

# Periodic Trends Worksheet Answers Pogil

\* Notice - the group #1 example given for question #4 contains exceptions to the general trend. Know general trends, not exceptions.

Key P.T.

## Periodic Trends

Can the properties of an element be predicted using a periodic table?

### Why?

The periodic table is often considered to be the "best friend" of chemists and chemistry students alike. It includes information about atomic masses and element symbols, but it can also be used to make predictions about atomic size, electronegativity, ionization energies, bonding, solubility, and reactivity. In this activity you will look at a few periodic trends that can help you make those predictions. Like most trends, they are not perfect, but useful just the same.

1. Consider the data in Model 1 on the following page.

a. Each element has three numbers listed under it. Which value represents the atomic radius?

The first number under the Electron Shell Diagram

b. What are the units for the atomic radius?

pm - picometer

c. Write a complete sentence to convey your understanding of atomic radius. Note: You may not use the word "radius" in your definition.

The distance between the nucleus and the valence electrons of the atom.

2. In general, what is the trend in atomic radius as you go down a group in Model 1? Support your answer, using examples from three groups.

Atomic radius decreases as you go down a group (vertical column).

Grp #1 Li-152, Na-186, K-227 Grp #2 Ne-70, Ar-98, Kr-112  
Grp #3 Be-112, Mg-160, Ca-197

3. Using your knowledge of Coulombic attraction and the structure of the atom, explain the trend in atomic radius that you identified in Question 2. Hint: You should discuss either a change in distance between the nucleus and outer shell of electrons or a change in the number of protons in the nucleus.

\* As you go down a group, the greater the distance between the nucleus and valence electrons, the smaller the attractive force.

Grp #1 Li-152, Be-112, B-83, C-77, N-71, O-66, F-71, Ne-70

4. In general, what is the trend in atomic radius as you go across a period (left to right) in Model 1? Support your answer, using examples from two periods.

The general trend is atomic radius decreases in a period (horizontal row) moving left to right.

Grp #2 Ne-70, Ar-98, Kr-112, Xe-143, Rn-157, At-117, Po-115, Bi-104, Pb-99, Au-98

5. Using your knowledge of Coulombic attraction and the structure of the atom, explain the trend in atomic radius that you identified in Question 4.

As you move to the right across a period, protons are added to the nucleus. The greater number of protons increases the attractive force on the valence electrons. This decreases the atomic radius.

Periodic Trends

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**Periodic trends worksheet answers pogil** play a crucial role in helping students understand the fundamental concepts of the periodic table and the various trends that arise from the arrangement of elements. The Phosphorescent Guided Inquiry Learning (POGIL) approach focuses on collaborative learning and encourages students to explore concepts actively. In this article, we will delve into the periodic trends that are typically covered in a worksheet, discussing their importance and how to approach the answers effectively.

## Understanding Periodic Trends

Periodic trends refer to predictable patterns observed in the properties of elements as you move across or down the periodic table. These trends arise due to the arrangement of electrons in an atom and the influence of nuclear charge. The key periodic trends include:

- Atomic Radius
- Ionic Radius
- Ionization Energy
- Electron Affinity
- Electronegativity

Each of these trends has distinct characteristics that can be analyzed by looking at the periodic table.

## 1. Atomic Radius

The atomic radius is defined as the distance from the nucleus of an atom to the outermost electrons. As we move across a period from left to right, the atomic radius decreases. This occurs because:

- Electrons are added to the same energy level.
- The increasing positive charge of the nucleus attracts the electrons more strongly, pulling them closer.

Conversely, as we move down a group, the atomic radius increases due to:

- The addition of new energy levels (shells).
- Increased shielding effect, where inner electrons repel outer electrons, reducing the effective nuclear charge felt by the outermost electrons.

## 2. Ionic Radius

The ionic radius refers to the size of an ion. Cations (positively charged ions) are smaller than their parent atoms because they lose electrons and the remaining electrons are pulled closer to the nucleus. Conversely, anions (negatively charged ions) are larger than their parent atoms due to the addition of electrons, which increases electron-electron repulsion.

- Cations: Smaller than their neutral atoms.
- Anions: Larger than their neutral atoms.

As in atomic radii, the trend for ionic radii also shows a decrease across a period and an increase down a group.

## 3. Ionization Energy

Ionization energy is the energy required to remove an electron from an atom in the gas phase. This

energy tends to increase across a period due to:

- Increased nuclear charge making it harder to remove an electron.
- Electrons being added to the same energy level, which experiences increased attraction from the nucleus.

As we move down a group, ionization energy decreases because:

- The outer electrons are further from the nucleus and experience more shielding from inner electrons, making them easier to remove.

## **4. Electron Affinity**

Electron affinity is the energy change that occurs when an electron is added to a neutral atom. Generally, as you move across a period, electron affinity becomes more negative (more energy is released) because:

- Atoms become more eager to gain electrons due to increased nuclear charge.

Moving down a group, electron affinity tends to become less negative because:

- The added electron is farther away from the nucleus, reducing the effective nuclear charge experienced by the added electron.

## **5. Electronegativity**

Electronegativity is a measure of an atom's ability to attract and hold onto electrons in a chemical bond. It increases across a period due to:

- Increasing nuclear charge that attracts bonding electrons more strongly.

Conversely, electronegativity decreases down a group because:

- The increased distance between the nucleus and the valence electrons diminishes the attraction.

# **Worksheet Structure and Answering Techniques**

To effectively tackle a periodic trends worksheet, students should adopt a structured approach. Generally, a POGIL worksheet will include sections with questions related to the aforementioned trends, often requiring students to analyze data, graphs, or periodic table information.

## **1. Analyze the Data Provided**

Most worksheets will present specific data, such as atomic radii or ionization energies, in tabular or graphical form. Take the following steps:

- Identify Trends: Look for patterns in the data. For instance, does the atomic radius decrease across periods?
- Compare Groups: Compare the properties of elements in the same group versus those in the same period.

## **2. Use the Periodic Table**

The periodic table is an invaluable tool when answering worksheet questions. Before answering, ensure you:

- Familiarize yourself with the layout of the periodic table.
- Understand which elements are being compared.

## **3. Collaborate with Peers**

The POGIL approach emphasizes teamwork. Discussing trends and sharing insights can help clarify concepts. Consider these strategies:

- Group Discussions: Share your observations and reasoning with classmates.
- Peer Teaching: Explaining a trend to someone else can reinforce your understanding.

## **4. Justify Your Answers**

When completing the worksheet, it's essential to provide rationale for your answers. This may include:

- Referring back to the trends explained in your study materials.
- Citing specific data points that support your conclusions.

## **5. Practice with Examples**

To build confidence, practice with additional examples beyond the worksheet. Look for online resources or textbooks that offer problems related to periodic trends.

## **Conclusion**

Understanding periodic trends is fundamental in chemistry, as these trends provide insight into the behavior of elements and their compounds. The periodic trends worksheet answers pogil serve as an excellent resource for reinforcing these concepts through collaborative and inquiry-based learning. By

analyzing data, utilizing the periodic table, collaborating with peers, and justifying answers, students can deepen their understanding of these essential chemical principles.

In summary, mastering periodic trends not only enhances your knowledge of chemistry but also prepares you for more advanced topics in the field. Embrace the collaborative spirit of POGIL, and leverage the tools at your disposal to successfully navigate periodic trends and their implications in the world of chemistry.

## **Frequently Asked Questions**

### **What is a periodic trend in the context of the periodic table?**

A periodic trend refers to the predictable patterns and behaviors of elements as you move across or down the periodic table, including trends in atomic radius, ionization energy, electronegativity, and electron affinity.

### **How does atomic radius change across a period and down a group?**

Atomic radius decreases across a period from left to right due to increasing nuclear charge, which pulls electrons closer to the nucleus. It increases down a group as additional electron shells are added.

### **What is ionization energy and how does it vary in the periodic table?**

Ionization energy is the energy required to remove an electron from an atom. It generally increases across a period (due to increased nuclear charge) and decreases down a group (due to increased distance from the nucleus).

### **Define electronegativity and discuss its trend in the periodic table.**

Electronegativity is a measure of an atom's ability to attract and hold onto electrons in a chemical bond. It increases across a period and decreases down a group.

### **What role does electron shielding play in periodic trends?**

Electron shielding occurs when inner shell electrons repel outer shell electrons, reducing the effective nuclear charge felt by outer electrons. This contributes to trends like atomic radius and ionization energy.

### **How can understanding periodic trends help predict element behavior in reactions?**

Understanding periodic trends allows chemists to predict how elements will interact based on their properties, such as reactivity, bond formation, and the types of bonds they will likely form.

## **What is the significance of the octet rule in relation to periodic trends?**

The octet rule explains the tendency of atoms to prefer having eight electrons in their valence shell, influencing their reactivity and the formation of chemical bonds, which is reflected in periodic trends.

## **How do metals and nonmetals differ in terms of periodic trends?**

Metals typically have lower ionization energies and electronegativities, and larger atomic radii, while nonmetals have higher ionization energies and electronegativities, and smaller atomic radii.

## **What is the trend for electron affinity as you move across a period?**

Electron affinity generally becomes more negative (indicating a stronger attraction for electrons) as you move across a period from left to right.

## **How can a POGIL (Process Oriented Guided Inquiry Learning) approach enhance understanding of periodic trends?**

A POGIL approach encourages students to work collaboratively, engage in hands-on activities, and develop critical thinking skills, leading to a deeper understanding of periodic trends through inquiry and exploration.

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