MERIT BADGE SERIES









CHEMISTRY









STEM-Based



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CHEMISTRY



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Requirements

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.
   b. Describe what a safety data sheet (SDS) is and tell why it is used.
   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.
   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?

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.
   b. Describe how you would separate sand from water, table salt from water, oil from water, and gasoline from motor oil. Name the practical processes that require these kinds of separations.
   c. Describe the difference between a chemical reaction and a physical change.

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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.

4. Do EACH of the following:

   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 unions 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.

   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.

   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.

5. List the four classical divisions of chemistry. Briefly describe each one, and tell how it applies to your everyday life.

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 to the public and the environment.

   b. Define pollution. Explain the chemical effects of ozone, global warming, and acid rain. Pick a current environmental problem as an example. Briefly describe what people are doing to resolve this hazard and to increase understanding of the problem.

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

   1) The production of aluminum cans or plastic milk cartons

   2) Sulfur from burning coal

   3) Used motor oil

   4) Newspaper

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

7. Do ONE of the following:

   a. Visit a laboratory and talk to a practicing chemist. Ask what the 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, pollutants 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.

Chemistry Resources

Scouting Literature

Astronomy, Cooking, Electricity, Energy, Engineering, Environmental Science, Fingerprinting, Fire Safety, Forestry, Gardening, Geology, Inventing, Medicine, Metalwork, Nuclear Science, Oceanography, Painting, Plant Science, Pottery, Public Health, Pulp and Paper, Soil and Water Conservation, Space Exploration, Textile, and *Veterinary Medicine* merit badge pamphlets

Visit the Boy Scouts of America's official retail website at http://www.scoutstuff.org for a complete listing of all merit badge pamphlets and other helpful Scouting materials and supplies.

Books

Balbes, Lisa M. *Nontraditional Careers for Chemists: New Formulas in Chemistry.* Oxford University Press, 2006.

Bonnet, Bob. *Science Fair Projects: Chemistry.* Sterling, 2001.

Brown, Cynthia Light. Amazing Kitchen Chemistry Projects You Can Build Yourself. Nomad Press, 2008.

Churchill, E. Richard, et al. *365 Simple Science Experiments With Everyday Materials.* Black Dog & Leventhal Publishers, 2013.

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Editors of TIME. *Big Book of Science Experiments: A Step-by-Step Guide.* Time for Kids, 2011.

Evernden, Margery. *The Experimenters: Twelve Great Chemists.* Avisson Press, 2001.

Franceschetti, Donald R., ed. *Careers in Chemistry.* Salem Press, 2013.

Gardner, Robert. *Science Projects About Kitchen Chemistry.* Enslow, 1999.

Kramer, Alan. *How to Make a Chemical Volcano and Other Mysterious Experiments.* Scholastic, 1991.

Newmark, Ann. *Chemistry.* Dorling Kindersley, 2005.

Potter, Jean. *Science in Seconds for Kids: Over 100 Experiments You Can Do in Ten Seconds or Less.* Wiley, 1995.

Snyder, Carl H. *The Extraordinary Chemistry of Ordinary Things.* Wiley, 1995.

VanCleave, Janice Pratt. *Janice VanCleave's A + Projects in Chemistry.* Wiley, 1993.

———. *Janice VanCleave's Chemistry for Every Kid: 101 Easy Experiments That Really Work.* Wiley, 1989.

Wolke, Robert L. *What Einstein Didn't Know: Scientific Answers to Everyday Questions.* Dell, 1999.

Woodburn, John H. *Opportunities in Chemistry Careers.* VGM Career Books, 2002.

Organizations and Websites

American Chemical Society
1155 16th St. NW
Washington, DC 20036
Toll-free telephone: 800-227-5558
Website: http://www.acs.org

Occupational Safety and Health Administration
U.S. Department of Labor
200 Constitution Ave. NW
Washington, DC 20210
Website: http://www.osha.gov

The Science Page
Website: http://sciencepage.org

U.S. Department of Agriculture
1400 Independence Ave. SW
Washington, DC 20250
Website: http://www.usda.gov

U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Ave. NW
Washington, DC 20460
Telephone: 202-272-0167
Website: http://www.epa.gov

U.S. Food and Drug Administration
10903 New Hampshire Ave.
Silver Spring, MD 20993
Toll-free telephone: 888-463-6332
Website: http://www.fda.gov

WebElements™ Periodic table is available at http://www. webelements. com. A periodic table with models can be found at http://www.pittsford-schools.org/webpages/jmellon/general.cfm.

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