

## 14: The Periodic Table

### Key Chemistry Terms

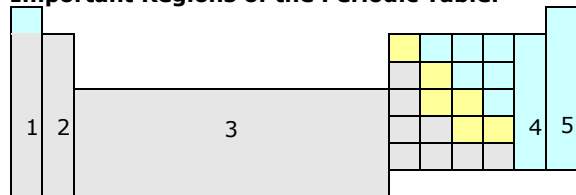
- **Periodic Table:** Tool for organizing the elements.
- **Periods:** Rows on the periodic table.
- **Groups:** Columns on the periodic table.
- **Periodicity:** Predictable patterns and trends on the periodic table.
- **Atomic Number:** Number of protons in an atom. Defines the element. Periodic table is organized in increasing order of atomic number.
- **Atomic Mass:** Mass in grams of 1 mole of atoms ( $6.02 \times 10^{23}$  atoms).
- **Atomic Radius:** Half the distance between two nuclei of the same element when bonded together.
- **Electronegativity:** Pull an atom has on the shared electrons in a bond with another atom.
- **Ionization Energy:** Energy required to remove the outermost electron from an atom.
- **Electron Affinity:** Energy released when another electron is added to an atom.
- **Ion:** Atom or polyatoms with a charge.
- **Cation:** Positively charged ion. Results from loss of electrons.
- **Anion:** Negatively charged ion. Results from gain of electrons.
- **Mnemonic:** Cation = Ca<sup>+</sup>ion (letter "t" appears like "+", hence a positive ion; ANION = **A** Negative **ION**).

### Reading the Periodic Table

**Most periodic tables give the following information.** (although it may be in a different order):

12	Atomic #
C	Symbol
Carbon	Name
12.01	Atomic Mass

### Important Regions of the Periodic Table:



Metals
  Metalloids
  Non-metals

1. Alkali Metals
2. Alkaline Earth Metals
3. Transition Metals
4. Halogens
5. Nobel Gases
6. Lanthanides
7. Actinides
- 8 tall columns = main groups or representative elements

### Memorizing the First 20 Elements

Use a Mnemonic to remember the symbols of the first 20 elements in order:

**H**appy **H**enry, the **L**ittle **B**each **B**oy, **C**a**N** d**O** **F**i**N**e; **N**aughty **M**egan, the **A**lpine **S**ister, **P**retends to **S**ki at **C**l**A**r**K** **C**anyon.

### Periodicity, Atomic Mass & Atomic Radii

#### Atomic Mass

##### → Period:

Subatomic particles are being added. This causes atomic mass to **increase**.

##### ↓ Group:

Subatomic particles are also being added. This causes mass to **increase**.

#### Atomic Radii

##### → Period:

# of protons and electrons increase, increasing the "pull" between the nucleus and the electrons. Radii **decreases**.

##### ↓ Group:

# of protons and electrons increase, but the electrons are added in a new electron shell. The new electrons are "shielded" by the inner electrons from the pull of the nucleus. Radii **increases**.

### Same Trend: Electronegativity (EN), Ionization Energy (IE) and Electron Affinity (EA)

##### → Period:

As radii decreases:

The electrons are closer to the nucleus and therefore feel the "pull" more strongly.

**Electronegativity, ionization energy and electron affinity increase.**

##### ↓ Group:

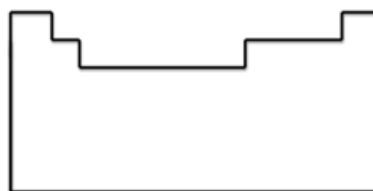
As radii increase:

The electrons are farther from the nucleus and therefore are more "shielded" by inner electrons from the pull of the nucleus.

**Electronegativity, ionization energy and electron affinity decrease.**

### Periodic Trend Mnemonic: (Word beginning with "E")

**Max: EN, IE & EA**



**Max: Mass, Radii**

**Trend Mnemonic:** "E" word containing properties (EN, IE and EA) have their max value on the upper right corner of the periodic table and Non-"E" word containing properties (Atomic Mass and Atomic Radii) have their max value at the lower left.

### Ionic Radii

#### Radii when forming a cation:

Loss of electrons. There are now more protons than electrons. The pull of the protons on each electron is greater. Cations have smaller radii than their parent atom.

**List Ca<sup>2+</sup>, Ca and Ca<sup>+</sup> in order of increasing radii:**

Ca<sup>2+</sup> < Ca<sup>+</sup> < Ca

(Each time an electron is lost, a charge of +1 is added. As electrons are lost, there is a higher ratio of protons : electrons and radii decreases).

#### Radii when forming an anion:

Gain of electrons. There are fewer protons than electrons.

The pull of the protons on each electron is less.

Anions have larger radii than their parent atom.

**How to Use This Cheat Sheet:** These are the keys related to this topic. Try to read through it carefully twice then write it out from memory on a blank sheet of paper. Review it again before the exams.