Name:

Regents Chemistry: Mr. Palermo

Practice Packet Unit 4: Periodic Table

Name:

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Vocabulary:

1. Allotrope Nonmetals Mendeleev
2. Ion Metalloids Period
3. Cation Luster Group(family)
4. Anion Malleability Alkali Metals
5. Electron Ductility Alkaline Earth Metals
6. Proton Conductivity Halogens
7. Neutron Nonmetals Atomic radius
8. Compound Brittleness Ionization energy
9. Element Dull Electronegativity
10. Valence electron Non-conductor Reactivity
11. Lewis Dot Diagram Noble gas Electron configuration
12. Metals Periodic Law

Unit Objectives: When you complete this unit you *will be able to do* the following...

1. Describe the origin of the periodic table
2. State the modern periodic law
3. Explain how an element's electron configuration is related to the element's placement within a period and a group on the periodic table'
4. State the trends of the following properties within periods and groups of elements
   including:
   - Ionization energy
   - Electronegativity
   - Atomic Radius
   - Reactivity
   - Metallic/Nonmetallic character
5. Identify and state the properties of the following groups in the periodic table:
   - Alkali metals
   - Alkaline earth metals
   - Halogens
   - Noble Gases
   - Transition elements
6. Locate and state the properties of the metals, nonmetals, and metalloids (semi-metals)

Unit 4: Periodic Table
LESSON 1: Development of the Periodic Table

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Objective:

- ***Explain how the periodic table was developed***
- ***Identify the differences between periods and groups***

MENDELEEV: Organized the periodic table based upon _____.

MOSELEY: Developed the modern day periodic table; organized elements by

_____.

Organization of the Periodic Table

PERIODS: (horizontal rows) _____

GROUPS: (vertical columns) _____

_____.

Reactivity of Elements

Determined by the # of _____.

All atoms (except Hydrogen) want _____
to become _____ (full valence shell)

Called a _____.

The closer to a stable octet the **MORE REACTIVE** the element is.

****Period 1** elements need **2 electrons** to have a full valence shell **NOT 8.**

PRACTICE 1:

Which element is in Group 2 and has 4 energy levels?

PRACTICE 2:

Which two elements have similar chemical properties and why? Na, K, Li, Be

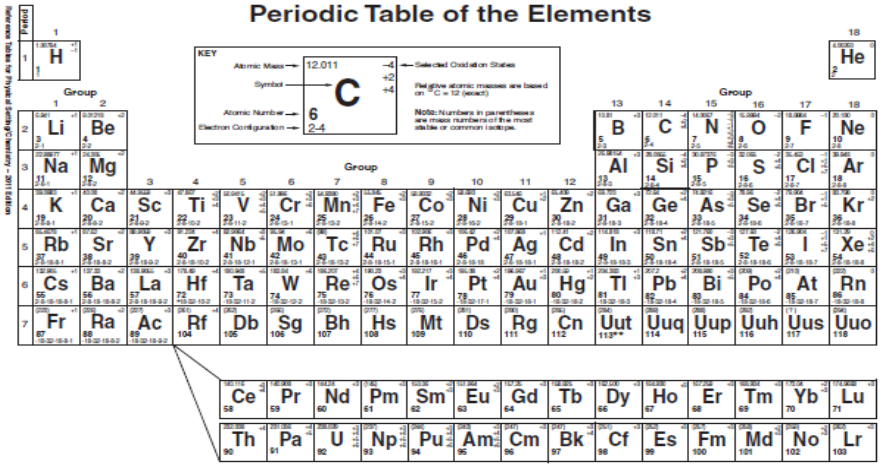
CHECK YOUR UNDERSTANDING:

Which element is more reactive Oxygen or Fluorine and why?

Objective:

- ***Differentiate between the different groups of elements***
- ***Identify the properties specific to each category of element***

Metals, Nonmetals and metalloids



ELEMENT GROUPS

GROUP 1: ALKALINE METALS

- _____
- Lose 1 electron to form +1 ions
- Extremely reactive with water
- Most REACTIVE metal is Fr

GROUP 2: ALKALINE EARTH METALS

- _____
- Lose 2 electrons to form +2 ions
- Fairly reactive in water

GROUPS 3-12: TRANSITION METALS

- Least reactive metals
- Form _____ in solution

GROUP 17: HALOGENS

- _____
- Gain 1 electron to for -1 ions
- Most REACTIVE nonmetal is F

GROUP 18: NOBLE GASES

- _____
- Stable octet (8 valence electrons)
- Exception is He which has 2 valence electrons
- monoatomic

HYDROGEN:

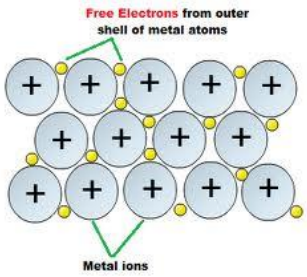
- Not officially part of a group
- Nonmetal
- Gas at STP

PROPERTIES OF ELEMENTS

A. PROPERTIES OF METALS:

- _____ (can be hammered or rolled into thin sheets)
- _____ (can be drawn into a wire)
- _____ of heat and electricity
- _____ (Shiny)
- Lose electrons to form _____
- Solid @ STP (except Hg)

Metals have a _____
which results in ELECTRICAL CONDUCTIVITY



METALLIC CHARACTER: How much like a metal an element is

- Franicium_ is most metallic
- Closer to Fr more metallic…further from Fr least metallic

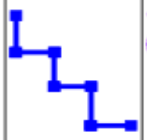
B. PROPERTIES OF METALLOIDS

- _____ (good/moderate conductor)
- _____ (like metals) and _____ (like nommetals)
- Used for making computer microchips
-

C. PROPERTIES OF NONMETALS

- _____ of heat and electricity
- _____ (shatter when struck)
- _____
- Tend to gain electrons to form _____

SUMMARY OF CATEGORIES OF ELEMENTS

	Metals	Metalloids	Nonmetals
Phys. prop.	• malleable • ductile • shiny • excellent conductors (heat, electricity… MOBILE e-'s)	in-between 	• brittle • dull • poor conductors (heat, electricity)
Chem. prop.	• lose e-'s • form + ions • low E.N. • low I.E.	B, Si, Ge, As, Sb, Te	• gain e-'s • form - ions • high E.N. • high I.E.

PRACTICE 1:

Which of the following are symbol(s) for halogen elements Na, Mg, Fe, Ni, Cl?

PRACTICE 2:

Identify each property below as more characteristic of a metal or a nonmetal

Brittle -

Malleable -

Poor conductor of electricity -

Shiny -

Tend to gain electrons –

CHECK YOUR UNDERSTANDING 1:

Why is hydrogen a nonmetal but it is listed on the metal side of the periodic table?

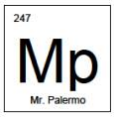
CHECK YOUR UNDERSTANDING 2:

In which pair of elements are the chemical properties of the elements most similar?

a. sodium and chlorine

b. nitrogen and phosphorus

c. boron and oxygen



Objective:

- ***Describe the trend in atomic radius***
- ***Explain why the trend in atomic radius exists***

ATOMIC RADIUS: _____
located on Table S.

TREND IN ATOMIC RADIUS

Across a PERIOD	**Down a GROUP**
Trend:	**Trend:**
Why: Nuclei have greater _____ (larger positive charges) which PULL electrons CLOSER	**Why:** GREATER number of _____ (indicated by the PERIOD #)

Using Table S to determine the trend:

Pick a Period (row) or Group (column) and note the values of the elements

EXAMPLE: Going across *a period* what is the trend in atomic radius?

Pick an element on the left side of the periodic table and pick another element on the right side of the same period. The trend is : _____.

PRACTICE:

Compare the atomic radius of a period-2 alkaline earth metal with that of a period-4 alkaline earth metal?

RECALL……

ION SIZE: METALS	**ION SIZE: NONMETALS**
Ion radius SMALLER than atomic radius	Ion radius LARGER than atomic radius
Why?	*Why?*
Metal ions LOSE electrons to form Cations	Nonmetal ions GAIN electrons to for anions

CHECK YOUR UNDERSTANDING 1:

What is the trend in atomic radius going down a group?

CHECK YOUR UNDERSTANDING 2:

Why does this trend occur down a group?

UNIT 4: Periodic Table
LESSON 3b: Trends in Ionization Energy& Electronegativity

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Objective:

- ***Describe the trend in ionization energy and electronegativity***
- ***Explain why these trends exists***

RECALL**....REACTIVITY**

METALS	**NONMETALS**
■ Decreases across period	■ Increases across period
■ Increases down group	■ Decreases down group
■ ***Reason***: The larger the atom the weaker the nuclear pull and the more easily you lose electrons and become stable	■ ***Reason:*** The smaller the atom the greater the **nuclear pull (+)** and the more easily it attracts **electrons (-)**

IONIZATION ENERGY: Energy required to _____ the most loosely bound _____.

- Located on Table S

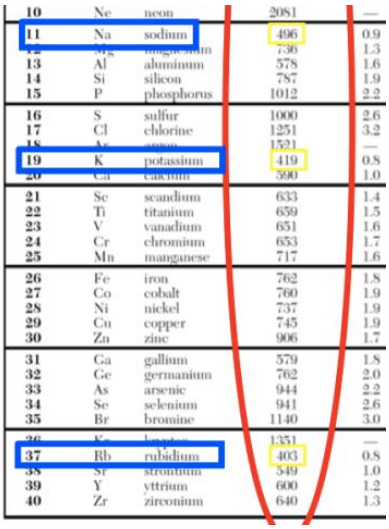
TREND IN IONIZATION ENERGY

Across a PERIOD	**Down a GROUP**
Trend: _____ across a _____.	**Trend: _____** down a _____.
Why: STRONGER _____ makes it more difficult to remove electrons	**Why:** Larger atomic radius means LESS _____ on outer electrons

PRACTICE: (use table S to determine the trend)

a. What is the trend in ionization energy going down a group?

b. Why does this trend occur?



10	Ne	neon	2081	—
11	Na	sodium	496	0.9
12	Mg	magnesium	736	1.3
13	Al	aluminum	578	1.6
14	Si	silicon	787	1.9
15	P	phosphorus	1012	2.2
16	S	sulfur	1000	2.6
17	Cl	chlorine	1251	3.2
18	Ar	argon	1521	—
19	K	potassium	419	0.8
20	Ca	calcium	590	1.0
21	Sc	scandium	633	1.4
22	Ti	titanium	659	1.5
23	V	vanadium	651	1.6
24	Cr	chromium	653	1.7
25	Mn	manganese	717	1.6
26	Fe	iron	762	1.8
27	Co	cobalt	760	1.9
28	Ni	nickel	737	1.9
29	Cu	copper	745	1.9
30	Zn	zinc	906	1.7
31	Ga	gallium	579	1.8
32	Ge	germanium	762	2.0
33	As	arsenic	944	2.2
34	Se	selenium	941	2.6
35	Br	bromine	1140	3.0
36	Kr	krypton	1351	—
37	Rb	rubidium	403	0.8
38	Sr	strontium	549	1.0
39	Y	yttrium	600	1.2
40	Zr	zirconium	640	1.3

ELECTRONEGATIVITY: Measure of the _____ for electrons

- Located on Table S
- _____ most electronegative (4.0)
- The closer an atom is to Fluorine the _____ the electronegativity
- Scale of 0 - 4

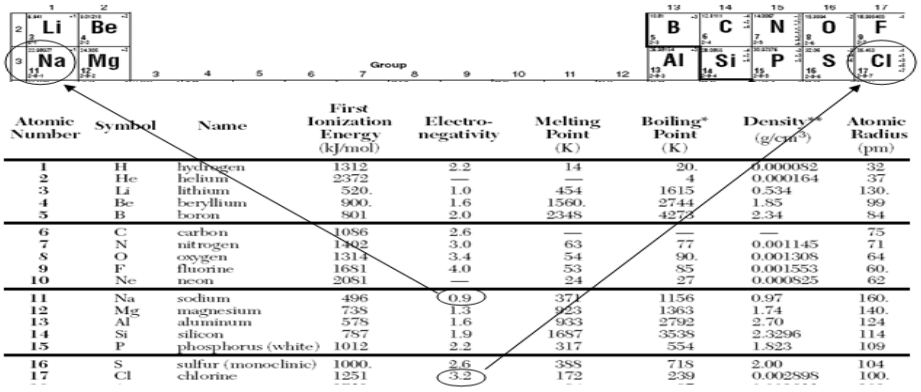
TREND IN IONIZATION ENERGY

Across a PERIOD	**Down a GROUP**
Trend: _____ across a _____.	**Trend:** _____ down a _____.
Why: Greater nuclear charge (pull) to attract electrons	**Why:** Larger atomic radius means LESS _____ to attract electrons to the valence shell

PRACTICE 2:

a. What is the trend in electronegativity across a period?

b. Why does this trend occur?



Atomic Number	Symbol	Name	First Ionization Energy (kJ/mol)	Electro-negativity	Melting Point (K)	Boiling* Point (K)	Density** (g/cm^3)	Atomic Radius (pm)
1	H	hydrogen	1312	2.2	14	20.	0.0000S2	32
2	He	helium	2372	—	—	4	0.000164	37
3	Li	lithium	520.	1.0	454	1615	0.534	130.
4	Be	beryllium	900.	1.6	1560.	2744	1.85	99
5	B	boron	801	2.0	2348	4273	2.34	84
6	C	carbon	1086	2.6	—	—	—	75
7	N	nitrogen	1402	3.0	63	77	0.001145	71
8	O	oxygen	1314	3.4	54	90.	0.001308	64
9	F	fluorine	1681	4.0	53	85	0.001553	60.
10	Ne	neon	2081	—	24	27	0.000825	62
11	Na	sodium	496	0.9	371	1156	0.97	160.
12	Mg	magnesium	738	1.3	923	1363	1.74	140.
13	Al	aluminum	578	1.6	933	2792	2.70	124
14	Si	silicon	787	1.9	1687	3538	2.3296	114
15	P	phosphorus (white)	1012	2.2	317	554	1.823	109
16	S	sulfur (monoclinic)	1000.	2.6	388	718	2.00	104
17	Cl	chlorine	1251	3.2	172	239	0.002898	100.

Summary

Periodic Property	Variation across a Period	Variation down a Group
Metallic Character	Decreases	Increases
Atomic Radius	Decreases	Increases
Ionization Energy	Increases	Decreases
Ion Size	Decreases	Increases
Electronegativity	Increases	Decreases

CHECK YOUR UNDERSTANDING 1:

What is the trend in ionization energy going down a group?

CHECK YOUR UNDERSTANDING 2:

Why does this trend occur?