

Unit 2 Projects

Inquiry Project

The pH of your “Pop” (Student textbook page 180)

Pedagogical Purpose

This activity connects a chemical reaction most students are familiar with—soda pop going flat—to the chemistry they have just learned. Students will demonstrate how to write a word and chemical equation, work safely, and use pH indicators.

Planning	
Materials	Per group: can or bottle of clear soda pop (any type as long as it is carbonated) pH paper, universal indicator, or pH meter 250 mL beaker BLM A-49 Unit 2 Inquiry Project Rubric (optional) BLM 2-53 Inquiry Project: The pH of your “Pop” (optional)
Time	30 min in class plus 10 min per day for 2 days 5 min preparation
Safety	Remind students not to eat or drink anything in the science classroom.

Background

Carbon dioxide plus water makes carbonic acid. When soda pop goes flat, the reaction is the reverse. Carbonic acid makes water and carbon dioxide.



A similar reaction occurs in our bloodstream when carbon dioxide gas dissolves in our veins and is carried back to our lungs to be expelled. This is why blood is slightly acidic. As more CO_2 leaves the pop, the pH should increase and approach a neutral reading.

Skills Focus

- plan an inquiry, controlling some variables
- work safely with chemicals and equipment
- gather and analyze data

Activity Notes and Troubleshooting

- This activity should be started only when there are three consecutive school days available for observation.
- Any type of soda pop could be used but a clear soda pop will make pH readings easier with the universal indicator or cabbage juice.
- Provide students with a list of materials to choose from for this investigation to reduce the preparation time. For example: beaker, pH paper, litmus paper, pH meter, and so on.
- To reduce costs (and waste), buy large bottles of soda pop and distribute small amounts (10-50 mL) to each group in beakers. Be careful to pour the pop down the side of the beaker to reduce the formation of bubbles and loss of carbonation.
- Have a space available in the room for storing the open pop.
- Students should not drink the pop in class. If they want to add to their observations, they can open a can of pop at home and drink it each day to compare the taste.

Additional Support

- Enrichment—Have students compare different brand names of the same type of soda. For example: Sprite or 7-Up versus no-name lemon-lime soda,
- **DI** **ELL** Have spatial and English language learners draw a diagram for each step in their procedure. Prior to completing their report, ensure that English language learners have had an opportunity to write a report. Use one of the previously completed activities to demonstrate what is expected.
- **DI** Logical-mathematical learners could collect data more frequently (every 4 hours, for example) and then graph the results.

Rubric

ACHIEVEMENT CHART CATEGORY	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding	Not able to write a word equation for pop going flat.	Able to write a word equation for pop going flat.	Able to write a complete word equation for pop going flat.	Able to write a complete and accurate word equation for pop going flat.
	Not able to write a chemical equation for pop going flat.	Able to write a chemical equation for pop going flat.	Able to write a complete chemical equation for pop going flat.	Able to write a complete and accurate chemical equation for pop going flat.
Thinking and Investigation	Prediction made is lacking in clarity.	Hypothesis lacking.	Hypothesis answers the research question.	Clearly stated hypothesis that thoroughly answers the research question.
	Conducts the experiment, carrying out the procedure safely.	Designs and conducts the experiment, carrying out the procedure safely.	Designs and conducts the experiment, carrying out the procedure safely.	Designs and conducts the experiment, carrying out the procedure safely.
	Data not recorded daily or not organized in a chart.	Records daily data in a chart.	Records daily data accurately in a chart.	Data well-organized and accurately recorded daily in a chart.
	Findings not summarized; statement missing.	Findings summarized;	Findings summarized; statement made as to whether or not findings support or refute hypothesis.	Findings summarized; clear statement made as to whether or not findings support or refute hypothesis.
Communication	Report poorly written; results are not communicated effectively.	Report communicates some results effectively.	Report communicates results effectively; correct headings used.	Report very well written and results are effectively communicated with correct headings.
	Few graphs and tables are provided.	Detailed and accurate graphs and tables are provided.	Detailed and accurate graphs and tables are provided.	Detailed and accurate graphs and tables are provided.
Application	Makes connections between science, technology, society, and the environment with limited effectiveness.	Makes connections between science, technology, society, and the environment with some effectiveness.	Expresses opinion using the results of the experiment; makes connections between science, technology, and society.	Expresses opinion using the results of the experiment; makes connections between science, technology, society, and the environment.

Please see also **BLM A-49 Unit 2 Inquiry Project Rubric**.

An Issue to Analyze

Mining Gold from e-Waste (Student textbook page 181)

Pedagogical Purpose

Students are asked to think about the electronic waste they generate and to assess the possibility of recovering some of the precious metals that would otherwise be lost to a landfill. Students must ask good questions and find good research sources to help them analyze this issue.

Planning	
Materials	Internet access or research materials chart paper BLM A-50 Unit 2 An Issue to Analyze Rubric (optional) BLM 2-54 An Issue to Analyze: Mining Gold from e-Waste (optional)
Time	75 min in class 5 min preparation

Background

E-mining will require 10 to 20 years of gathering e-waste before it will be feasible and will have enough valuable material to reuse in large scale production. Some people suggest that old pit mines be filled with e-waste and that the waste then be processed using the same techniques as traditional mining to recover metals like gold, copper, and iron. Glass and plastic could also be recovered and recycled. A cell phone contains 10 to 50 times more copper than copper ore and 5 to 10 times more gold than gold ore. Many countries now have mandatory e-waste recovery programs. Canada is not one of them.

Skills Focus

- choose good sources of information
- communicate ideas
- make decisions

Activity Notes and Troubleshooting

- The idea of e-waste mining is relatively new and students will find it challenging to find research sources that are reliable. Spend some time discussing how to decide if a research source is a good one.
- Introduce this issue by handing out an article on e-waste recovery and have students, in small groups, generate questions on chart paper.
- Discuss the difference between fact finding questions and deeper questions. For example: “What is e-waste?” compared to “How will the forests of northern Ontario be affected by reduced gold mining?”
- Students could work in pairs to do the research and then produce individual reports.

Additional Support

- **DI** Interpersonal learners will benefit from working in small group to generate questions.
- **DI** Spatial learners will benefit from using a graphic organizer like a concept map to organize their ideas.
- **DI** Encourage logical-mathematical learners to think in terms of “If . . . then . . .” statements when analyzing this issue. For example: *If we throw out cell phones, then the gold they contained will be lost.*

- **ELL** Group English language learners with others students while generating questions. Make sure that students understand what is being asked and let them select a few questions for research. Encourage them to find research materials in their first language or to partner with an English-speaking student who is researching the same questions. Invite their partners to write their own reports and to help the English language learner partners with areas in which they have difficulty. For example, in some cultures, expressing opinions is discouraged. Some English language learners may need help with appropriate language for opinions.

Rubric

ACHIEVEMENT CHART CATEGORY	Level 1	Level 2	Level 3	Level 4
Knowledge and Understanding	Few safety concerns described that need to be addressed to make e-mining safe.	Mentions some of the safety concerns that need to be addressed to make e-mining safe.	States the safety concerns that need to be addressed to make e-mining safe.	Clearly states the safety concerns that need to be addressed to make e-mining safe.
	Little investigation into how the environment is affected by mining e-waste.	Investigated how the environment is affected by mining e-waste.	Investigated the numerous ways that the environment is affected by mining e-waste.	Thoroughly investigated the numerous ways that the environment is affected by mining e-waste.
Thinking and Investigation	Few research questions about e-mining and its environmental impact are included.	Some research questions about e-mining and its environmental impact are included.	Numerous and reasonable research questions about e-mining and its environmental impact included.	Numerous and thoughtful research questions about e-mining and its environmental impact are included.
	Little research conducted; some data recorded; not in a graphic organizer.	Conducts some research, recording data accurately in a graphic organizer.	Conducts research, recording data accurately in a graphic organizer.	Conducts research, recording data accurately in a detailed graphic organizer.
	Little information presented that can be analysed for accuracy or bias.	Some information analyzed for bias and accuracy.	Information analyzed for bias and accuracy.	Information analyzed for bias and accuracy.
Communication	Some information is presented using a podcast or a presentation.	Most information is presented using a podcast or a presentation.	Information is presented using a podcast or a presentation.	Information is presented using a very creative podcast or a presentation.
Application	Some opinion presented about the safety of mining e-waste; does not consider employees and the environment.	Opinion presented about the safety of mining e-waste; does not consider employees and the environment.	Opinion presented about the safety of mining e-waste; considers employees and the environment.	Informed opinion presented about the safety of mining e-waste; considers employees and the environment.

Please also see **BLM A-50 Unit 2 An Issue to Analyze Rubric**.