

You have mastered this topic when you can:

- 1) define or describe **IONIZATION ENERGY**.
- 2) describe and provide a theoretical explanation for the *periodic trends* among elements for **IONIZATION ENERGY**.
- 3) describe and explain the similarities and differences among elements using the *periodic trends* for **ATOMIC RADIUS, CHEMICAL REACTIVITY** and **IONIZATION ENERGY**.

IONIZATION ENERGY

I) *IONIZATION ENERGY* _____

_____.

The *FIRST IONIZATION ENERGY* _____

_____.

Ionization energy is measured using these units kJ/mol.

II) **EXPLORATION ACTIVITY 1:** Discovering the periodic trends for *First Ionization Energy*.

A) Use periodic table titled: **8. First ionization energy, electron affinity and electronegativity of the elements** to draw a graph of **First ionization energy versus Atomic number** for the first 38 elements. **Be sure to label each point with its correct symbol, each axis appropriately and give the graph a title.** Complete the **Analysis** (creating empirical knowledge) and **Synthesis** (creating theoretical knowledge). Be sure to use a pencil to draw your graph and your answers for the **Analysis** and **Synthesis** as you may want to adjust your answers.

1. **Analysis:** Describe any *periodic trends* you detect. (There are two *periodic trends*.)

2. **Synthesis:** Suggest explanations for each *periodic trend*.

B) There are two *trends* for *first ionization energy*, **MEMORIZE THEM!!**

1)

2)

III) **EXPLORATION ACTIVITY 2:** Explaining the *periodic trend* for *first ionization energy* within groups.

A) In this activity you will use your knowledge of the periodic trends studied thus far to explain the periodic trend for *first ionization energy* within groups.

INSTRUCTIONS: Draw orbital diagrams for the first three Group 2 elements, the alkaline earth metals, then answer the questions below.

1. State the trend for the *first ionization energy* as the atomic number increases down a group.
2. Describe how the *atomic radius* changes as the atomic number increases down a group.
3. Describe how the *shielding effect* changes as the atomic number increases down a group.
4. Describe how the *attraction between the nucleus and valence electrons* changes as the atomic number increases down a group.
5. Describe how the *energy required to remove the first valence electron* changes as the atomic number increases down a group.
6. Write a theoretical explanation for the *first ionization energy* trend down a group. **PLEASE USE NUMBERED POINT OR BULLIT FORM.**

B) THEORETICAL EXPLANATION OF THE *FIRST IONIZATION ENERGY TREND* WITHIN A GROUP**1) THE TREND:**

- 2) The *decrease in first ionization energy* as atomic number increases down a group is explained using the theoretical reasoning outlined below.
- a) **THE EXPLANATION FOR THIS TREND:** *As the atomic number increases down a group, the first ionization energy decreases because...*

IV) EXPLORATION ACTIVITY 3: Explaining the *periodic trend* for *first ionization energy* within the periods.

A) In this activity you will use your knowledge of the periodic trends studied thus far to explain the periodic trend for *first ionization energy* within the periods.

INSTRUCTIONS: Draw orbital diagrams for the first three period 3 elements, then answer the questions below.

1. State the trend for the *first ionization energy* as the atomic number increases left to right across a period.
2. Describe how the *atomic radius* changes as the atomic number increases left to right across a period.
3. Describe how the *shielding effect* changes as the atomic number increases left to right across a period.
4. Describe how the *attraction between the nucleus and valence electrons* changes as the atomic number increases left to right across a period.
5. How do the changed in the *shielding effect* and the *attraction between the nucleus and valence electrons* as the atomic number increases left to right across a period compare to each other.
6. Describe how the *energy required to remove the first valence electron* changes as the atomic number increases down a group.
7. Write a theoretical explanation for the *first ionization energy* trend left to right across a period.
PLEASE USE NUMBERED POINT OR BULLIT FORM.

B) THEORETICAL EXPLANATION OF THE *FIRST IONIZATION ENERGY TREND* WITHIN A PERIOD**1) THE TREND:**

2) The *increase in first ionization energy* left to right across a period is explained using the theoretical reasoning outlined below.

a) **THE EXPLANATION FOR THIS TREND:** *As atomic number increases left to right across a period, first ionization energy tends to increase because...*

ANSWERS TO THE EXPLORATION ACTIVITIES**EXPLORATION ACTIVITY 2 from page 2**

1. As the atomic number increases down a group, the first ionization energy decreases. 2. As the atomic number increases down a group, the atomic radius increases. 3. As the atomic number increases down a group of metals, the shielding effect increases. 4. As the atomic number increases down a group of metals, the attraction between the nucleus and the valence electrons decreases. 5. As the atomic number increases down a group, the energy required to remove the first valence electrons decreases.

6. **i.e.** The first ionization energy decreases as the atomic number increases moving down a group because...

1. As the Atomic Radius increases...
2. the shielding effect increases, and...
3. the attraction between the nucleus and the valence electrons decreases, which...
4. decreases the energy required to remove the first valence electron.

EXPLORATION ACTIVITY 2 from page 3

1. As the atomic number increases left to right across a period the first ionization energy increases. 2. As atomic number increases left to right across a period the shielding effect increases. 3. As atomic number increases left to right across a period of metals the shielding effect increases. 4. As the atomic number increases left to right across a period the attraction between the nucleus and the valence electrons increases. 5. As the atomic number increases left to right across a period the attraction between the nucleus and the valence electrons increases more than the shielding effect. 6. As the atomic number increases left to right across a period, the energy required to remove the first valence electron increases.

8. **i.e.** As the atomic number increases left to right across a period, the first ionization energy increases because

1. As the Atomic Radius decreases...
2. the shielding effect increases, while...
3. the attraction between the nucleus and the valence electrons increases more, which...
4. increases the energy required to remove the first valence electron.

BRING GRID PAPER NEXT CLASS!!
