

Go to msrobbinspnhs.weebly.com Chemistry Notes Page. Download and go through the development of the Periodic Table PowerPoint and go through it as a slide show.

WS 1 Classes of Elements

1. Write the name or symbol for each of the following elements and identify them as:

Metals , Nonmetals , or Metalloids

Name	Symbol	Class
carbon	C	Nonmetal
sodium	Na	metal
argon	Ar	Non
calcium	Ca	metal
silicon	Si	metalloid
zinc	Zn	metal
chlorine	Cl	Non
sulfur	S	Non
lead	Pb	metal
iron	Fe	metal
potassium	K	metal
oxygen	O	Non
boron	B	metalloid
Tin	Sn	metal
bromine	Br	Nonmetal
hydrogen	H	Non

2. How are metalloids different from metals and nonmetals? _____

3. Identify each of the following as more characteristic of a metal, nonmetal, or metalloid.

- a. malleable metal
- b. brittle nonmetal
- c. able to be drawn into a wire metal
- d. gas at room temperature nonmetal
- e. semi-conductor metalloid
- f. shiny metal
- g. poor conductor nonmetal
- h. shiny and brittle metalloid
- i. most elements metal

4. Write the name and symbol of each element described:

	<u>Name</u>	<u>Symbol</u>
a.	the nonmetal in period 3 with the fewest protons	<u>phosphorus</u> <u>P</u>
b.	the metalloid in group 17 (7A)	<u>astatine</u> <u>At</u>
c.	the metal in period 3 with the most electrons	<u>aluminum</u> <u>Al</u>
d.	the metal in group 2 with lowest atomic number	<u>beryllium</u> <u>Be</u>
e.	the nonmetal in group 14 (4A)	<u>carbon</u> <u>C</u>
f.	the metal in group 12 that is a liquid at room temp.	<u>mercury</u> <u>Hg</u>
g.	the metal in period 4 with the fewest electrons	<u>potassium</u> <u>K</u>
h.	the least metallic element in period 5	<u>xenon</u> <u>Xe</u>
i.	the most metallic element in period 3	<u>sodium</u> <u>Na</u>
j.	the metal in group 15 (5A)	<u>bismuth</u> <u>Bi</u>
k.	the metalloid in group 13 (3A)	<u>boron</u> <u>B</u>
l.	the gas in group 16 (6A)	<u>oxygen</u> <u>O</u>
m.	the gas in group 17 (7A) with the fewest electrons	<u>fluorine</u> <u>F</u>
n.	the metal in period 4 used most for electrical wire	<u>copper</u> <u>Cu</u>
o.	the heaviest nonmetal in group 17 (7A)	<u>iodine</u> <u>I</u>
p.	the lightest metal	<u>lithium</u> <u>Li</u>
q.	the heaviest nonmetal	<u>radon</u> <u>Rn</u>
r.	the metalloid used most in microchips	<u>silicon</u> <u>Si</u>
s.	the solid nonmetal in period 2	<u>carbon</u> <u>C</u>
t.	the liquid nonmetal in period 4	<u>bromine</u> <u>Br</u>

5. List two elements that will react similarly to chlorine. fluorine bromine

6. Write the symbols of 3 precious metals commonly used in jewelry. Au Ag Pt

7. List the 2 metals named after scientists who made new atomic models after an experiment.

<u>Name</u>	<u>Symbol</u>	
<u>bohrium</u>	<u>Bh</u>	107
<u>rutherfordium</u>	<u>Rf</u>	104

Go to msrobbinspnhs.weebly.com Chemistry Notes Page. Download and go through the ppt_2_groups PowerPoint and go through it as a slide show.

WS 2 Groups of Elements

1. Write the name or symbol for each of the following elements and their group name as:
alkali metal, alkaline earth metal, halogen, or noble gas

Name	Symbol	Group Name
chlorine	Cl	halogen
potassium	K	alkali metal
helium	He	noble gas
magnesium	Mg	alkaline earth metal
bromine	Br	halogen
neon	Ne	noble gas
fluorine	F	halogen
iodine	I	halogen
calcium	Ca	alkaline earth metal
beryllium	Be	" " "
lithium	Li	alkali metal
argon	Ar	noble gas
strontium	Sr	alkaline earth metal
barium	Ba	" " "
sodium	Na	alkali metal
Krypton	Kr	noble gas

2. What are valence electrons? electrons in an atom's highest occupied energy level
3. List the group number and the number of valence electrons for each of the following elements.

name	group number	number of valence e ⁻
sodium	1 1A	1
potassium	1 1A	1
fluorine	17 7A	7
chlorine	17 7A	7
nitrogen	15 5A	5
magnesium	2 2A	2
barium	2 2A	2
carbon	14 4A	4
aluminum	13 3A	3
neon	18 8A	8

4. Because elements in the same group have the same number of valence electrons, they ...

have the same chemical properties or react similarly

5. Why are noble gases so unreactive?

they all have a full outer shell or a stable octet

6. Match the elements with the letter of the category that describes it.

- 1) lithium A
- 2) uranium F
- 3) nickel E
- 4) chlorine C
- 5) zinc E
- 6) sodium A
- 7) magnesium B
- 8) einsteinium F
- 9) fluorine C
- 10) strontium B
- 11) mendelevium F
- 12) has *d* orbitals E
- 13) most reactive metals A
- 14) almost totally unreactive D
- 15) most reactive nonmetals C
- 16) has *f* orbitals F

Categories

- A. alkali metal
- B. alkaline earth metal
- C. halogen
- D. noble gas
- E. transition metal
- F. inner transition metal

D $2s^2 1d^{10}$

7. Write the noble gas core electron configuration for: (example: aluminum is $[\text{Ne}]3s^23p^3$)

- a. potassium $[\text{Ar}]4s^1$
- b. rubidium $[\text{Kr}]5s^1$
- c. strontium $[\text{Kr}]5s^2$
- d. barium $[\text{Xe}]6s^2$
- e. bromine $[\text{Ar}]4s^2 3d^{10}4p^5$
- f. iodine $[\text{Kr}]5s^2 4d^{10}5p^5$

GO TO MSROBBINSPNHS.WEBLY.COM AND CLICK ON THE CHEMISTRY NOTES PAGE. DOWNLOAD AND GO THROUGH THE Ut_5_Pt_3_atomic_radius_trends.ppt POWERPOINT AND GO THROUGH IT AS A SLIDE SHOW.

UNIT 5 WS 3 ATOMIC & IONIC RADII

Atomic Size

- 1. As you go down a group, atomic radius gets larger.
 This happens because as you go down each successive row a new energy level of electrons → more shielding
 As you go right across a period, atomic radius gets smaller.
 This happens because as you go across a period the nuclear charge increases (more protons) pulling the electrons toward the nucleus
- 2. Which of the following elements has a larger atomic radius? (circle one)
 - a) fluorine or bromine
 - b) sodium or magnesium
 - c) potassium or strontium
- 3. Write the name of the element with the largest atom in each of the following groups.
 - a) F, Cl, Br bromine
 - b) N, O, F nitrogen
 - c) C, N, P, S phosphorus
- 4. Write the symbols of the elements in order of increasing atomic size. (smallest to largest)
 - a) oxygen, aluminum, magnesium O < Al < Mg
 - b) strontium, tin, iron Fe < Sn < Sr
 - c) calcium, potassium, carbon C < Ca < K
- 5. Write the symbols of the elements in order of decreasing atomic size. (largest to smallest).
 - a) Na, K, Cl K > Na > Cl
 - b) C, Ge, Sn Sn > Ge > C
 - c) Al, C, B Al > B > C
 - d) Ba, Zn, O Ba > Zn > O

Ions & Ionic Size

- 7. What is an ion? When an atom gains or loses electrons
- 8. Metals lose/gain electrons to form positive cations.
- 9. Nonmetals lose/gain electrons to form negative anions.
- 10. Positive cations are larger/smaller than the neutral atoms from which they formed because the outer shell is lost.
 Negative anions are larger/smaller than the neutral atoms from which they formed because less nuclear charge.

11. Circle the element or ion that is larger.

a) **K** or K^+

b) S or **S^{2-}**

c) **Ca** or Ca^{2+}

12. Circle the element or ion that is smaller.

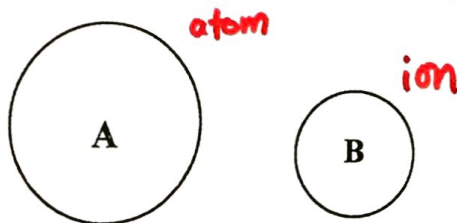
a) **Cl** or Cl^-

b) Mg or **Mg^{2+}**

c) Al or **Al^{3+}**

13. In the following picture, A is an element and B is an ion of the same element.

Is the ion B a positive or negative ion of atom A? positive



Explain your answer.

The atom lost e⁻s it loses its outer shell of electrons and pulls the e⁻ closer because of the higher protons

UNIT 5 WS 4 PERIODIC TRENDS

Ionization Energy

1. Define ionization energy: energy required to remove an electron from an atom

2. A lower ionization energy means that it is easier or harder to remove an electron.

Metals have lower or higher ionization energies than nonmetals because they more easily give up electrons.

3. As you go down a group, the ionization energy decreases.

This happens because there is more shielding and less attraction to the valence electrons

As you go across a period, the ionization energy increases

This happens because there is greater nuclear charge + metals want to lose e's, nonmetals want to gain e's to obtain noble gas stability

4. Circle the element with the lower ionization energy.

- a) Na K d) O S
b) Si Ge e) K Ca
c) Cl F

5. Order the symbols of the elements by decreasing ionization energy. (highest to lowest).

- a) Na, Mg, S S > Mg > Na
b) Mg, Ba, Ca Mg > Ca > Ba
c) N, F, Br F > N > Br
d) Li, K, Mg Mg > Li > K

6. Write the name of the element with the lowest ionization energy in each of the following.

- a) Ca, Na, Mg, K potassium
b) P, O, S, N sulfur

Electronegativity

7. Define electronegativity: an atom's ability to attract bonded e's

8. A higher electronegativity means that it is more or less likely to gain an electron.

Nonmetals have lower or higher electronegativities than metals because they more easily attract electrons.

9. As you go down a group, electronegativity decreases.

This happens because there is more shielding + less attraction between the nucleus + the valence electrons.

As you go across a period, electronegativity increases.

This happens because there is greater nuclear charge.

10. Circle the element with the higher electronegativity.

a) Mg Na

d) O N

b) C N

e) Cl F

c) S O

11. Order the symbols of the elements by increasing electronegativity. (lowest to highest).

a) Cl, Br, F Br < Cl < F

b) Al, Na, S Na < Al < S

c) C, O, Ne Ne < C < O

d) O, Cl, I I < Cl < O

12. Write the name of the element with the highest electronegativity in each of the following.

a) S, O, Cl, F Fluorine

b) P, O, S, N oxygen

Summary of Periodic Trends

1. Answer the following questions by circling the correct element.

Which is more electronegative?

O Br

Which has the smaller radius?

Ca Fe

Which has the lower ionization energy?

Li K

Which has the higher electronegativity?

Al S

Which is less electronegative?

C N

Which has the larger radius?

Ba P

Which has the higher ionization energy?

Be Sr

Which has the lower ionization energy?

Al Na

Which has the smaller radius?

Au Ag

Which is less electronegative?

Br F

Which is less electronegative?

Na Rb

Which has the smallest radius?

C Si

Which has the lower electronegativity?

I Sn

Which is less electronegative?

I Cl

Which has the larger radius?

Ne Kr

Which has the higher ionization energy?

Li K

Which is more reactive?

Na Cs

Which is more reactive?

Br F

Which is more reactive?

He H

Name: KEY

Date: _____ Period: _____

Review Unit 4: The Periodic Table

1. Elements in the same family or group have same number of _____ electrons.

2. Classify the elements below as: metal, nonmetal, metalloid

a. sulfur nonmetal

d. magnesium metal

b. iron metal

e. silicon metalloid

c. hydrogen nonmetal

f. chromium metal

3. Write the symbol for the mystery element based on the clue.

He a. non-reactive, stable element having the smallest radius in its group

F b. halogen having the highest ionization energy

Se c. period 4 element, having 6 valence electrons

Fe d. transition metal having the smallest atomic mass in Group 8

Na e. period 3 metal with one valence electron

C f. Group 14 element with the lowest atomic number

Ra g. alkaline earth metal having the lowest ionization energy

O h. has 2 more protons than carbon

As i. period 4 element with 5 valence electrons

Cs j. very reactive group 1 element, found in period 6

F k. the most electronegative element on the periodic table



4. A chemist needs calcium to perform an experiment in the lab and discovers that she does not have any calcium. List the two elements that she could use for this experiment to best replace calcium.

magnesium strontium

Explain your choices: They are in the same family so they have similar chemical properties

5. For each family of elements, list the sublevel block in which it is located in the periodic table.

(s, p, d, f)

a. alkali metals

s

b. halogens

p

c. transition metals

d

d. alkaline earth metals

s

e. noble gases

p

6. The periodic table was developed by Mendeleev in the 1800s. He arranged the elements that were known at the time by increasing atomic mass and placed them into groups based on similar properties.

7. What was Mendeleev able to do using the periodic table that he designed?

predict the properties of undiscovered elements

8. What does each period number on the periodic table represent about the atoms in that period?

The number of energy levels of electrons that element's atoms have

9. What is the amount of energy required to remove an electron from an atom?

ionization energy

10. What is an atom's ability to attract electrons when involved in a chemical bond?

electronegativity

11. How many valence electrons do each of the following groups or families of elements have?

- a. halogens 7
- b. noble gases 8
- c. Group 2 2
- d. Group 13 3
- e. alkali metals 1

3 Li Lithium 6.94	4 Be Beryllium 9.01
-----------------------------------	-------------------------------------

5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18
---------------------------------	----------------------------------	------------------------------------	----------------------------------	------------------------------------	----------------------------------

12. For the elements listed above, which element has the largest atomic radius? Li

Which element has the smallest atomic radius? Ne

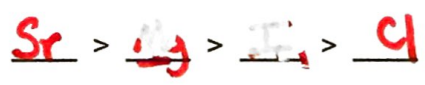
These atoms change size from left to right. Why do their sizes follow this trend from left to right?

The nuclear charge increases, pulling the e⁻s closer to the nucleus

1A												3A		4A		5A		6A		7A		8A	
1	H Hydrogen 1.01											5	B Boron 10.81	6	C Carbon 12.01	7	N Nitrogen 14.01	8	O Oxygen 16.00	9	F Fluorine 19.00	10	Ne Neon 20.18
2	3	4											13	14	15	16	17	18					
	Li Lithium 6.94	Be Beryllium 9.01											Al Aluminum 26.98	Si Silicon 28.09	P Phosphorus 30.97	S Sulfur 32.07	Cl Chlorine 35.45	Ar Argon 39.95					
3	11	12	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18					
	Na Sodium 22.99	Mg Magnesium 24.31	Sc Scandium 44.96	Ti Titanium 47.87	V Vanadium 50.94	Cr Chromium 52.00	Mn Manganese 54.94	Fe Iron 55.85	Co Cobalt 58.93	Ni Nickel 58.69	Cu Copper 63.55	Zn Zinc 65.38	Ga Gallium 69.72	Ge Germanium 72.61	As Arsenic 74.92	Se Selenium 78.96	Br Bromine 79.90	Kr Krypton 83.80					
4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36					
	K Potassium 39.10	Ca Calcium 40.08	Sc Scandium 44.96	Ti Titanium 47.87	V Vanadium 50.94	Cr Chromium 52.00	Mn Manganese 54.94	Fe Iron 55.85	Co Cobalt 58.93	Ni Nickel 58.69	Cu Copper 63.55	Zn Zinc 65.38	Ga Gallium 69.72	Ge Germanium 72.61	As Arsenic 74.92	Se Selenium 78.96	Br Bromine 79.90	Kr Krypton 83.80					
5	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54					
	Rb Rubidium 85.47	Sr Strontium 87.62	Y Yttrium 88.91	Zr Zirconium 91.22	Nb Niobium 92.91	Mo Molybdenum 95.94	Tc Technetium (98)	Ru Ruthenium 101.07	Rh Rhodium 102.91	Pd Palladium 106.42	Ag Silver 107.87	Cd Cadmium 112.41	In Indium 114.82	Sn Tin 118.71	Sb Antimony 121.76	Te Tellurium 127.60	I Iodine 126.90	Xe Xenon 131.29					
6	55	56	57	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86					
	Cs Cesium 132.91	Ba Barium 137.33	La Lanthanum 138.91	Hf Hafnium 178.49	Ta Tantalum 180.95	W Tungsten 183.84	Re Rhenium 186.21	Os Osmium 190.23	Ir Iridium 192.22	Pt Platinum 195.08	Au Gold 196.97	Hg Mercury 200.59	Tl Thallium 204.38	Pb Lead 207.2	Bi Bismuth 208.98	Po Polonium (209)	At Astatine (210)	Rn Radon (222)					
7	87	88	89	104	105	106	107	108	109														
	Fr Francium (223)	Ra Radium (226)	Ac Actinium (227)	Rf Rutherfordium (261)	Db Dubnium (262)	Sg Seaborgium (266)	Bh Bohrium (264)	Hs Hassium (269)	Mt Meitnerium (268)														

Key
 11 — Atomic number
 Na — Element symbol
 sodium — Element name
 22.99 — Average atomic mass

13. Place the highlighted elements in the periodic table in order from largest to smallest by atomic radius.



14. Arrange the following particles from smallest to largest.



11 Na Sodium 22.99	12 Mg Magnesium 24.31
19 K Potassium 39.10	20 Ca Calcium 40.08

15. Which element above has the lowest ionization energy? K

Which element has the highest ionization energy? Mg

16. Organize the elements in **Figure A** from least to most reactive.



Organize the elements in **Figure B** from least to most reactive.



Figure A

4 Be Beryllium 9.01
12 Mg Magnesium 24.31
20 Ca Calcium 40.08
38 Sr Strontium 87.62
56 Ba Barium 137.33

Figure B

9 F Fluorine 19.00
17 Cl Chlorine 35.45
35 Br Bromine 79.90
53 I Iodine 126.90
85 At Astatine (210)

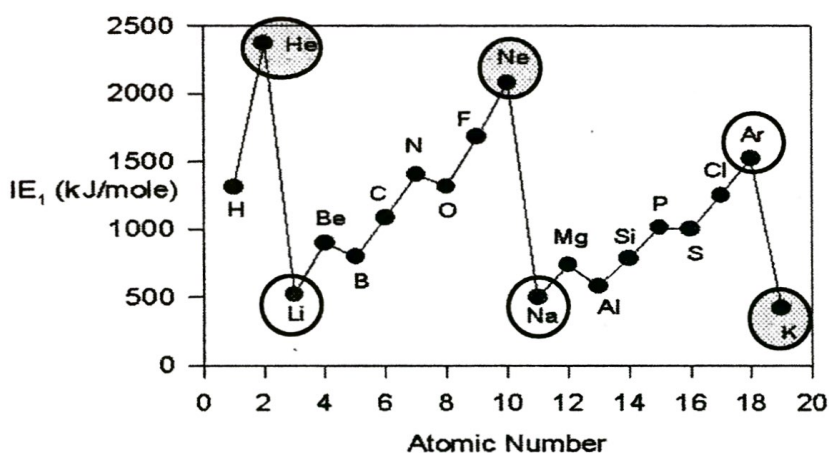
17. Fill in the missing information for the element fluorine.

- a. F has the smallest atomic radius in its group.
- b. F has the highest ionization energy in its group.
- c. F has the highest electronegativity in its group.
- d. F is the most reactive element in its group.

9
F
19.00

For questions 18 – 20, use this graph showing the first ionization energies of elements 1-19.

First Ionization Energy versus Atomic Number



Graph showing the 1st ionization energies of elements 1-19

18. What does the graph show about the elements He, Ne and Ar?

They have the highest ionization energies because their outermost energy level has (2) 8 electron(s) and is held closer to the atom's nucleus by extra protons.

What does this indicate about their stability? relatively stable or fairly reactive

19. What does the graph show about the elements Li, Na, and K?

They have the lowest ionization energies because their outermost energy level has one electron(s) and is located further from the atom's nucleus.

What does this indicate about their stability? relatively stable or fairly reactive

20. The direction of the line graph from Li to Ne and from Na to Ar generally goes up as atomic number increases. But it drops suddenly from Ne to Na and from Ar to K. Why does this sudden drop occur from Ne to Na?

- A. atomic radius decreases
- B. atomic number increases
- C. valence electron now in energy level further from nucleus**
- D. valence electron now attracted more to the nucleus