Amp It Up! Engineering/Technology and Industry Lesson Extension



Teacher Name(s):	**Cecelia Pernice**
School and District:	**Hamilton Wenham Regional High School, Hamilton Wenham Regional School District**
Course:	**Chemistry**

Abstract: In 200 words or less, please provide a summary of the goal for the lesson extension and its relationship between industry and academic topic.

When I met with the employess of Medtronic, I was most interested to learn the skills high school students need to be successful in a career at Medtronic. Employees reported that building good habits in lab notebook maintenance/data recording is an essential high school-level skill that they use in the field daily. Although my students complete lab assignments (often as reports or discussion question worksheets), I have not taught lab notebook skills. The goal of this lesson is to teach appropriate lab notebook protocols, and use those skills in a lab.

Engineering/Technology Link:

1. How did you *introduce* engineering/ technology concepts or the company/industry focus in your course? Check the appropriate box(es) or choose Other.

   ☐ Defined terms (science, engineering, technology)

   ☐ Described the engineering design process

   ☐ Engineering design challenge related to industry

   ☐ Overview of the company

   ☐ Challenge based on 'industry specific' area of focus (manufacturing process, quality control, measurement, development, teamwork etc.)

   X Other: Necessary science skill used in the field

Level of Inquiry: Which of the following best describes the level of inquiry (adapted from Bell 2005) you used for this lesson/unit? Check the appropriate level.

☒ *Structured inquiry*: Instructor provides question and procedure. Students determine the results based on given procedures.
☐ *Guided inquiry*: Instructor provides question. Students design procedure and determine the results.
☐ *Open inquiry*: Students investigate their own research question. Students design procedures and implement the procedure on their own.

Lesson Extension Plan:

Title/Topic: Introduction to Lab Notebooks & Exploring Metal Reactivity.
Time (minutes): 70 minutes
Company Name and brief Description: Medtronic Medtronic is a medical device company, which specializes in the engineering of catheters.
Overview of the Lesson Students will first consider the purpose of lab notebooks, then learn what kinds of information must be recorded in a lab notebook. Students will then complete a lab on metal reactivity, while recording observations in their lab notebooks.
Standard(s)/Unit Goal(s) to be addressed in this lesson: HS-PS1-1. Use the periodic table as a model to predict the relative properties of main group elements, including ionization energy and relative sizes of atoms and ions, based on the patterns of electrons in the outermost energy level of each element. Use the patterns of valence electron configurations, core charge, and Coulomb's law to explain and predict general trends in ionization energies, relative sizes of atoms and ions, and reactivity of pure elements.
Essential Question(s) addressed in this lesson: - How do scientists organize, recall, and communicate their findings? - Does location on the periodic table have anything to do with reactivity?
Objectives (academic and/or engineering/technology, career): - Students wiil be skilled at maintaining a lab notebook. - Students will be skilled at predicting periodic trends.
Link to Industry (how the lesson connects to the industry visited: Medtronic engineers rely on thorough and well-organized laboratory notebooks, and reported that this was an essential skill for science students to learn.
What students should know and be able to do before starting this lesson

This lab is intended as an "engage activity". This is our first lab of the year, and is completed prior to learning content. The goal is to encourage students to make predictions, and to pique their interest in the topic of periodicity. Later in the unit, after learning more about trends, we will revisit their recorded observations (all the more reason to have a well-organized, thorough log in their notebooks) and see if our lab findings are consistent with what we learned about periodic trends and atomic structure.

Before beginning this leasson, students should know how to safely conduct a lab experiment.

Instructional Materials/Resources/Tools

- Internet connection and ability to project a video
- Lab facilities
- **samples Lithium, Sodium, Potassium, Magnesium, Calcium, Aluminum**
- **phenolthphalein**
- **pipets for each lab group**
- **watch glasses for each lab group**
- **beaker for each lab group**
- **wire mesh for each lab group**
- **Bunsen burners for each lab group**
- **Lab notebook for each student**
- **Lab goggles for each student**

Lesson Delivery

Lesson Opening

- Discuss visit to Medtronic, discussion with engineers about the most important skills needed entering their field.
- Show students video on lab notebooks.
- Have students record their answers to discussion questions (think-pair-share).

During the Lesson (activities/labs/challenges)

- Have students read "notebook rules", then quickly go explain the rules and reasoning.
- Read lab procedure together, emphasizing important safety concerns. (It is important to make clear that students should not make contact with Li, Na, K, or Ca, and that when the metals are added to water, the beaker should be promptly covered in wire mesh, and students should remove their hands and faces from the area).
- Ask students to prep their notebooks, including date, title, hypothesis, important safety hazards. It may help to brainstorm possible hypotheses as a class before students record their hypothesis in their notebooks.
- Students will then get into lab groups, and begin experiment, recording data as they work.
- Teacher will closely moniter, handing out Li, Na, K, Ca individually only when students demonstrate that they are prepared. Optional: teacher may prefer to add the metal directly to the beaker themself.

Lesson Closing

- Give students time to clean their lab space and ensure that all observations are recorded.

- Discuss, as a class, what they noticed in the lab. Take some time to revisit their hypotheses, and emphasize that it is okay if data disproves a hypothesis, we all learned something whether our expectations were correct or not. (And getting it wrong is NOT a reason to erase or change your work.) - Finally, point out the location of the 6 metals on the periodic table. Ask students to look for any patterns in reactivity based on the location on the periodic table.
Assessment
Student Assessment: Students will be assessed informally based on class discussion. Notebooks will be collected after lesson, to assess notebook skills.
Delivery Assessment: See above.

Additional resources and assessments: Attachments should include handouts, readings (with references), lab write-ups, rubrics, exams/quizzes, and/or other similar materials.

Link to lab notebook video: https://www.youtube.com/watch?v=-47lJ-fso7U

Video Discussion Questions

Why do scientists keep lab notebooks (what could they use them for)?

What are some ways lab notebooks may vary?

The scientists in the video study volcanos. They are discussing the kinds of information and details that may be helpful to record. We will be doing very different types of experiments in this class. What kinds of details would we want to jot down in our notebooks?

If an experiment does not go according to plan, should we remove it from our notebooks? Explain.

How to Maintain a Lab Notebook

- Always start off with the date and names of each member of your lab group. Record the title of the lab at the top of the page.
- Use pen. If you make a mistake, cross out the error with one single line (so that it does not look sloppy).
- Add a subtitle: Safety Info, and then record any important precautions or safety concerns. The teacher will discuss these prior to each lab, so pay close attention.
- Add a subtitle: Hypothesis, and then write your hypothesis. This may be different from your lab partners. What do *you* expect will happen?
- If asked to design your own procedure, the next step would be a new subtitle, with a detailed explanation of the procedure you will follow. If you are given a procedure, you should glue it into your notebook. (However, if the procedure must be altered in anyway, make a note of that.)
- Last subtitle: Data. Record all data throughout the lab, in detail. Choose the method of data recording that makes the most sense to the lab. Data tables are often best. In some cases, drawing your observations may be helpful. Remember, even mistakes or surprising observations are important. Record everything, and be detailed.
- At the end of each lab, ask yourself if you would be able to recreate everything you did today with the information you have written down. If not, you need to go back and add more information.

Chemistry Lab: Comparing the Activities of Groups 1A, 2A, 3A

Objective:
To investigate the relative properties and reactions of Groups 1-3A and relate these observations to valence electrons and ionization energy.

Materials:
-samples of 1A elements: Lithium, Sodium, Potassium
-samples of 2A elements: Magnesium, Calcium
-sample of 3A element: Aluminum
-pipet of phenolthphalein
-watch glass
-beaker
-wire mesh
-Bunsen burner

In Your Notebook:
Before entering the lab, set up your notebook. Add the title of the lab to the top of the page. Write the date, and the names of all of your lab partners. Next, pay close attention as your teacher discusses important safety tips, and record them in your notebook. Finally, write your hypothesis down.

Procedure:
1. Aluminum: Place a sample of Aluminum into a 250 mL. beaker ½ of water. Add 1-2 drops of phenolthphalein. Observe reaction.
Remove with tongs. Heat in flame. Observe reaction
2. Magnesium: Place a sample of Magnesium into a beaker of water. Observe reaction. Remove with tongs. Heat in flame. Observe reaction
When complete, turn off gas, and put the Bunsen burner away.

In Your Notebook:
Be sure that you have recorded all observations, in detail, before moving on to the next part of the lab.

For the following: Only place in water. DO NOT HEAT
3. Calcium: Place a sample of Calcium into a beaker of water. Cover with wired mesh. Observe reaction.
4. Lithium: Place a sample of Lithium into a beaker of water. Cover with wire mesh. Observe reaction.
5. Sodium: Place a sample of Sodium into a beaker of water. Cover with wire mesh. Observe reaction.
6. Potassium: Place a sample of Potassium into a beaker of water. Cover with wire mesh. Observe reaction.

In Your Notebook:
Be sure that you have recorded all observations, in detail.