Atomic Trends Worksheet Questions and Answers PDF

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Part 1: Foundational Knowledge

What is the atomic number of an element?

Hint: Think about what defines the identity of an element.

- ◯ The number of neutrons in an atom
- ◯ **The number of protons in an atom ✓**
- ◯ The total number of protons and neutrons
- ◯ The number of electrons in an atom

> The atomic number is defined as the number of protons in an atom.

Which of the following statements about isotopes are true?

Hint: Consider the definitions of isotopes and their properties.

- ☐ **Isotopes have the same number of protons. ✓**
- ☐ **Isotopes have different numbers of neutrons. ✓**
- ☐ Isotopes have different atomic numbers.
- ☐ **Isotopes have the same chemical properties. ✓**

> Isotopes have the same number of protons but different numbers of neutrons.

Describe the relationship between atomic number and the identity of an element.

Hint: Consider how the atomic number determines the element's properties.

The atomic number uniquely identifies an element and determines its position in the periodic table.

List two characteristics that differentiate metals from nonmetals.

Hint: Think about physical and chemical properties.

1. Characteristic 1

Conductivity

2. Characteristic 2

Luster

Metals are typically conductive and malLEable, while nonmetals are usually insulators and brittle.

Which trend is observed in atomic radius as you move across a period from left to right?

Hint: Consider how the number of protons affects the size of the atom.

- It increases.
- **It decreases. ✓**
- It remains constant.
- It varies unpredictably.

The atomic radius generally decreases as you move from left to right across a period.

Part 2: Understanding Periodic Trends

Which factors contribute to the increase in ionization energy across a period?

Hint: Think about the effects of nuclear charge and electron configuration.

- [ ] **Increased nuclear charge ✓**
- [ ] **Decreased atomic radius ✓**
- [ ] Increased electron shielding
- [ ] Decreased electron affinity

> Increased nuclear charge and decreased atomic radius contribute to higher ionization energy across a period.

Explain why electronegativity generally increases across a period.

Hint: Consider the role of nuclear charge and electron attraction.

> **Electronegativity increases across a period due to increased nuclear charge attracting electrons more strongly.**

Identify two elements that are exceptions to the general trend of electron affinity and explain why.

Hint: Think about the electron configurations of these elements.

1. Element 1

> Neon

2. Element 2

- Noble gases

> Exceptions to electron affinity trends often involve noble gases and certain transition metals due to their stable electron configurations.

Part 3: Applying Knowledge and Analyzing Relationships

If an element has a high electronegativity, what type of bond is it likely to form with a metal?

Hint: Consider the nature of the bond formed between different types of elements.

- ◯ **Ionic bond ✓**
- ◯ Covalent bond
- ◯ Metallic bond
- ◯ Hydrogen bond

> A highly electronegative element is likely to form an ionic bond with a metal.

Which of the following scenarios would result in a decrease in atomic radius?

Hint: Think about the effects of electron loss or gain on atomic size.

- ☐ **An atom loses an electron. ✓**
- ☐ An atom gains an electron.
- ☐ **An atom forms a cation. ✓**
- ☐ An atom forms an an ion.

> An atom loses an electron or forms a cation, resulting in a decrease in atomic radius.

Predict how the reactivity of alkali metals changes as you move down the group and explain why.

Hint: Consider the trends in atomic size and electron shielding.

> **Reactivity of alkali metals increases down the group due to increased atomic size and decreased ionization energy.**

Which of the following best explains the decrease in atomic radius across a period?

Hint: Think about the relationship between nuclear charge and electron shielding.

- ◯ Increased electron shielding
- ◯ **Increased nuclear charge ✓**
- ◯ Decreased nuclear charge
- ◯ Decreased electron shielding

> The decrease in atomic radius across a period is best explained by increased nuclear charge.

Analyze the following elements: Na, Mg, and Al. Which statements are true regarding their ionization energies?

Hint: Consider the trends in ionization energy across periods.

- ☐ **Na has the lowest ionization energy. ✓**
- ☐ Al has the highest ionization energy.
- ☐ **Mg has a higher ionization energy than Na. ✓**
- ☐ **Al has a lower ionization energy than Mg. ✓**

> Na has the lowest ionization energy, while Al has a higher ionization energy than Na but lower than Mg.

Part 4: Synthesis and Reflection

Which element would you predict to have the highest electron affinity based on its position in the periodic table?

Hint: Consider the trends in electron affinity across periods and groups.

- ◯ **Fluorine ✓**
- ◯ Oxygen
- ◯ Chlorine
- ◯ Nitrogen

> Fluorine is predicted to have the highest electron affinity due to its high electronegativity.

Evaluate the following statements and select those that correctly describe the reactivity of halogens.

Hint: Think about the trends in reactivity among halogens.

- [ ] **Reactivity decreases down the group. ✓**
- [ ] Reactivity increases down the group.
- [ ] **Halogens form ionic bonds with metals. ✓**
- [ ] **Halogens form covalent bonds with nonmetals. ✓**

> Reactivity of halogens decreases down the group, and they form ionic bonds with metals and covalent bonds with nonmetals.

Propose a real-world application that utilizes the high reactivity of alkali metals and explain the underlying atomic trend that makes this application possible.

Hint: Consider how alkali metals react with water or halogens.

> **Alkali metals react vigorously with water, which is utilized in various chemical processes and applications.**

Create a hypothetical element with unique properties based on known periodic trends. Describe its atomic number, likely chemical properties, and potential uses.

Hint: Think about how the position in the periodic table influences properties.

1. Atomic Number

> 120

2. Chemical Properties

> Highly reactive, metallic

3. Potential Uses

> Advanced materials, batteries

> A hypothetical element could have an atomic number of 120, exhibiting properties similar to those of alkali metals, with potential uses in advanced materials.