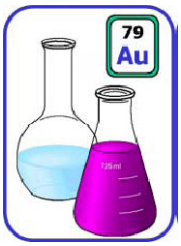
girl scouts of wisconsin badgerland

Chemistry IPA



Girl Scouts of Wisconsin – Badgerland Council
For Girl Scout Cadettes, Seniors and Ambassadors
Created by Women in Chemistry
At Michigan State University

To complete this Interest Project Patch, Cadette, Senior, and Ambassador Girl Scouts must complete:

- Two activities from the Skill Builders section
- One activity from the Technology section
- One activity from the Service Project section
- One activity from the Careers section
- Two additional activities from any sections

Skill Builders:

Remember: SAFETY FIRST!

- ALWAYS wear safety glasses when conducting any chemical experiment.
- Experiments should ONLY be carried out under adult supervision and with the approval of your parents or guardian.
- NEVER attempt unauthorized experiments.

1. Acidic, basic, neutral, pH… these are all commonly used terms: on the news you hear that acid rain dissolves statues and harms plant and animal life in lakes; commercials tout the benefits of a pH balanced shampoo; gardeners know that some plants thrive in acidic soil while others prefer a more basic environment. What do these terms really mean and how is pH measured? Find out by making a pH indicator from red cabbage. Use it to determine the pH of household chemicals and water samples. In addition find out how the pH of a solution can be neutralized by adding vinegar to a solution of baking soda. (Caution: **DO NOT mix** bleach with cleaning products containing ammonia – this produces poisonous chlorine gas).

Red Cabbage pH indicator instructions

An indicator is a solution that turns a certain color when an acid or base is added to it. It is what is on the pH paper that makes it turn colors when you dip it in an acid or base. Red cabbage can be used as an indicator for acids with pH's between 4 and 6. You can prepare the cabbage juice one of two ways...

1) Chop half a red cabbage and place it in a container for boiling. Add water to just cover the cabbage. Boil for 15 minutes then remove the cooked cabbage and discard it. Add the other half of the uncooked cabbage to the juice in the pan and boil it for an additional 15 minutes. Remove the cabbage and discard. Pour juice into desired container.
2) Cut up ¼ head of red cabbage and put it into a blender or food processor. Just cover with water and blend the cabbage into a slurry (1-3 minutes). Pour the slurry through a strainer collecting the juice in a container.

You can split up the cabbage juice into different cups and add different solutions (juices, soda, etc) and watch the cabbage juice change color. Around pH four the cabbage juice will be a pink color. At pH five it will be a dark purple. At pH 6 it will change to blue color. From pH 7 and up it will be a green color.

2. One of the properties of a gas that distinguishes it from condensed phases of matter (solids and liquids) is its compressibility. Make a Cartesian diver and explain why it "dives" when the sides of the bottle are squeezed. In your explanation include a discussion of the term "density", how it can be changed, and how it affects whether an object floats or sinks.

3. Chemists separate components of complex mixtures not only to purify products but also when identification and/or quantification of individual components in a mixture is desired. Many of the techniques used fall under the category of chromatography. These methods separate compounds based upon the difference in their affinity for molecules in a mobile and stationary phase. Learn about chromatographic methods by performing a paper chromatography experiment to separate the components of inks in different types of markers.

4. Have you ever noticed a bathtub ring? This is the result of a chemical reaction between soap and minerals that are dissolved in water. Unlike the soap and minerals, the products of *this* reaction are insoluble in water and precipitate as a scummy ring in the tub. Water hardness is a measure of mineral concentration: the harder the water, the worse the problem. Water softeners are often used to remove the minerals from water. Find out about the water cycle and the origins of hard water. Learn how to determine the hardness of water using an EDTA titration. Learn how water softeners work. If possible, use an EDTA titration to determine the hardness of tap water from different communities, bottled water, snow, and water from natural sources such as rivers and lakes.

5. You may have heard that acid rain is causing beautiful, ancient statues to dissolve. Statues are commonly made of a mineral called limestone (calcium carbonate). Chalk and antacid tablets such as "Tums" are also composed of calcium carbonate. Drop pieces of chalk or "Tums" into pure water and into an acidic solution such as vinegar or lemon juice. What

happens? Discuss the results of your test and explain how the increase in acidity of our rain water could affect statues. Discuss how the dissolution of rocks is related to water hardness.

6. Everything is composed of chemicals. Have you ever thought about the chemicals in the food you eat? Find out about vitamin C and learn why it is important to a healthy diet. What foods (in addition to citrus fruits) are good sources of vitamin C? Learn how to test the amount of vitamin C in a liquid mixture. Compare the amount of vitamin C in different samples of juice, for example: fresh squeezed, frozen, and canned orange juice. You may also want to retest a sample of orange juice once it is passed its "use by" date. Has the amount of vitamin C changed?

7. Bacteria – is it bad? In some cases it is. Learn to test milk samples for bacterial contamination. You may want to compare milk from a freshly opened container, UHT milk, and milk that it is well past its "use by" date. What does this tell you about the "freshness" of the milk? Some bacteria, such as yogurt bacteria, are good. Find out about yogurt and make yogurt from fresh milk and a live yogurt culture.

8. Cooking and eating is chemistry! What chemical changes take place when vegetables cook? ...when meat cooks? ...when bread dough rises? ...when bread bakes? ...when bread is chewed?

9. Answer the following questions: What does the saying "You Are What You Eat" have to do with chemistry? What are the differences between saturated and unsaturated fats and oils? Cholesterol is manufactured by your body - why is its presence in food controversial? How does your body take protein and turn it into energy? What chemicals are used as preservatives in food?

10. You have all seen iron rust. Discover ways in which you can protect metals from rusting. Obtain four *non*-galvanized nails and nail them into a board. Treat three of them with various coatings. You could use paint, Vaseline, sealants, nail polish or other substances. Be sure to work in a well ventilated area. Leave your nails in a location exposed to the elements (sun, cold, rain, and/or snow). After several weeks; which nail was the most protected? Which nail rusted the most? Explain your results. What does galvanized mean?

Technology:

1. Have you ever seen a laser? Did you know that they are in all CD and DVD players? Does your teacher use a laser pointer in class? Have you heard of laser eye surgery or lasers used to remove tattoos? As you can tell, lasers are now commonly used in medicine, research, and everyday life. Learn about the different parts of a laser, how they work, and laser safety. Investigate how and why a laser is used in a one of the above applications or in chemical or medical research.

2. Where does our electricity come from? The development of alternative sources of energy is a large part of research in chemistry. Learn about energy in nature and the chemistry behind processes like photosynthesis. What are the major sources of energy used in the world today and what technologies are under development? What are the advantages and disadvantages of each? Some of the technologies you can include in your discussion are

solar power, wind power, coal-fired power plants, geothermal energy, hydroelectric power, nuclear fission, and nuclear fusion.

3. Where does the fuel to run our cars come from? Discuss why there is a need for alternative energy sources. What are hybrid cars? What is the average mileage of commercially available hybrid cars compared to the mileage of a conventional car? Learn about fuel cells, fuel cell cars, and how they work. Discuss the problems with fuel cells and possible ways to use chemistry to solve them.

4. Without chemistry our lives would be very different. Disposable diapers contain polymers that absorb large amounts of water. Photographers use chemicals to produce beautiful photographs. Artists use paints made with both organic and inorganic pigments. Petroleum is used to produce nylon and acrylic fabrics. Investigate how chemicals are used in one of these applications and how the chemistry might be used to improve upon the item (for example, use of flame retardants in acrylic clothing manufacturing).

5. Chemical pollution threatens our oceans, estuaries, lakes and rivers. Find out about one chemical pollutant that is problematic. What are the sources of this pollutant? How does it move and react in water? What effect does it have on aquatic ecosystems? What technology can be used to remove the chemical pollutant from wastewater before it becomes a problem?

6. Our air is threatened with acid rain, ozone depletion and global warming. Pick one of these problems and determine its cause, effects on human health, materials, weather, animals and plants. What technology can be used to remove the air pollutant before it causes problems?

Service Project:

1. Create a poster about chemicals in your home. Study 10 chemicals, both hazardous and non-hazardous. (Remember, everything is made up of chemicals, cleaning products, food, perfume, toothpaste, etc., so be creative!!) On the poster, address how the chemicals are used, some physical properties of the chemical (i.e., solid, liquid, color, odor, etc.), potential hazards, method for safe disposal of any hazardous chemicals, and alternative chemicals that can be used to help protect the environment from hazardous substances. Visit an elementary school, Brownie troop, or other youth group and discuss your poster. Teach others the important information that you learned about chemicals in your home.

2. Assist with a local project to monitor air or water quality. Work with a scientist or researcher to interpret your data.

3. Participate as a judge or assistant in an elementary science fair. Give a presentation to the younger students pertaining to something you have learned while completing this IPP.

4. Assist at a local science museum/center. Teach children about how chemistry impacts their lives.

5. Create an educational game for younger children to teach them about chemistry and its importance in their everyday lives.

6. Teach a younger group about how different materials can be recycled. What are the different types of plastics? Explain how each type can be recycled?

Career Exploration:

1. Visit a hospital, health department, university, chemical manufacturer, crime laboratory, or other business that employs chemists. How is chemistry used routinely in these settings? Talk to the chemists working in the business and find out what education, training, apprenticeships and/or internships are recommended for someone interested in working in that field.

2. Interview or read about a famous (or not so famous) woman chemist. What inspired her to become a chemist? Did she have role models? Were there obstacles that she had to overcome? What has been the significance of her work? If you are able to interview her, find out about the aspects of her career she has found most rewarding. Does she have any advice for a young woman who is considering a career in chemistry?

3. There are many different types of chemists: analytical, physical, inorganic, organic, biochemists, environmental, clinical, and forensic. Learn about at least four types of chemists and the jobs they do.

4. Chemistry is used in many fields, including food science, plant science, animal science, and soil science. Talk to someone in at least two of these fields and find out how they use chemistry in their occupation.

5. Attend a career fair or science day that gives you the opportunity to meet with individuals working in chemical professions. Find out about how they use chemistry in their profession and what type of education and training is needed for their job.