



CHEMISTRY

Merit Badge Requirements at North Central College



These original requirements and worksheets were pulled from

<http://www.scouting.org/scoutsources/BoyScouts/AdvancementandAwards/MeritBadges/mb-CHEM.aspx> and modified to fit the program at North Central College. Before arriving on campus you should answer the questions that have been *. The other questions we will tackle during the workshop. You should give yourself several hours to complete these sections before coming to the workshop with the appropriately completed sections. You do not need to be meticulous on these but you should have a sense of what the question is asking and be able to answer it in a rudimentary way. We will not be able to award the badge until the sections are complete.

*1) Do EACH of the following activities:

- A) Describe three examples of safety equipment used in a chemistry laboratory and the reason each one is used.
<http://www.baruch.cuny.edu/tutorials/weissman/chemlab/> and go to Exploring the Lab, Slides 6, 7, and 9.
- B) Describe what a material safety data sheet (MSDS) is and tell why it is used.
<http://www.ilpi.com/msds/faq/parta.html#whatis>
- C) Obtain an MSDS for both a paint and an insecticide. Compare and discuss the toxicity, disposal, and safe-handling sections for these two common household products.
Compare the paint from Sherwin Williams and the insecticide Lorsban from Dow. You will find the toxicity in Section 11 where the LD₅₀ tells you the lethal dose of 50% of the subjects (rats typically). The disposal is in Section 13 and the handling is in Section 7.
<http://www.paintdocs.com/webmsds/webPDF.jsp?SITEID=STORECAT&prodno=601225733&doctype=MSDS&lang=E>
and use the oral LD50 of the different ingredients.
<http://www.greenbook.net/docs/MSDS/M31830.PDF>
- 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?
School: <http://www.flinnsci.com/sections/safety/chemicalSafety/hazardousStorage.asp>
Home, Community, and Environment: <http://www.extension.umn.edu/distribution/naturalresources/components/6680b.html>

2) Do EACH of the following activities:

- 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 a formula for the reaction that you best 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.

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 under water.

4) Do EACH of the following activities:

- A) *We will be doing a lab that will get at this experiment but because we do not allow anything to be eaten in the laboratory you can perform this experiment at home if you like.* 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.

*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.

<http://sci-toys.com/ingredients/toothpaste.html>

<http://lancaster.unl.edu/home/Articles/2002/HouseholdCleaning.htm>

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C) *We will also tackle this experiment in lab.* 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.

Go to: <http://paul.brandt.faculty.noctrl.edu/service/service.html>

*6) Do EACH of the following activities:

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.

Check out the following governmental agencies Mission Statements.

The CDC: <http://www.cdc.gov/niosh/about.html>

The EPA: http://www.epa.gov/ocir/scas_lgac/mission.htm

The FDA: <http://www.fda.gov/AboutFDA/WhatWeDo/default.htm>

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.

Ozone: http://www.ucar.edu/learn/1_7_1.htm

Global Warming: http://en.wikipedia.org/wiki/Global_warming

Acid Rain: <http://pubs.usgs.gov/gip/acidrain/2.html>

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

Al cans <http://www.cancentral.com/canc/nontext/lesson5.htm> (go to "Background")

Plastic <http://www.blueegg.com/quiz/Which-Milk-Container-Is-Better-for-the-Environment-Plastic-Or-Paperboard.html>

Sulfur http://tonto.eia.doe.gov/kids/energy.cfm?page=coal_home-basics#coal_environment-basics

Oil http://tonto.eia.doe.gov/kids/energy.cfm?page=oil_home-basics#oil_environment-basics

Paper http://www.tappi.org/paperu/all_about_paper/earth_answers/Whyrec1.htm and
http://www.tappi.org/paperu/all_about_paper/earth_answers/Recycle1.htm

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.

Fertilizer <http://www.scienceinAfrica.co.za/2001/november/phosphate.htm>

Fertilizer and Detergent <http://www.ncsu.edu/sciencejunction/depot/experiments/water/lessons/np/>

7) Do ONE of the following activities – *You will be doing Part A:*

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 jobs, 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 they are handled.

E) Visit a county farm agent or similar governmental agency and learn how chemistry is used to meet the needs of agriculture in your county.

Worksheet Created by: Rob Greenland – robgreenland@juno.com

Worksheet Modified by: Dr. Paul Brandt – pbrandt@noctrl.edu

Requirement 1 (Complete this before arriving for the workshop)

Describe three examples of safety equipment used in a chemistry laboratory and the reason each one is used.

Safety Equipment: _____

Reason Used: _____

Safety Equipment: _____

Reason Used: _____

Safety Equipment: _____

Reason Used: _____

What is a material safety data sheet (MSDS)? _____

Obtain an MSDS for both a paint and an insecticide. Compare and discuss the toxicity, disposal, and safe-handling sections for these two common household products: _____

Discuss the safe storage of chemicals: _____

How does the safe storage of chemicals apply to your home: _____

How does the safe storage of chemicals apply to your school: _____

How does the safe storage of chemicals apply to your community: _____

How does the safe storage of chemicals apply to the environment: _____

Requirement 2

Predict what would happen if you placed an iron nail in a copper sulfate solution: _____

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: _____

Describe how you would separate sand from water: _____

Describe how you would separate table salt from water: _____

Describe how you would separate oil from water: _____

Describe how you would separate gasoline from motor oil: _____

Name the practical processes that require these kinds of separations: _____

Describe the difference between a chemical reaction and a physical change: _____

Requirement 3

Construct a Cartesian diver. Show it to your counselor.

Describe its function in terms of how gases in general behave under different pressures and different temperatures: _____

Describe how the behavior of gasses affects a backpacker at high altitudes: _____

Describe how the behavior of gasses affects a scuba diver underwater: _____

Requirement 4

We will be doing a lab that will get at this experiment but because we do not allow anything to be eaten in the laboratory you can perform this experiment at home and complete this section if you like; however, you should complete part 4b below. 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: _____

Describe the chemical similarities and differences between toothpaste and an abrasive household cleanser (**Complete this before arriving for the workshop**): _____

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Explain how the end use or purpose of a product affects its chemical formulation: _____

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: _____

Requirement 5 (Complete this before arriving for the workshop)

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

1) _____

Description: _____

How does it apply to your everyday life? _____

2) _____

Description: _____

How does it apply to your everyday life? _____

3) _____

Description: _____

How does it apply to your everyday life? _____

4) _____

Description: _____

How does it apply to your everyday life? _____

Requirement 6 (Complete this before arriving for the workshop)

Name two government agencies that are responsible for tracking the use of chemicals for commercial or industrial use.

- 1) _____ 2) _____

Pick one agency and briefly describe its responsibilities to the public and the environment: _____

Define pollution: _____

Explain the chemical effects of ozone: _____

Explain the chemical effects of global warming: _____

Explain the chemical effects of acid rain: _____

Pick a current environmental problem as an example. Which problem did you choose? _____

Briefly describe what people are doing to resolve this hazard and to increase understanding of the problem: _____

Select one of the following (circle it):

- 1) The production of aluminum cans or plastic milk cartons
- 2) Sulfur from burning coal
- 3) Used, motor oil
- 4) Newspaper

Using reasons from chemistry, take the item you circled above and describe the effect it has on the environment: _____

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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: _____

Requirement 7

You have been given four options for this requirement. You will be doing Option A at NCC.

What does a chemist do? _____

What training and education are needed to work as a chemist? _____
