Chemistry Merit Badge Workbook

This workbook is designed to help Scouts complete the 2026 Chemistry Merit Badge requirements. It can be used for ***pre-requisites 1, 5, 6, 7 and 8C at home*** and the remaining requirements during the Merit Badge College session**.**

Requirement 1 – Safety and Chemical Awareness

a) Use the links below (*Resources)* to view safety data sheets (SDSs) for sucrose (sugar), isopropyl alcohol (rubbing alcohol), and a waterproofing spray. Compare their properties and potential hazard(s), including handling and disposal guidelines and toxicity information.

Sucrose:	
Isopropyl alcohol:	
Waterproofing spray:	

Resources: Safety Data Sheets Training (video), Sucrose SDS, Isopropyl Alcohol SDS, Waterproofing Spray SDS

b) What types of personal protective equipment (PPE) are recommended for each, and why? How does the recommended PPE change with toxicity and route of exposure?

Sucrose PPE: _____

Isopropyl Alcohol PPE: _____

Waterproofing Spray PPE: _____

How PPE changes with toxicity/exposure: _____

_____

Resource: How to Dress in the Lab and the Use of PPE (video)

Requirement 1 (Continued)

c) Review the pictograms in Section 2 of each SDS. What do they mean, and how do you see them used in your community?

Sucrose: ☐  ☐ NONE

Pictogram(s) meaning: _____

Community example(s): _____

Isopropyl Alcohol: ☐  ☐

Pictogram(s) meaning: _____

Community example(s): _____

Waterproof Spray: ☐  ☐

Pictogram(s) meaning: _____

Community example(s): _____

Resource: Safety Pictograms in SDS (video)

d) Discuss the safe storage of chemicals. How does the safe storage of chemicals apply to your home, school, community, and the environment?

Home: _____

School: _____

Community: _____

Environmental impact: _____

Resources: Chemical Storage Safety (video), Store Household Chemicals Safely (video)

Requirement 2 – Chemistry and First Aid

a) Discuss with your counselor why you think soap and alcohol are used to clean cuts and scrapes. Discuss how you could test your hypotheses with your counselor.

Why do you think soap and alcohol are used to clean cuts and scrapes?

_____

Requirement 2 (Continued)

How could you test your hypothesis?

_____

Resource: Soap and Hand Sanitizers vs Viruses and Bacteria (video)

b) Coat your hands with a mixture of cooking oil and a nontoxic powder, such as sand or cocoa. Wash your hands with water and observe what happens. Coat your hands again, then wash with soap and water. Discuss the differences with your counselor.

Observations (water only)	
Observations (soap and water)	
Conclusion	

Resource: How Does Soap Work? (video)

c) Perform an experiment to demonstrate how rubbing alcohol affects microbial growth using baker's yeast. Discuss the results with your counselor.

Experiment procedure	
Observations	
Results and discussion	

Resource: Watching How Alcohol Kills Viruses and Bacteria Under a Microscope (video)

Requirement 3 – Chemistry and Cooking

a) Perform a Maillard, or browning, reaction. Discuss with your counselor whether a physical or chemical change has occurred, and what happened to molecules in the food during the cooking process.

What food you cooked	
Physical or chemical change	
What happened to the molecules	

Resources: The Maillard Reaction (video), Why Pizza Tastes So Good (video), Understanding the Maillard Reaction (video)

b) Prepare and use red cabbage indicator to measure the pH of five common household liquids, including water. Discuss your observations with your counselor.

Resources: Why Is Red Cabbage a pH Indicator (video), pH Indicator Made From Red Cabbage (video), Red Cabbage Indicator Infographic (website)

5 liquids tested	
Observations	
Conclusions	

Requirement 4 – Chemistry and Camping

Perform only 2 of the following: *a (compare waterproofing), b (describe fire extinguishers), c (flame tests), d (synthesize nylon);* ***after all requirements are done****, you may complete the other 2 if there's time left in the session!*

a) Design and conduct an experiment to compare at least two different types of waterproofing. Discuss with your counselor which one you would prefer to use on your tent and which one you would prefer to use on your boots, and why.

Types of waterproofing tested	
Results	
Preference for tent	

Preference for boots	

Requirement 4 (Continued)

Resources: Transforming Paper into a Waterproof Marvel (video), Waterproofing Fabrics (video), Waterproofing Tent Seams (video)

b) Describe the four classes of fires, and the four classes of fire extinguishers. Discuss with your counselor how sand, baking soda, and the four classes of extinguishers work to put out fires.

Four classes of fires	
Four classes of extinguishers	
Sand and baking soda	

Resources: Four Classes of Fires (video), Four Types of Fires (video)

c) Under your counselor's supervision and/or the supervision of a knowledgeable adult approved in advance by your counselor, conduct flame tests of at least five elements using a kitchen or propane torch.

Elements tested	
Colors observed	
Conclusions	

Resource: Metal Flame Test (video)

d) Under your counselor's supervision and/or the supervision of a knowledgeable adult approved in advance by your counselor, synthesize nylon (may be from a kit).

Procedure summary	

Observations	

Resource: Making Nylon (video)

Requirement 5 – Chemistry and the Environment

Describe how chemistry can be used to reduce the environmental impacts of single-use items, such as water bottles, bags, straws, or batteries.

Resources: Upcycling Plastic Bags Into Battery Parts (video), What Is Sustainable Development (video), Edible, Biodegradable Food Packaging (video)

Requirement 6 – Fields of Chemistry

Identify five fields of chemistry. Briefly describe each, tell how each applies to your life and how they interact.

Resource: Areas of Chemistry - American Chemical Society (website)

Requirement 7 – Government Agencies and Chemical Safety

Identify three government agencies that oversee or provide guidance on the use of chemicals for personal, pharmaceutical, commercial, or industrial use, and discuss the agencies' history and responsibilities with your counselor.

Resources: Why Does the FDA Exist? (video), The EPA Was Formed | Today in History (video), Preventing HAZMAT Accidents: DOT Safety Rules Explained (video), Chemistry of a Killer: Inside a DEA Drug Lab (video)

Requirement 8 – Option C: Career Exploration

Identify three career opportunities that would use skills and knowledge in chemistry. Pick one and research the training, education, certification requirements, experience, and expenses associated with entering the field. Research the prospects for employment, starting salary, advancement opportunities and career goals associated with this career. Discuss what you learned with your counselor and whether you might be interested in this career.

Resources: What do Chemical Engineers Do? (video), Interactive Site for Chemical Careers (website), Careers in Science and Engineering (video)