

Name _____

Date _____

Chemistry 11- Trends on the Periodic Table

Part 1—Chemical Reactivity

1. As you move down a column of *metals*, the reactivity (*increases/decreases*) _____
2. As you move down a column of *non-metals*, the reactivity (*increases/decreases*) _____
3. As you move from the left side toward the centre of the periodic table, the reactivity (*increases/decreases*) _____
4. Describe the chemical reactivity of the family of elements called the Noble Gases.

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

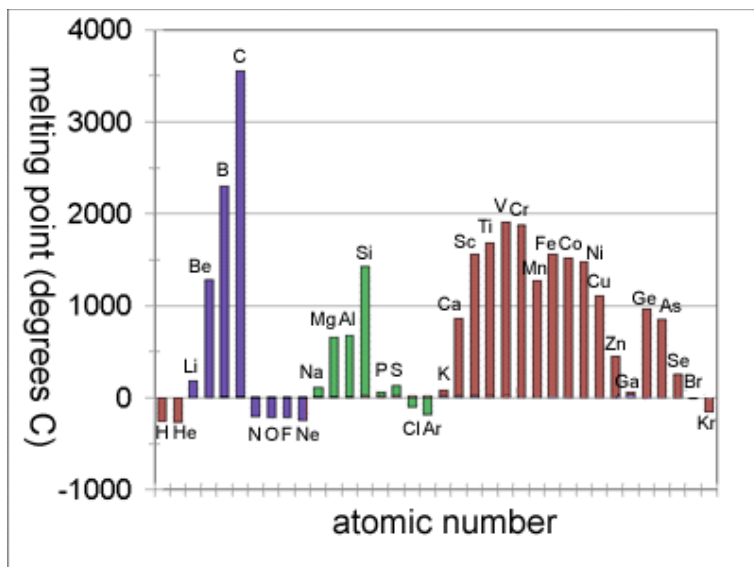
of Valence e^s — —
Ion Charge — —

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											Tl	Pb	Bi	Po	At	Rn																														
Fr	Ra	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub																																					
<table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="background-color: #FFFF00;">La</td><td style="background-color: #FFFF00;">Ce</td><td style="background-color: #FFFF00;">Pr</td><td style="background-color: #FFFF00;">Nd</td><td style="background-color: #FFFF00;">Pm</td><td style="background-color: #FFFF00;">Sm</td><td style="background-color: #FFFF00;">Eu</td><td style="background-color: #FFFF00;">Gd</td><td style="background-color: #FFFF00;">Tb</td><td style="background-color: #FFFF00;">Dy</td><td style="background-color: #FFFF00;">Ho</td><td style="background-color: #FFFF00;">Er</td><td style="background-color: #FFFF00;">Tm</td><td style="background-color: #FFFF00;">Yb</td><td style="background-color: #FFFF00;">Lu</td> </tr> <tr> <td style="background-color: #FFFF00;">Ac</td><td style="background-color: #FFFF00;">Th</td><td style="background-color: #FFFF00;">Pa</td><td style="background-color: #FFFF00;">U</td><td style="background-color: #FFFF00;">Np</td><td style="background-color: #FFFF00;">Pu</td><td style="background-color: #FFFF00;">Am</td><td style="background-color: #FFFF00;">Cm</td><td style="background-color: #FFFF00;">Bk</td><td style="background-color: #FFFF00;">Cf</td><td style="background-color: #FFFF00;">Es</td><td style="background-color: #FFFF00;">Fm</td><td style="background-color: #FFFF00;">Md</td><td style="background-color: #FFFF00;">No</td><td style="background-color: #FFFF00;">Lr</td> </tr> </table>																		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
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																																	

1. What is the relationship between the number of valence electrons and the ionic charge?

Part 3—Melting Points

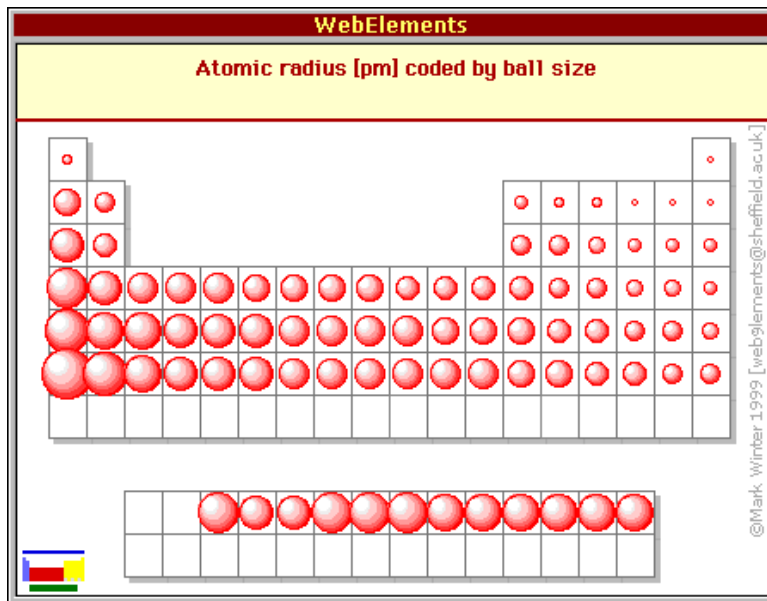
Look at the following graph showing the melting points of different elements and answer the questions below it:



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*) _____ 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*) _____
3. What can you say about the bonds that hold the atoms together as you move down the column of Alkali Metals? _____
4. What is the general trend in melting points of the Halogens as you move down the column from F to Br? (*increase/decrease*) _____
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*) _____
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*) _____
7. Do non-metals have the same melting point trend as metals? _____
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 _____
Is the same trend observed for Period 3 from Na to Si? _____
9. Which element has the highest melting point of all elements in the first 3 Periods? _____

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:



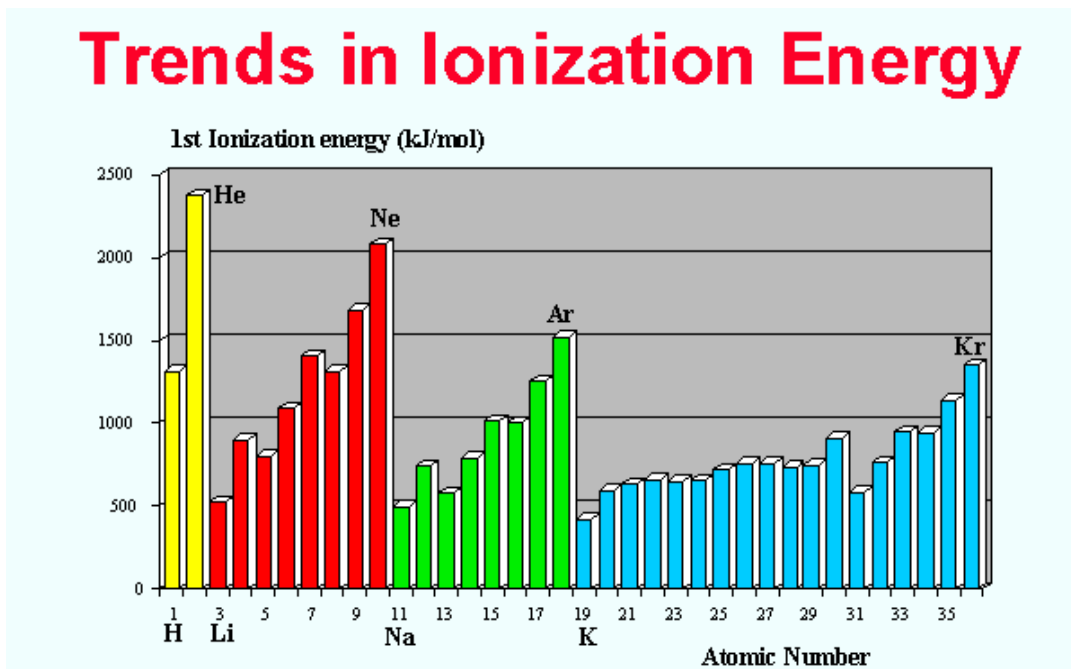
1. What is the general trend in atomic radius (size of atoms) as you move from left to right across any Period? (*increase/decrease*) _____
2. As you move from Li to Ne, electrons are filling (*the same/different*) _____ energy levels(s). This may help explain why atoms *don't* get bigger as you move 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? _____. Suggest a reason why the atoms in a period actually get *smaller* as you move from left to right. Get help from your teacher if you can't get this one!
3. What is the general trend in atomic radius (size of atoms) as you move *down* a vertical column (group)? (*increase/decrease*) _____
Suggest a reason for this trend. (*Hint: are electrons filling up the same energy level (orbitals) as you move down a column?*)

NEGATIVE IONS are _____ than the corresponding neutral atom.
POSITIVE IONS are _____ than the corresponding neutral atom.

Part 5—First Ionization Energy

Define **First Ionization Energy** (Use textbook or other reference. It is available on the internet!)

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:



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*) _____
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?*)
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*) _____
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.

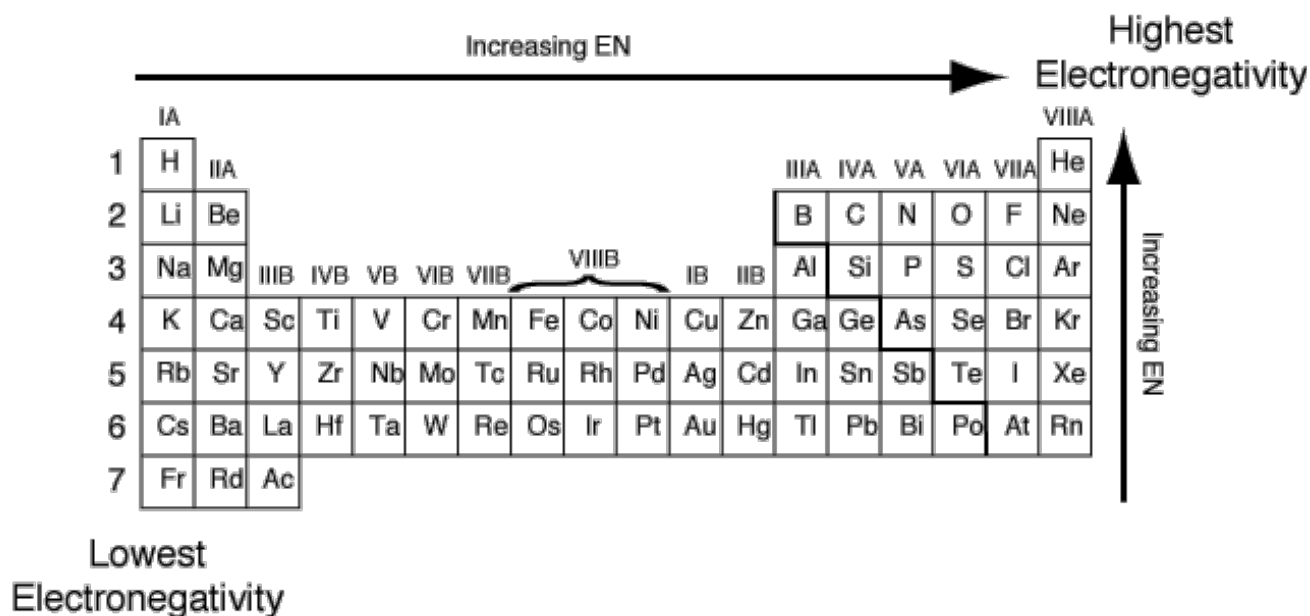
Part 5 - Electronegativity

1. Define **electronegativity**.

Atoms with relatively high electronegativity (EN) tend to pull bonded e⁻ closer to their nuclei. Atoms with lower EN values have their bonded electrons pulled farther away. This will dictate the nature of the chemical bonds that form and the properties of the compounds that contain those bonds.

2. Would you expect smaller atoms to have (*higher/lower*) EN values? _____ This is because their nuclei are (*closer/further*) _____ to bonded electrons.
3. Would you expect bigger atoms to have (*higher/lower*) EN values? _____ This is because their nuclei are (*closer/further*) _____ to bonded electrons.
4. The trend in EN is (*similar/different*) _____ to the trend in ionization energy?

Note that the noble gases don't have EN values because they don't generally form chemical bonds.

**Part 6 - Personal Periodic Table**

On your personal periodic table, indicate the trends in atomic size, ionization energy, electronegativity and melting point using arrows.