

## II. ION SIZE

Define ion, cation, anion.

Ion: an atom that has a unequal amount of  $p^+$  &  $e^-$ .

Cation: #  $e^- > \# p^+$  therefore negative charge. Anion: #  $e^- < \# p^+$  therefore positive charge.

1. What happens to ion size down a family?

Increases

2. What happens to ion size across a period?

Larger to smaller from 1A to 3A

Then larger to smaller from 4A to 7A.

Let's understand these trends. Answering the following questions should help.

3. Is an ion larger or smaller when it loses electrons?

Smaller

4. Once electrons are lost, what happens to the repulsive electric force between electrons remaining around the ion?

The repulsive electric force ↓ since less  $e^-$  to repel each other.

5. Why would ions get larger when they gain electrons?

The repulsive electric force ↑ ∴ the  $e^-$  spread out further.

6. Based on the above questions, explain why the ions decrease in size from 1A to 3A then start out large and decrease from 4A to 7A.

From 1A to 3A, atoms loses more  $e^-$  ∴ ion size decreases.

From 4A to 7A, atoms gain less  $e^-$  ∴ ion size decreases.

7. Why does ion size increase down a family?

Adding more energy levels increases size.



## STABILITY IS THE BEST!!! ☺

**OCTET RULE** states that: atoms tend to gain, lose, or share  $e^-$  in order to acquire a full set of valence  $e^-$ . For representative elements,

9. According to the Octet rule, why would ions change from positive to negative across a row? this is

Atoms will take the easiest path to obtain a full valence shell.

**IONIZATION ENERGY** is: energy needed to lose an  $e^-$  when in a gaseous state.

10. Why do you think ionization energies are measured when the element is in the gaseous state?

In the gaseous state, the atoms are furthest away from each other, since bonds are broken. This allows for accurate measurements.

11. a.) Why do the noble gases have the highest ionization energies?

There valence shells are filled.  $s^2 p^6 \Rightarrow 8e^-$

b.) Why do the alkali metals have the lowest ionization energies?

They only need to lose 1  $e^-$  to be stable.

c.) Predict the trend for ionization energies down a group. Explain your prediction.

IE ↓ since  $e^-$  are further away (higher energy levels)

∴ easier to rip off  $e^-$

d.) Predict the trend for ionization energies across a period. Explain your prediction.

IE ↑ across a period since the electrons are closer to nucleus

∴ stronger attractive force between electrons & nucleus.

e.) What is the relationship between ion size and ionization energy, direct or inverse?

Inverse, since as Ion size ↑, IE ↓

**ELECTRONEGATIVITY** is: the ability of an atom to attract electrons in a chemical bond.

What is the trend across a period?

Increases

Down a group?

Decreases.

