

Ionization Energy Periodic Trends Worksheet

- ① What is the periodic trend for first ionization energy?
- ② Explain why you see this trend as you move across a period?
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- ④ Arrange the following groups of elements in order of increasing first ionization energy.
- ① a Be, Mg, Sr ① b Bi, Cs, Ba ① c Na, Al, S
- _____
- ⑤ Circle the atom in each pair that has the greater first ionization energy.
- ① a Li or Be ① b Ca or Ba ① c Na or K ① d P or Ar ① e Cl or Si
- ⑥ Predict the relative strength of the second ionization energy compared to the first ionization energy.
- ⑦ Which has the larger ionization energy - sodium or potassium? Why?
- ⑧ Compare the first ionization energies for a noble gas with that of a halogen in the same period.

Ionization Energy Periodic Trends Worksheet

Answers

- ① What is the periodic trend for first ionization energy?

It increases going from left to right across a period and decreases going down a group.

- ② Explain why you see this trend as you move across a period?

A larger positive charge within the nucleus results from the increase in protons. There is a larger pull on the electrons in that outer shell, so it is harder to pull them away, requiring more energy to achieve it.

- ③ Explain why you see this trend as you move across a period?

Atomic size increases down a group. The outer electrons get farther and farther away from the positive charge of the nucleus, and the inner electrons shield the outer electron. This makes it easier to remove an electron because the attractive force holding the outer electron(s) is less.

- ④ Arrange the following groups of elements in order of increasing first ionization energy.

Ⓐ Be, Mg, Sr

Ⓑ Bi, Cs, Ba

Ⓒ Na, Al, S

Sr < Mg < Be

Cs < Ba < Bi

Na < Al < S

- ⑤ Circle the atom in each pair that has the greater first ionization energy.

Ⓐ Li or **Be** Ⓑ **Ca** or Ba Ⓒ **Na** or K Ⓓ P or **Ar** Ⓔ **Cl** or Si

- ⑥ Predict the relative strength of the second ionization energy compared to the first ionization energy.

It should be higher because now the atom will be charged, and the attractive force for the electron will be higher. It should be more challenging to pull a second electron away.

- ⑦ Which has the larger ionization energy - sodium or potassium? Why?

Na has the larger 1st IE because the lone electron in the 3s sublevel feels more of the pull from the nucleus. There are fewer inner core electrons shielding the 3s electron. So, more energy is needed to remove this electron. In the K atom, the 1st IE is smaller than Na's. Potassium is located in period 4. The electron is further from the nucleus and does not feel the pull of the nucleus as tightly. The inner core electrons shield the 4s electron, thus requiring less energy to remove it.

- ⑧ Compare the first ionization energies for a noble gas with that of a halogen in the same period.

1st IE of each halogen is lower than that of the noble gas element next to it in the same period. Each halogen atom has one electron less than its corresponding noble gas atom, with a full valence electron shell. The elements strive for a full shell, so noble gas members require larger IE to lose their electrons.