the difference between “theoretical” and “technological” inorganic chemistry.
7. Describe the development of the periodic table by Russian chemist Dmitri Mendeleev. Explain how this theoretical concept was useful.
8. Define any TWO of the following areas of physical chemistry.
  - a. Electrochemistry
  - b. Colloid chemistry
  - c. Photochemistry
  - d. Thermodynamics
  - e. Chemical kinetics
9. Define DNA and describe where it is found.
10. Obtain a copy of the periodic table of the elements and complete the following:
  - a. What purpose does the periodic table serve?
  - b. What is the total number of discovered elements? How many are natural and how many are man-made?
  - c. What is meant by the “atomic weight” value, and how is it used to characterize elements in the table?
  - d. What is the “shell” of an atom? How does the shell determine the families, groups of elements, that appear in the table? How does the function of the shell help us understand the atom’s behavior?
11. Identify the following chemicals and list the atoms in each.
  - a. H<sub>2</sub>O
  - b. NaHCO<sub>3</sub>
  - c. NaCl
  - d. CO<sub>2</sub>
  - e. H<sub>2</sub>SO<sub>4</sub>
  - f. KOH
  - g. H<sub>2</sub>O<sub>2</sub>
12. Explain the chemical reaction that the following chemical formula graphically describes:  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
13. Do each of the following experiments. Develop a hypothesis prior to each experiment. Write a report and explain the results of the experiment, including what you learned.
  - a. Study the reaction of vinegar mixed in baking soda.

Items needed: one-liter plastic pop bottle, rubber balloon, two teaspoons of baking soda, one-fourth cup of vinegar, rubber band

Steps:

    1. Pour the vinegar into the plastic bottle. Carefully pour the baking soda into the balloon.
    2. Making sure not to tip up the balloon and spill any baking soda into the bottle of vinegar, stretch the opening of the balloon over the open mouth of the bottle. Secure it by wrapping the rubber band around the seal a couple times.
    3. Carefully tip the balloon and allow the baking soda to fall into the vinegar. Almost instantly a frothy mixture begins to form in the closed bottle. In addition, the balloon begins to inflate.
  - b. Reverse the tarnishing effect of silver.

Items needed: a tarnished piece of silver, a pan or dish large enough to completely immerse the silver in, enough water to fill the pan or dish, aluminum foil, a vessel in which to heat the water, hot pads, baking soda (about one cup per gallon of water)

Steps:

    1. Line the bottom of the pan with aluminum foil. Place the silver object on the aluminum foil. Be sure the silver touches the aluminum.
    2. Heat the water to boiling. Remove it from the heat and place it in a sink. Add about one cup of baking soda for each gallon of hot water. The mixture will froth and may spill over; this is why it is placed in the sink.
    3. Pour the hot baking-soda-and-water mixture into the pan, completely covering the silver piece.

4. The tarnish will begin to disappear almost immediately. If the silver is only lightly tarnished, the tarnish will disappear within several minutes. However, if the silver is badly tarnished, the baking-soda-and-water mixture may need to be reheated in order to give the silver several treatments to remove all of the tarnish.