

## Chemistry Merit Badge

### Prerequisite Requirement / Pre-Event Recommendations and Notes



To have the best experience possible during the Chemistry Merit Badge course, the following notes and recommendations are being provided for each Chemistry Merit Badge requirement. All notes and recommendations are highlighted in yellow, and the prerequisite requirement (4A) are in red.

1. Do EACH of the following:

(a) Describe three examples of safety equipment used in a chemistry laboratory and the reason each one is used. Recommendation: Scouts should come with notes on this topic and be prepared to describe.

(b) Describe what a safety data sheet (SDS) is and tell why it is used. Recommendation: Scouts should research this ahead of time and make notes they can use to describe during the course.

(c) Obtain an SDS for both a paint and an insecticide. Compare and discuss the toxicity, disposal, and safe-handling sections for these two common household products. Recommendation: This part of the requirement will be completed in the session however Scouts should be familiar with the requirement to be better prepared for the discussion.

(d) Discuss the safe storage of chemicals. How does the safe storage of chemicals apply to your home, your school, your community, and the environment? Recommendation: Scouts should review this requirement and make notes on each of the locations to prepare to discuss during the course.

2. Do EACH of the following:

(a) Predict what would happen if you placed an iron nail in a copper sulfate solution. Then, put an iron nail in a copper sulfate solution. Describe your observations and make a conclusion based on your observations. Compare your prediction and original conclusion with what actually happened. Write the formula for the reaction that you described. Note: This portion will be completed during the course.

(b) Demonstrate how you would separate sand (or gravel) from water. Describe how you would separate table salt from water, oil from water, and gasoline from motor oil. Name the practical processes that require these kinds of separations and how the processes may differ. Recommendation: The first part (separate sand from water) will be completed during the course. Scouts should research the other separations and take notes they can use to describe the other separations and name several practical processes using these separations.

(c) Describe the difference between a chemical reaction and a physical change. Observe one of each and share your observations with your counselor. Recommendation: Examples will be demonstrated during the course, but Scouts should research this, take notes, and be prepared to describe the key differences.

3. Construct a Cartesian diver. Describe its function in terms of how gases in general behave under different pressures and different temperatures. Describe how the behavior of gases affects a backpacker at high altitudes and a scuba diver underwater. Recommendation: The Cartesian diver will be constructed in the session. Scouts should research the other questions and be prepared to describe answers during the course.

4. Do EACH of the following:

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(a) Cut a round onion into small chunks. Separate the onion chunks into three equal portions. Leave the first portion raw. Cook the second portion of onion chunks until the pieces are translucent. Cook the third portion until the onions are caramelized, or brown in color. Taste each type of onion. Describe the taste of raw onion versus partially cooked onion versus caramelized onion. Explain what happens to molecules in the onion during the cooking process.

**Prerequisite Requirement:** Scouts should complete this requirement at home with adult supervision and take notes as if they were making an entry in a laboratory notebook. Use a few tablespoons of cooking oil in the pan. Include date and time, description of the procedure (in detail; for example, type of pan and oil used, burner setting) and all observations made (what did you see, hear, smell, taste). Have the supervising adult sign your procedure and observations. Bring your notes, signed by the supervising adult, to the session and be prepared to explain what happens to the molecules (use research sources such as the merit badge pamphlet).

(b) Describe the chemical similarities and differences between toothpaste and an abrasive household cleanser. Explain how the end use or purpose of a product affects its chemical formulation. **Recommendation:** This requirement will be completed during the course. Scouts will be provided with samples of toothpaste and cleanser and will complete a table of ingredients. Scouts should prepare an answer to the portion related to explaining how end use affects formulation.

(c) In a clear container, mix a half-cup of water with a tablespoon of oil. Explain why the oil and water do not mix. Find a substance that will help the two combine, and add it to the mixture. Describe what happened, and explain how that substance worked to combine the oil and water. **Recommendation:** This requirement will be completed during the course. Scouts should review information in the Merit Badge pamphlet or other sources to prepare to answer the question.

5. Discuss with your counselor the 5 classical areas of chemistry (organic, inorganic, physical, analytical and biological), and two others from the following list. Explain what they are, and how they impact your daily life.

- (a) Agricultural chemistry
- (b) Atmospheric chemistry
- (c) Computational chemistry
- (d) Electrochemistry
- (e) Environmental chemistry and green chemistry
- (f) Flavor chemistry, fragrance chemistry, and food chemistry
- (g) Medicinal and natural products chemistry
- (h) Photochemistry
- (i) Polymer chemistry
- (j) Or another area of chemistry of your choosing.

**Recommendation:** Scouts should research this and come prepared with notes to aid in discussion during the course.

6. Do EACH of the following:

(a) Name two government agencies that are responsible for tracking the use of chemicals for commercial or industrial use. Pick one agency and briefly describe its responsibilities.

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(b) Define pollution. Explain the chemical impacts on the ozone layer and global climate change.

(c) Using reasons from chemistry, describe the effect on the environment of ONE of the following:

(1) The production of aluminum cans

(2) Burning fossil fuels

(3) Single-use items, such as water bottles, bags, straws, or paper

(d) Briefly describe the purpose of phosphates in fertilizer and in laundry detergent. Explain how the use of phosphates in fertilizers affects the environment. Explain why phosphates have been removed from laundry detergents.

**Recommendation: All parts of this requirement should be researched by the Scout in advance of the course. Scouts should bring their notes to aid in discussion during the course.**

7. Do ONE of the following activities:

(a) Visit a laboratory and talk to a chemist. Ask what that chemist does and what training and education are needed to work as a chemist.

(b) Using resources found at the library and in periodicals, books, and the internet (with your parent's permission), learn about two different kinds of work done by chemists, chemical engineers, chemical technicians, or industrial chemists. For each of the four positions, find out the education and training requirements.

(c) Visit an industrial plant that makes chemical products or uses chemical processes and describe the processes used. What, if any, by-products are produced and how are they handled?

(d) Visit a county farm agency or similar governmental agency and learn how chemistry is used to meet the needs of agriculture in your county. **Note: The instructors for this course will facilitate a group discussion on the above topics, talking about their own experiences and career tracks.**