Lab 7. Periodic Trends: Which Properties of the Elements Follow a Periodic Trend?

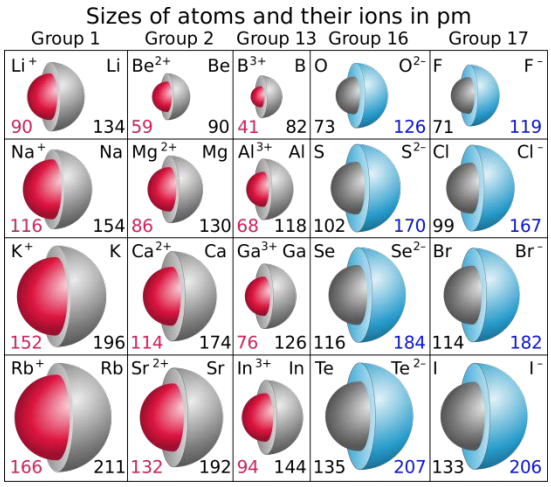
Introduction

Periodic trends are the tendencies of certain properties of the elements to increase or decrease as you progress along a row or a column of the periodic table. A row in the periodic table is called a *period*, and a column in the periodic table is called a *group*. These trends can occur in both physical and atomic properties of the elements. The periodic table is organized in a way that makes these trends relatively easy to determine. Scientists can use these trends to help them predict an element's properties, which can determine how it will react in certain situations. The similar atomic structure among elements in a group or period helps explain how these trends occur.

Atomic radius is an example of a property that has a periodic trend; as illustrated in Figure L7.1, atomic radius increases as you move down the periodic table regardless of group. Some properties, however, only change in a uniform manner within a specific group. These properties are often described as having a *quasiperiodic trend*. Boiling point is an example of a property that has a quasiperiodic trend; boiling point only changes in a uniform manner within a group, but it does not follow a similar pattern when you look across a period. In this investigation, you will explore how the physical and atomic properties of the element change across periods and groups in order to identify the other periodic trends.

FIGURE L7.1

Atomic radius is an example of a periodic trend.



Your Task

You will be given an Excel file that includes a list of the known elements and information about the atomic mass, density, melting point, specific heat capacity, and electronegativity of the elements. You must use this information along with the definitions provided in the "Introduction" to determine which of these properties follow a periodic trend and which ones do not.

The guiding question of this investigation is, **Which properties of the elements follow a periodic trend?**

Materials

You may use any of the following materials during your investigation:

- Computer
- "Properties of Elements" Excel file
- Periodic table

Safety Precautions

Follow all normal lab safety rules.

Investigation Proposal Required? ☐ Yes ☐ No

Getting Started

To answer the guiding question, you will need to analyze an existing data set. To accomplish this task, you must determine what type of data you need to examine and how you will analyze the data.

To determine *what type of data you will need to examine*, think about the following questions:

- What makes something a periodic trend or a quasi-period trend?
- Which elements will you need to look up to establish a trend?

To determine *how you will analyze the data*, think about the following questions:

- What type of graph could you create to help make sense of your data?
- What types of calculations will you need to make?

Connections to Crosscutting Concepts, the Nature of Science, and the Nature of Scientific Inquiry

As you work through your investigation, be sure to think about

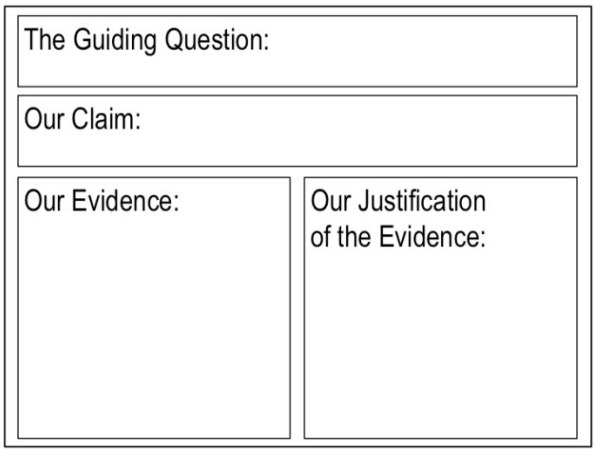
- the importance of identifying patterns in science,
- the importance of proportional relationships,
- the difference between observations and inferences, and
- how science is influenced by social and cultural values.

Initial Argument

Once your group has finished collecting and analyzing your data, you will need to develop an initial argument. Your argument must include a *claim*, which is your answer to the guiding question. Your argument must also include *evidence* in support of your claim. The evidence is your analysis of the data and your interpretation of what the analysis means. Finally, you must include a *justification* of the evidence in your argument. You will therefore need to use a scientific concept or principle to explain why the evidence that you decided to use is relevant and important. You will create your initial argument on a whiteboard. Your whiteboard must include all the information shown in Figure L7.2.

FIGURE L7.2

Argument presentation on a whiteboard



Argumentation Session

The argumentation session allows all of the groups to share their arguments. One member of each group stays at the lab station to share that group's argument, while the other members of the group go to the other lab stations one at a time to listen to and critique the arguments developed by their classmates. The goal of the argumentation session is not to convince others that your argument is the best one; rather, the goal is to identify errors or instances of faulty reasoning in the initial arguments so these mistakes can be fixed. You will therefore need to evaluate the content of the claim, the quality of the evidence used to support the claim, and the strength of the justification of the evidence included in each argument that you see. To critique an argument, you might need more information than what is included on the whiteboard. You might therefore need to ask the presenter one or more follow-up questions, such as:

- What did your group do to analyze the data, and why did you decide to do it that way?
- Is that the only way to interpret the results of your group's analysis? How do you know that your interpretation of the analysis is appropriate?
- Why did your group decide to present your evidence in that manner?
- What other claims did your group discuss before deciding on that one? Why did you abandon those alternative ideas?
- How confident are you that your group's claim is valid? What could you do to increase your confidence?

Once the argumentation session is complete, you will have a chance to meet with your group and revise your original argument. Your group might need to gather more data or design a way to test one or more alternative claims as part of this process. Remember, your goal at this stage of the investigation is to develop the most valid or acceptable answer to the research question!

Report

Once you have completed your research, you will need to prepare an *investigation report* that consists of three sections that provide answers to the following questions:

1. What question were you trying to answer and why?
2. What did you do during your investigation and why did you conduct your investigation in this way?
3. What is your argument?

Your report should answer these questions in two pages or less. The report must be typed and any diagrams, figures, or tables should be embedded into the document. Be sure to write in a persuasive style; you are trying to convince others that your claim is acceptable or valid!