

Name _____

Date _____

Activity on Trends on the Periodic Table

Part 1—Chemical Reactivity: Read pg. 291-292 and refer to your reactivity lab.

- As you move down a column of *metals*, the reactivity (*increases/decreases*) increases
- As you move down a column of *non-metals*, the reactivity (*increases/decreases*) decreases
- As you move from the left side toward the center of the periodic table, the reactivity (*increases/decreases*) decreases
- Describe the chemical reactivity of the family of elements called the Noble Gases.
do not react

Part 2—Valence Electrons and Ion Charge

On the following diagram of the Periodic Table, list the number of valence electrons and the most common ion charge in Groups 1, 2 & 13-18

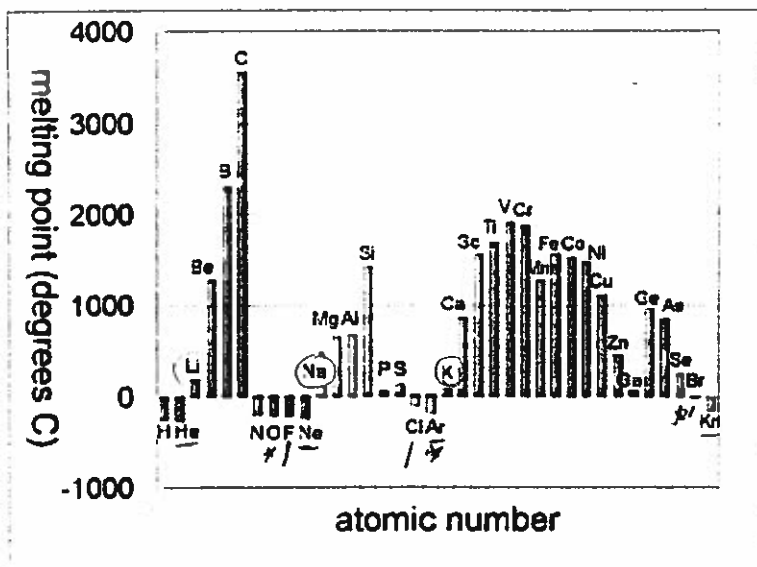
of Valence e's
Ion Charge

1 +1	2 +2											3 +3	4 +4	5 -3	6 -2	7 -1	0 0
H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba		Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra		Rf	Db	Sg	Bh	Hs	Mt	U..n	U..n	U..n	U..n	U..n				
			La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
			Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

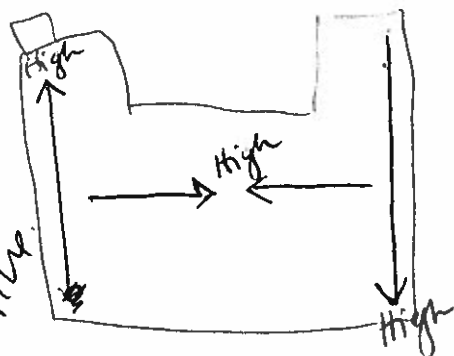
- Summarize the general trends that you observe. How does this relate to reactivity?
Most reactive when only one electron is removed or added to make an ion with full valence shell; that mimics a noble gas and is very stable.

Part 3—Melting Points

Look at the following graph showing the melting points of different elements and answer the questions below it:



High where least reactive

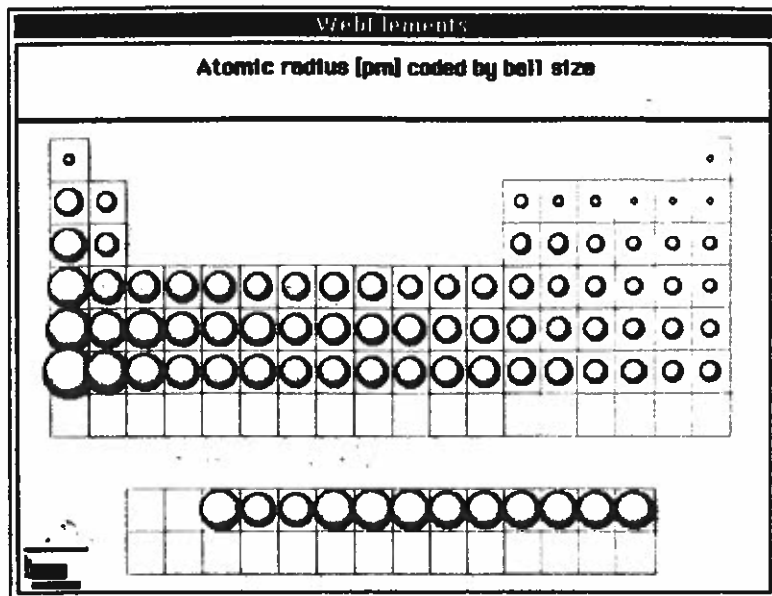


1. Look at the melting points of the elements Li, Na and K (Group 1). The melting points of the Alkali Metals appear to be (*higher/lower/about the same as*) lower the melting points of other metals.
2. What is the general trend in melting points of the Alkali Metals as you move down the column from Li to K? (*increase/decrease*) decrease
3. What can you say about the bonds that hold the atoms together as you move down the column of Alkali Metals? weaker
4. What is the general trend in melting points of the Halogens as you move down the column from F to Br? (*increase/decrease*) increase
5. What is the general trend in melting points of the Group 16 elements as you move down the column from O to Se? (*increase/decrease*) increase
6. What is the general trend in melting points of the Noble Gases as you move down the column from He to Kr? (*increase/decrease*) similar (decrease slightly)
7. Do non-metals have the same melting point trend as metals? no
8. Look at the elements in Period 2 (Li→Ne). What is the trend in melting points as you move from Li on the left side toward C in the middle of the Periodic Table increase
Is the same trend observed for Period 3 from Na to Si? yes
9. Which element has the highest melting point of all elements in the first 3 Periods? ~~Si~~ C

Part 4—Atomic Radius

Look at the picture here showing the relative Atomic Radii (size of atoms) of the elements in the Periodic Table. Use the information to answer the questions below:

Also, read pg.293-295 for further information.



1. What is the general trend in atomic radius (size of atoms) as you move from left to right across any Period? (increase/decrease) decrease
2. As you move from Li to Ne, electrons are filling (the same/different) same energy levels(s). This may help explain why atoms don't get bigger as you move to the right within a period. As you move across from Li to Ne, what is happening to the number of protons in the nucleus? ↑. What do the protons do to the electrons? attract. Suggest a reason why the atoms in a period actually get smaller as you move from left to right. Get help from your text and teacher if you can't get this one!

increase in \oplus and \ominus charge
increases attraction, pulling
atom together and \downarrow radius.

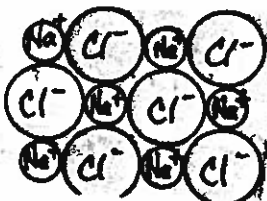
3. What is the general trend in atomic radius (size of atoms) as you move down a vertical column (group)? (increase/decrease) increases
Suggest a reason for this trend. (Hint: are electrons filling up the same energy level (orbitals) as you move down a column?)

electrons are filling higher energy
levels and more repulsion between
electrons.

When atoms form ions, their atomic radius changes (see pg. 294-295).

4. **Negative Ions:** Assume extra electrons are added to a neutral atom of O to make O^{2-} . The resulting ion has the same positive nuclear charge and an increased number of negative electrons surrounding the nucleus.
- What happens to the amount of electrostatic repulsion existing between the electrons?
increases
 - What happens to the volume occupied by the electrons due to the change in the amount of electron-electron repulsion?
increase
 - NEGATIVE IONS ARE** *larger* **than the corresponding neutral atom.**
5. **Positive Ions:** Assume electrons are removed from a neutral atom of Mg to make Mg^{2+} . The resulting ions has the same positive nuclear charge and a decreased number of negative electrons surrounding the nucleus.
- What happens to the amount of electrostatic repulsion existing between the electrons?
decreases
 - What happens to the volume occupied by the electrons due to the change in repulsion.
decreases
 - POSITIVE IONS** are *smaller* **than the corresponding neutral atom.**
6. Examine the diagram below, which shows a section of a crystal of NaCl. Which circles represent Na^+ , the larger or the smaller ones?

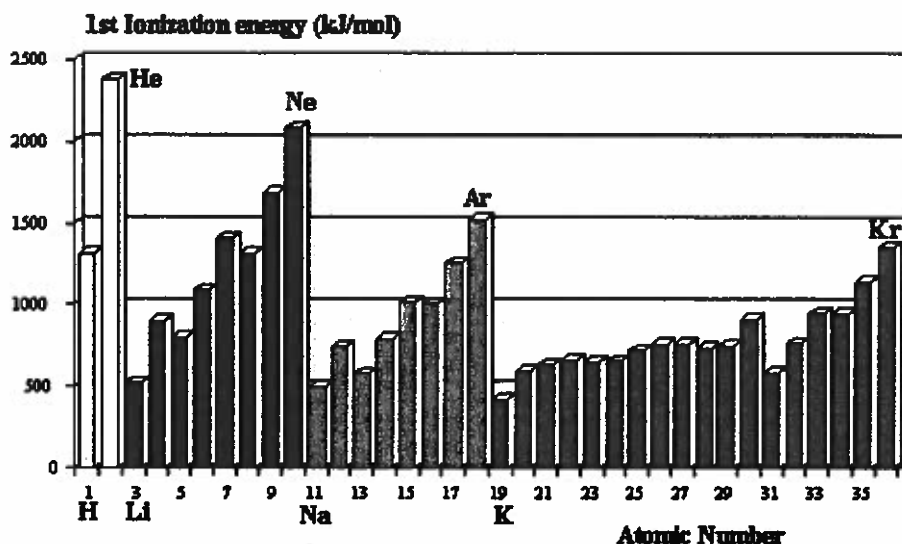
*↑
smaller*



Part 5—First Ionization Energy

Define **Ionization Energy** (pg.293 & 297): The energy required to remove one electron from the valence energy level

Look at the following graph of the First Ionization Energies of the elements in the first three periods and use it to answer the questions below:

Trends in Ionization Energy

1. What is the general trend in first ionization energy as you move from left to right across any Period? (eg. from Li→Ne or from Na→Ar) (increase/decrease) increase

2. Keeping in mind the trend in atomic radius as you move from left to right across a period, suggest a reason for this trend in ionization energies. (Hint: What happens to the distance and the force of attraction between the nucleus and the outer electron as atoms get smaller?)

From left to right atomic radius decreases so the outermost e^- is closer to the nucleus. This makes it harder to remove as the positive attraction from nucleus is stronger.

3. What is the trend in ionization energy as you move down a vertical column, like from Li→Na→K or from He→Ne→Ar→Kr? (increase/decrease) decreases

4. Suggest a reason for this trend based on atomic radius (size) and the distance and force of attraction between the nucleus and the outer electron.

As you go down a column the atomic radius increases. The valence e^- are further from the positive pull of the nucleus and thus easier to remove.

Section 6: Electronegativity

Definition: The electronegativity of an atom is the tendency of the atom to attract electrons from a neighboring atom.

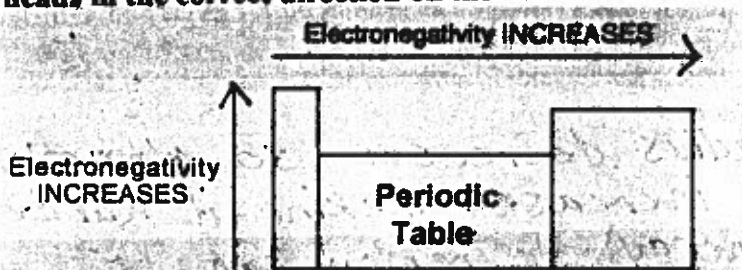
1. This exercise compares Li and F.

- a) Which atom is larger: Li or F *Li*
- b) Which atom has the stronger attraction to the outer electron on a neighbouring atom based only on the atomic radius? *F*
- c) Which atom has the greater nuclear charge? *F*
- d) Which atom can attract electron from an adjacent atom most strongly, based on both size and nuclear charge? *F*
- e) **IN GENERAL**, when going from left to right across the periodic table the electronegativity of the atom will increase (increase or decrease)

2. This exercise compares F and I.

- a) Which atom is larger: F or I *I*
- b) Which atom has a stronger attraction to the outer electrons of another atom? *F*
- c) **IN GENERAL**, when going down a family on the periodic table the electronegativities of the atoms will decrease (increase or decrease)

3. Place arrowheads in the correct direction on the horizontal and vertical arrows below:



4. a) ~~Ignoring the noble gases, which atom is the most electrogegative?~~
- b) Ignoring the noble gases, which atom is the most electronegative? *F*
- d) Which is more electronegative: K or Be? *Be*
- e) Which is more electronegative: Pb or S? *S*