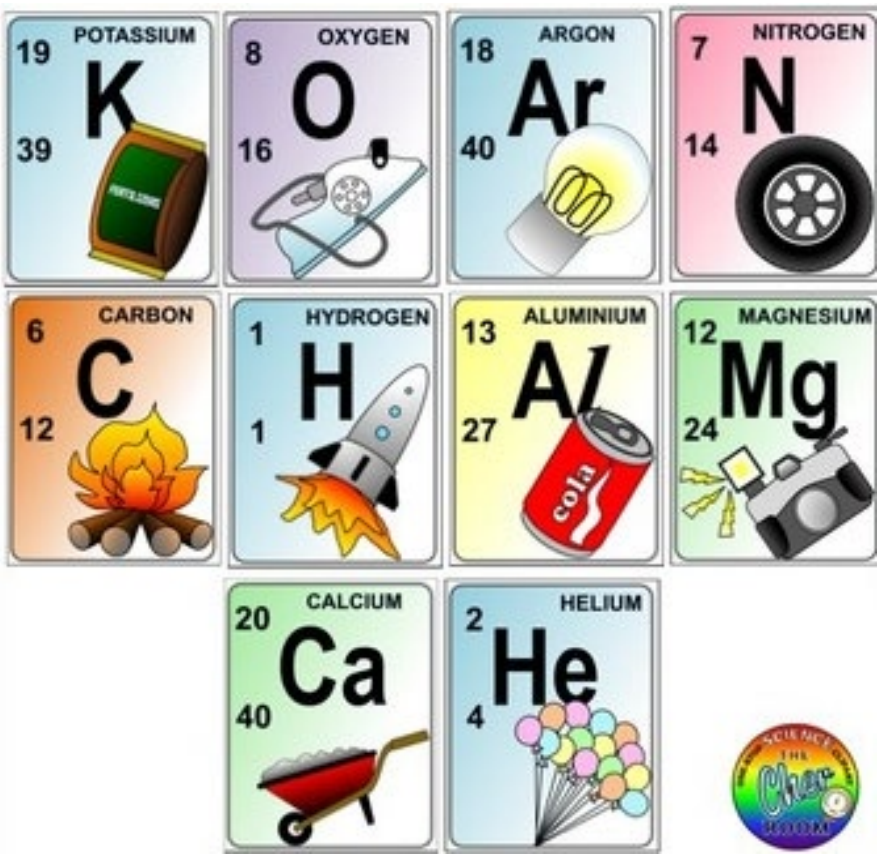
Science 9

Unit 2: Chemistry



Book 2: Atoms, The Periodic Table & Bohr Models

name: _____ **block:** _____

Periodic Table of the Elements

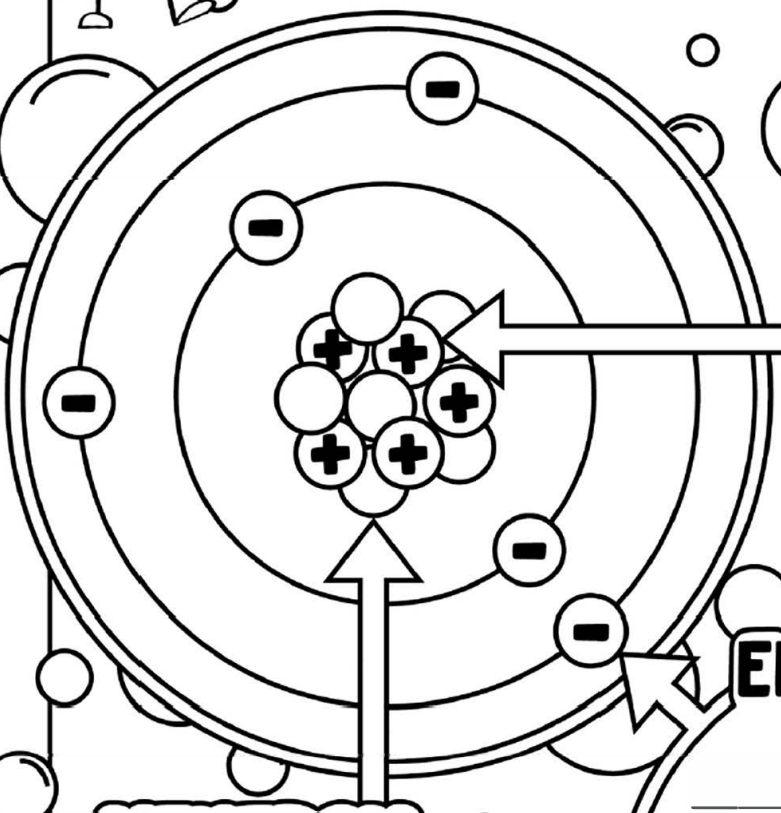
1																	18
1 H Hydrogen 1.01	2											13	14	15	16	17	2 He Helium 4.00
3 Li Lithium 6.94	4 Be Beryllium 9.01											5 B Boron 10.81	6 C Carbon 12.01	7 N Nitrogen 14.01	8 O Oxygen 16.00	9 F Fluorine 19.00	10 Ne Neon 20.18
11 Na Sodium 22.99	12 Mg Magnesium 24.31	3	4	5	6	7	8	9	10	11	12	13 Al Aluminum 26.98	14 Si Silicon 28.09	15 P Phosphorus 30.97	16 S Sulfur 32.07	17 Cl Chlorine 35.45	18 Ar Argon 39.95
19 K Potassium 39.10	20 Ca Calcium 40.08	21 Sc Scandium 44.96	22 Ti Titanium 47.87	23 V Vanadium 50.94	24 Cr Chromium 51.99	25 Mn Manganese 54.94	26 Fe Iron 55.85	27 Co Cobalt 58.93	28 Ni Nickel 58.69	29 Cu Copper 63.55	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.63	33 As Arsenic 74.92	34 Se Selenium 78.97	35 Br Bromine 79.90	36 Kr Krypton 84.80
37 Rb Rubidium 85.47	38 Sr Strontium 87.62	39 Y Yttrium 88.91	40 Zr Zirconium 91.22	41 Nb Niobium 92.91	42 Mo Molybdenum 95.95	43 Tc Technetium 98.91	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.6	53 I Iodine 126.90	54 Xe Xenon 131.29
55 Cs Cesium 132.91	56 Ba Barium 137.33	57-71 Lanthanides	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.84	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.09	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 208.98	84 Po Polonium [208.98]	85 At Astatine 209.99	86 Rn Radon 222.02
87 Fr Francium 223.02	88 Ra Radium 226.03	89-103 Actinides	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [278]	110 Ds Darmstadtium [281]	111 Rg Roentgenium [280]	112 Cn Copernicium [285]	113 Nh Nihonium [286]	114 Fl Flerovium [289]	115 Mc Moscovium [289]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]

57 La Lanthanum 138.91	58 Ce Cerium 140.12	59 Pr Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium 144.91	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.06	71 Lu Lutetium 174.97
89 Ac Actinium 227.03	90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium 237.05	94 Pu Plutonium 244.06	95 Am Americium 243.06	96 Cm Curium 247.07	97 Bk Berkelium 247.07	98 Cf Californium 251.08	99 Es Einsteinium [254]	100 Fm Fermium 257.10	101 Md Mendelevium 258.1	102 No Nobelium 259.10	103 Lr Lawrencium [262]

PART A: THE ATOM & SUBATOMIC PARTICLES

PARTS OF AN ATOM

All _____ is made of tiny particles called _____.
Atoms are made of even smaller _____ particles called _____, _____ and _____



PROTON

_____ charged particles in the _____ that have a mass of _____ AMU. The number of protons determines the _____ of an atom. For example hydrogen has _____, helium has _____.

AMU = ATOMIC MASS UNIT

ELECTRON

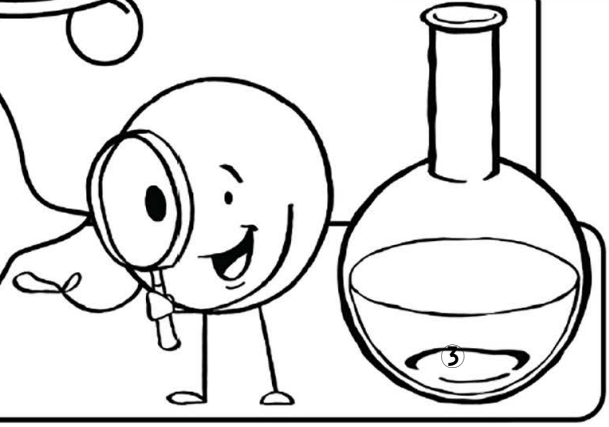
_____ charged particles in the _____ shells or _____. The mass of an electron is _____ than that of a proton, so it does not add _____ mass to the _____.

NEUTRON

_____ particles in the _____ of the atom. They have no _____ and have a mass of _____ AMU. _____ is the only element that does _____ have at least one neutron in its _____.

WOW!

Atoms are so small! The dot on this i contains about 1 trillion atoms!



Atoms are mostly _____ space. The mass comes from the _____ and _____ in the nucleus!

What are atoms and how do we know they exist?

- An atom is the _____particle of an _____ that still has the identity and properties of the element.
- Atoms are made up of_____particles *(particles that are smaller than atoms)*.
- These particles are _____, _____ and _____

Summary of the Parts of an Atom:

Name	Symbol	Charge	Location	Relative Mass

The Nucleus

- At the _____ of every atom is a _____
- _____ of the space inside an atom is taken up by the_____, the nucleus is _____
- As atoms get bigger, the _____ in the nucleus repel *(push away from)* each other more. So _____are required to make the nucleus stable.
    - Neutrons are though to be needed to hold all the protons together in the nucleus
    - The bigger the nucleus, the _____are needed.

True of False:

a) All matter is made of small particles called atoms _____

b) Atoms of one elements are different form the atoms of other elements _____

c) Electrons are locate din the nucleus of an atom _____

d) Most of the mass of an atom is concentrated in it's electrons _____

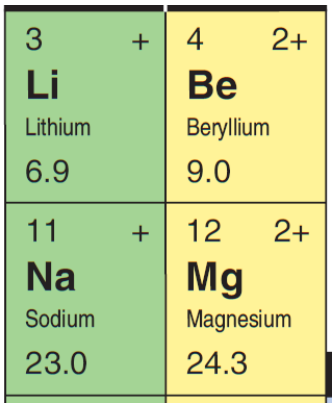
e) The nucleus contains protons and electrons _____

f) The nucleus is the tiny, dense, central core of the atom. _____

Atomic Number (Z)

The number of _____ in an atom is known as the atomic number or proton number.

It is the smaller of the two numbers shown in most periodic *tables. (usually on top...dependswhere you're looking)*



atomic number =

- always the _____for a particular element.
- The number of protons _____ the element!
- is also equal to the _____charge of the nucleus
    - this is also called the *positive* _____.
- in ther periodic table atoms are listed from _____ to right by _____ atomic number

If an atom has a Z = 12, then it MUST be an atom of:	_____
If an atom has a *nuclear charge* of +24, then it MUST be an atom of:	_____
What is the atomic number of polonium?	_____
What is the *positive nuclear charge* of lead?	

The ***overall charge on an atom is zero*** because

the number of _____ = number of _____

How many electrons?

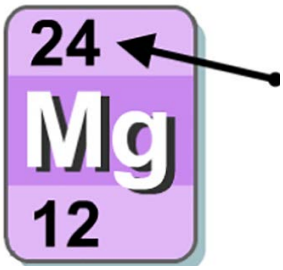
Atoms have no overall electrical charge and are_____

This means atoms must have an _____number of positive protons and negative electrons.

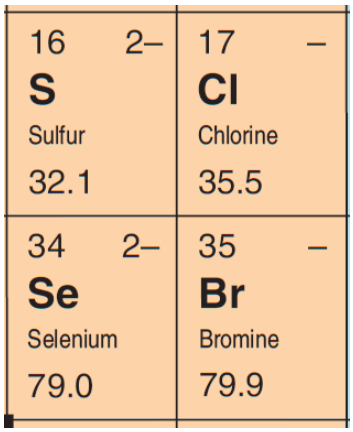
The number of electrons is therefore the same as the atomic _____.

Atoms	Protons	Neutrons	Electrons
helium			
copper			
iodine			

Mass Number (A)



- Atoms of a certain element *always* have the same number of _____, but can have different numbers of neutrons….these are called _____. *They are the different "versions "of an atom of an element that can exist.*
- Mass number = the total number of particles with mass (_____ + _____) in the _____ of an element
  - _____ have a mass of almost zero, which means that the mass of each atom results almost entirely form the number of protons and neutrons, _____electrons.
- Mass number is ALWAYS reported as a _____
- The mass number _____ appear exactly like this on the periodic table.
  - BE CAREFUL! The larger of the two numbers *(usually on the bottom)* shown on your periodic table is the ***relative* _____.** It is the **average** mass number of the element *(average of the isotopes).*
  - We must ROUND the atomic mass to the nearest WHOLE NUMBER in order to determine the number of neutrons.
  - **RULE:** numbers 0→4 = ROUND _____ 5→9 ROUND _____



- _____ are different atoms of a particular element that have the SAME number of _____ but a DIFFERENT number of _____.
- The mas number _____ be used to identify the element.
  - ***Example:*** Both He and H can have a mass number of _____

H : ____ p,___ n , He: ____ p,____ n

What's the mass number?

mass number = number of protons + number of neutrons

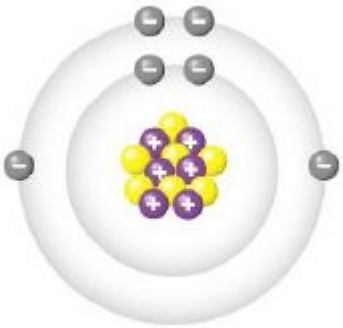
Atoms	Protons	Neutrons	Mass number
helium			
copper			
cobalt			
iodine			
germanium			

How many neutrons?

Atoms	Mass number	Atomic number	Neutrons
helium			
fluorine			
strontium			
zirconium			
uranium			

Example: Calculating the number of neutrons in an atom of lithium

Overall charge of an atom:



1. Label the parts of the atom to the right. Include the following labels: proton, electron, neutron, nucleus.

2. What elements is represented by this diagram? How do you know?

3. What is the charge of this nucleus? What is the charge of this atom overall?

4. What is the mass of this atom?

5. Using a periodic table, look up titanium.
    a. What is its atomic number?

    b. How many protons does a titanium atom have?

    c. How many electrons does it have?

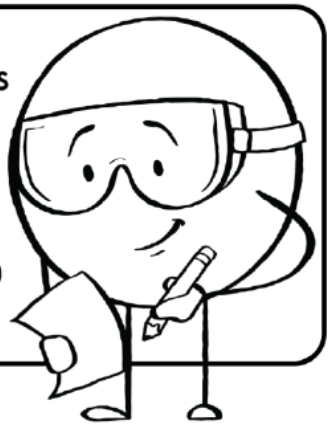
6. What element has 78 protons?

7. What is the atomic mass of a sample of chlorine that has 19 neutrons?

8. What atom has 18 electrons?

PART B: ELEMENTS

A substance that cannot be _____ _____ into simpler substances by _____ means. An element is composed of _____ that have the same number of _____ in their _____.

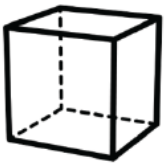


ELEMENTS

Every element has a unique _____ _____. It indicates the total number of _____ in the _____ of the atom. Normal atoms are electrically _____, same number of _____ as _____. So it is also the number of _____.

ATOMIC NUMBER

12



Mg

Magnesium

24.305

ELEMENT NAME

Every element has a unique name. Many element names are very _____ and are based on other _____. _____ is named after "khloros," the Greek work for "_____ _____" Newly discovered _____ are named by the discoverer, but must be _____ by an international committee.

Every elements is _____ using a unique _____ of one or _____ letters. The first letter is always _____ and if there is a second letter, it is _____ _____. Some are based on other languages, for example the symbol _____ is _____ from the Latin "ferrium."

SYMBOL

ATOMIC MASS

Atomic mass is the mass of the _____ and the _____ in an atom. Every proton and neutron has a _____ of _____ AMU. Electrons do _____ count towards the _____ because they are _____. The mass can be shown with a _____ because it is an average mass of the _____ of that element.

You try:

What element's neutral atom has 17 electrons?

How many neutrons are in a lithium atom?

What do you think the cube symbol in the upper right means?

ASSIGNMENT #1: Getting to Know Subatomic Particles pg 9 + Atomic Structure Worksheet pages 10-11 *This assignment is to be completed below in the space provided.*

Getting to Know Subatomic Particles:

Use your periodic table to complete the table below:

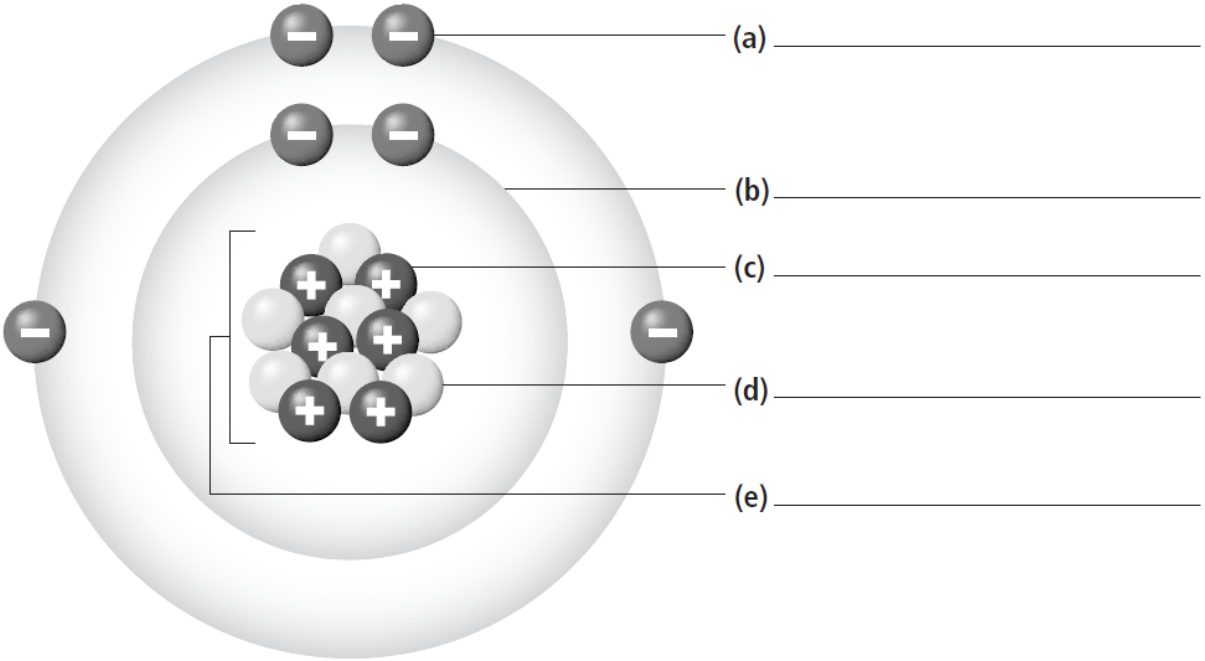
Element	Symbol	Atomic Number	# of protons	# of electrons	Atomic Mass	Rounded Atomic Mass	# of neutrons (show work)	Period
Oxygen	O	8	8	8	15.999	16	16 - 8 = **8**	2
Helium								
Carbon								
Aluminum								
Calcium								
Sodium								
Potassium								
Nitrogen								
Silicon								
Iron								
Hydrogen								
Uranium								

Homework

Atomic structure

1. Use the vocabulary terms that follow to label the parts of an atom. Place the correct term on the line next to each part of the atom. You will not need to use all the terms.

- atom
- proton
- nucleus
- neutron
- electron
- shell



2. Complete the following table describing the three subatomic particles.

	Proton	Neutron	Electron
electric charge			
location in the atom			

Homework

Complete the table below by referencing a periodic table. The first row has been completed as an example.

	Chemical Symbol	Atomic Number	Atomic Mass	Mass Number	Hyphenated Notation of Most Common Isotope	# of protons	# of electrons	# of neutrons (Show work : Mass Number - Atomic #)
Phosphorous	P	15	30.97	31	Phosphorous - 31	15	15	31 - 15 = 16
Aluminum								
Potassium								
Argon								
Lead								

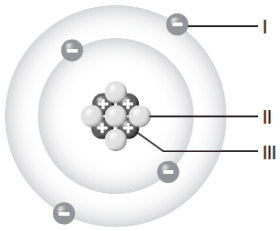
Match each item with the correct statement:

_____ 1. The smallest particle of an element that retains the properties of that element	A. PROTON
_____ 2. A positively charged subatomic particle	B. NUCLEUS
_____ 3. A negatively charged subatomic particle	C. ATOM
_____ 4. A subatomic particle with no charge	D. ELECTRON
_____ 5. The central part of an atom containing protons and neutrons	E. NEUTRON

Match each item with the correct statement:

_____ 1. Atoms with the same number of protons but different numbers of neutrons	A. ATOMIC MASS
_____ 2. Total number of protons and neutrons in the nucleus	B. MASS NUMBER
_____ 3. The weighted average of the masses of the isotopes of an element	C. ISOTOPE

Use the following diagram of an atom to answer questions 8 and 9.



8. Which of the following is the structure labelled II in the diagram?

A. atom
B. proton
C. neutron
D. electron

9. Which of the following exists in energy levels?

A. I only
B. II only
C. III only
D. II and III only

10. What is the electrical charge of the nucleus of an atom?

A. neutral charge
B. positive charge
C. negative charge
D. It depends on the element

11. The nucleus of the atom contains which of the following subatomic particles?

A. electron
B. proton and neutron
C. proton and electron
D. proton, neutron, and electron

The Periodic Table…OF ELEMENTS!

- The periodic table is made up of _____
  - An element is a _____ that _____ into anything simpler (if contains only _____ kind of atom)
- Every element has its own unique _____ and _____

Element	Symbol
Actinium	Ac
Aluminum	Al
Americium	Am
Antimony	Sb
Argon	Ar
Arsenic	As
Astatine	At
Barium	Ba
Berkelium	Bk
Beryllium	Be
Bismuth	Bi
Boron	B
Bromine	Br
Cadmium	Cd
Calcium	Ca
Californium	Cf
Carbon	C
Cerium	Ce
Cesium	Cs
Chlorine	Cl
Chromium	Cr
Cobalt	Co
Copper	Cu
Curium	Cm
Dubnium	Db
Dysprosium	Dy
Einsteinium	Es
Erbium	Er
Europium	Eu
Fermium	Fm
Fluorine	F
Francium	Fr
Gadolinium	Gd
Gallium	Ga
Germanium	Ge
Gold	Au
Hafnium	Hf
Helium	He
Holmium	Ho
Hydrogen	H
Indium	In
Iodine	I
Iridium	Ir
Iron	Fe
Krypton	Kr
Lanthanum	La
Lawrencium	Lr
Lead	Pb
Lithium	Li
Lutetium	Lu
Magnesium	Mg
Manganese	Mn
Mendelevium	Md

Element	Symbol
Mercury	Hg
Molybdenum	Mo
Neodymium	Nd
Neon	Ne
Neptunium	Np
Nickel	Ni
Niobium	Nb
Nitrogen	N
Nobelium	No
Osmium	Os
Oxygen	O
Palladium	Pd
Phosphorus	P
Platinum	Pt
Plutonium	Pu
Polonium	Po
Potassium	K
Praseodymium	Pr
Promethium	Pm
Protactinium	Pa
Radium	Ra
Radon	Rn
Rhenium	Re
Rhodium	Rh
Rubidium	Rb
Ruthenium	Ru
Rutherfordium	Rf
Samarium	Sm
Scandium	Sc
Selenium	Se
Silicon	Si
Silver	Ag
Sodium	Na
Strontium	Sr
Sulphur	S
Tantalum	Ta
Technetium	Tc
Tellurium	Te
Terbium	Tb
Thallium	Tl
Thorium	Th
Thulium	Tm
Tin	Sn
Titanium	Ti
Tungsten	W
Uranium	U
Vanadium	V
Xenon	Xe
Ytterbium	Yb
Yttrium	Y
Zinc	Zn
Zirconium	Zr

Examine the list of elements to the left. Note the different ways in which they were named. Add three examples to each of the following:

A. The symbol of some elements is just the first letter (*always capitalized*).

B. When the first letter had already been used, the first and second letter was used (*second letter always lowercase).*

C. When the first and second letters had been used, the first and the third were used (*third letter always lowercase).*.

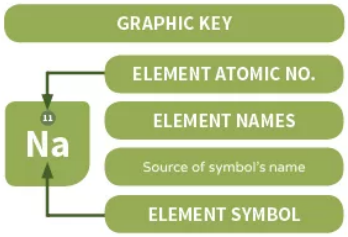
D. Some elements were named before English became the language of science, so their symbols derive from their Latin names.

Can you find an element name that is related to a country/continent?

How about an element name related to a famous scientist?

CONFUSING ELEMENT SYMBOLS EXPLAINED

Most of the chemical symbols for elements in the periodic table make perfect sense; there are a small selection, however, that seem to bear no relation to their element's name. Here's a look at these rogue symbols, along with explanations of the reasons behind them.



Na — 11 — SODIUM – NATRIUM — Arabic – *natrun*

Sodium's Latin name, 'natrium', derives from the Greek 'nítron' (a name for sodium carbonate). Its original source is likely to be the Arabic work 'natrun'. A number of modern languages still call the element natrium instead of sodium.

K — 19 — POTASSIUM – KALIUM — Arabic – *al qalÿ*

'Kalium' is potassium's Latin name, and derives from the Arabic 'al qalÿ', meaning "calcined ashes" (the ashes left over when plant material is burned). As with sodium, a number of modern languages still refer to potassium as kalium.

Fe — 26 — IRON – FERRUM — Latin – *ferrum*

Iron's Latin name, 'ferrum', simply means 'iron' or 'sword', and is possibly of Semitic origin. The element is known by a myriad of various names in different languages, with some sources suggesting there are over 200 different names for it.

Cu — 29 — COPPER – CUPRUM — Greek – *kypros*

Copper's Latin name was 'cyprium', which itself comes from 'kypros', which is the Greek name for Cyprus. The island of Cyprus was famous centuries ago for its copper reserves. The name was eventually simplified to 'cuprum'.

Ag — 47 — SILVER – ARGENTUM — Latin – *argentum*

The Latin name for silver, 'argentum', is thought to derive originally from Indo-European, likely referring to the metal's shininess. The country Argentina is named after silver, and is the only country to be named after a chemical element.

Sn — 50 — TIN – STANNUM — Latin – *stannum/stagnum*

Tin's Latin name, 'stannum', may be derived from the Indo-European 'stag' (dripping) because tin melts at a low temperature. There's also speculation it could be derived from the Cornish 'stean' due to Cornwall's famous tin mines.

Sb — 51 — ANTIMONY – STIBIUM — Greek – *stíbi*

The Latin 'stibium' derives from the Greek word 'stíbi', meaning eye paint, referring to antimony's use as an ancient eye cosmetic. This is in turn likely derived from Arabic or Egyptian. Few countries refer to antimony as stibium today.

W — 74 — TUNGSTEN – WOLFRAM — German – *wolf rahm*

Wolfram was named after the mineral it was found in, wolframite. This is from the German 'wolf rahm', or 'wolf's foam', referring to the amount of tin 'eaten' by the metal during its extraction. Wolfram is still used in several languages.

Au — 79 — GOLD – AURUM — Latin – *aurum*

The Latin name for gold was 'aurum', meaning 'yellow', derived from the word 'aurora' ('dawn'). The name 'gold', used in Germanic languages, means 'yellow, shining metal'; many other European languages use derivatives of aurum.

Hg — 80 — MERCURY – HYDRARGYRUM — Greek – *hydrargyros*

Mercury's original Latin name was actually 'argentum vivum' (living silver), but Latin later borrowed from the Greek 'hydrargyros' (liquid silver) to give 'hydrargyrum'. The original English name for the element was 'quicksilver'.

Pb — 82 — LEAD – PLUMBUM — Latin – *plumbum*

Lead's Latin name, 'plumbum', likely originally derives from a language pre-dating Ancient Greek. This Latin name is also the source of the English words 'plumbing' and 'plumber', due to the historic use of lead in water pipes.

On Earth about _____ elements occur naturally (ex. _____). There are many elements that do not occur naturally but are synthesized (_____) in _____.

As you've seen each element has a unique _____ and _____. The symbol is usually _____ or _____ letters. The first letter is always _____ and the remaining letters if there are any are _____. The names and symbols of the elements are accepted and used by scientists all _____. Many element names come from Latin words, others are named for countries or to honour scientists of note.

About _____ of the elements found in the periodic table are metals.

Metals **Non-Metals**

Write the symbol for the following elements.

Oxygen	Hydrogen	Chlorine	Potassium
Phosphorus	Iodine	Magnesium	Nitrogen
Fluorine	Manganese	Iron	Carbon
Copper	Calcium	Zinc	Cobalt
Sodium	Molybdenum	Sulphur	Mercury

Write the name of the following elements.

As	Rn	Pb	Al
Cu	K	Ba	Ag
He	Pu	Ne	Sr
Si	Am	U	Au
Sn	Ra	Pt	Ge

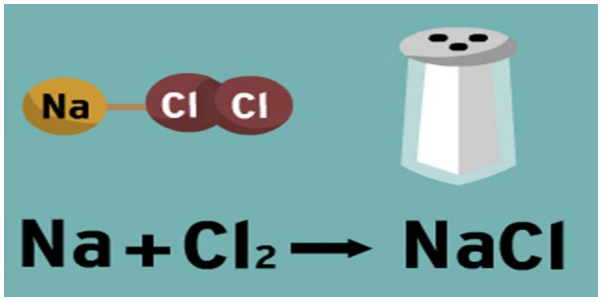
THINKING AHEAD ABOUT COMPOUNDS & CHEMICAL FORMULAE

As you know a compound is a p_____ s_____ that is made up of _____ or more ***different types*** of atoms.

These different types of atoms come from different types of e_____.

Elements combine to form _____,

something that we will look at later in this course.



ASSIGNMENT #2: Chemical Formula Practice page 15

This assignment is to be completed below in the space provided.

1. For each of the following molecules, identify the kind of atoms and the number of each.
   The first one is done for you.

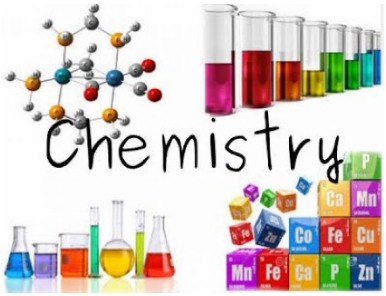
Chemical Formula	Kinds and Number of Atoms in Each Molecule
$CaCO_3$	1 atom calcium, 1 atom carbon, 3 atoms oxygen
AgBr	
PbS_2	
$MgCl_2$	
Al_2O_3	
$PbCl_4$	
Fe_2O_3	
AlP	
NH_4OH	
$NaHSO_4$	
$PbSO_3$	

2. Each particle of the following contains the atoms listed. Write the formula of each compound.
   The first one is done for you.

1. One copper atom and one sulphur atom — CuS
2. One nitrogen and three hydrogen atoms — _____
3. Two hydrogen and one sulphur atom — _____
4. One hydrogen, one nitrogen and three oxygen atoms — _____
5. Two potassium, one carbon and three oxygen atoms — _____
6. Two aluminium and three oxygen atoms — _____
7. One iron, one phosphorus and four oxygen atoms — _____
8. One nitrogen, four hydrogen, one carbon and three oxygen atoms — _____
9. One potassium, one chlorine and three oxygen atoms — _____
10. Six carbons, twelve hydrogen and 6 oxygen atoms — _____
11. One carbon, three hydrogen, one oxygen and one hydrogen — _____

ACTIVITY:
Elements and the Periodic Table

Activity 1: Comparing Properties of Elements



An **element** is a substance that cannot be broken down into simpler substances by heating it or causing it to react with other chemicals. The smallest unit of an element is a tiny particle called an **atom**. Each different element has a unique atom. Everything around you is made from incredibly small atoms of one or more of these elements.

A pure sample of an element contains many atoms of the same type. For example, the millions of iron atoms that make up a piece of iron metal are of the same type and have the characteristics of iron. Iron atoms, however, are very different from atoms of other elements, such as gold or oxygen. All elements have unique properties. It is atoms of an element that determine its properties.

Most elements are rarely found in pure form. Atoms of different elements tend to combine chemically, or react, with each other. Scientists say these elements are reactive. When elements react, they can form substances called compounds. One familiar compound is water, a combination of two hydrogen atoms and one oxygen atom.

Challenge: How can elements be grouped based on their physical and chemical properties and how are they related to compounds?

Materials: Element Cards, Element Family Cards

Part A: Classifying Elements

1. With your partners, spread the Element Cards out on a table. Each card provides information about an element. Two categories might be unfamiliar, reactivity (how likely the element is to react chemically with other elements) and number of bonds to hydrogen (the number of hydrogen atoms that usually combine chemically with this element).

2. Examine the information on each card carefully, noting similarities and differences among elements.

3. Working together, sort the elements into at least three groups. Each group of elements should have at least two similar properties.

4. List the groups you have made and the common features of each group. Be sure to record all of the elements in each group.

Group	Elements in Group	Common Features of the Group
1		
2		
3		
4 (if needed)		

Part B: Comparing Classification Systems

5. Your group will receive four Element Family Cards. Each card describes a group of elements called a family. Based on the information on the Family Cards, place each element under a Family Card.

6. Arrange the elements in each family in order from lowest atomic mass at the top to highest atomic mass at the bottom. Place the column on a half sheet of coloured paper.

7. Line up the four columns of elements to form a table, so that the elements are in columns and rows. Use the atomic masses of the elements to decide on an order for the columns.

8. Record your new classification system, complete with:

- Family names
- Similar properties within each family
- Elements in each family in order of increasing atomic mass

Family Name								
Similar Properties								
Elements + atomic mass	**Element**	**Mass**	**Element**	**Mass**	**Element**	**Mass**	**Element**	**Mass**

Analysis:

1. Which of the properties listed on the Element Cards are:

    a. Physical properties?

    b. Chemical properties?

2. How did your first classification system compare to the second classification with the Element Family Cards?

3. In what ways could grouping elements help scientists understand their properties?

4. Use the table of elements you constructed in step 8 above to find the family or families of elements that are:

    a. Not usually reactive:

    b. Highly reactive:

    c. All metals:

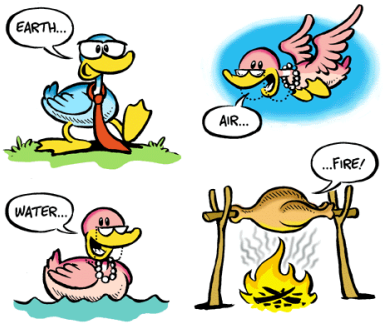
    d. All solids:

    e. All gases:

5. The element strontium (Sr) has properties that make it belong in the Alkaline Earth Metals family, directly below calcium (Ca) on your table of elements. Design an Element Card for strontium that shows its symbol, name and the properties you predict it will have:

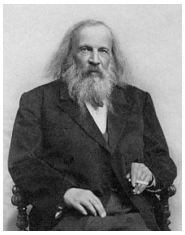
PART C: THE PERIODIC TABLE

History of Atomic Theory



- The ancient Greeks believed that there were four types of matter: _____.
- Democritus (400BC) proposed the idea of _____ and that they are _____. Science though, _____ this idea and it took hundreds of years to pass before Democritus' idea was accepted.
- Skipping ahead to the _____, scientists had identified _____, but there was no way of _____ them.
    - Some tried to classify them based on _____ or by how they _____ with other elements.
    - None of these worked for _____

The Periodic Table of Elements



- In 1867, Dmitri Mendeleev wrote down the characteristics of all the known elements on cards and arranged them into a pattern that made sense.
    - When elements were listed by _____ he noticed that certain _____ seemed to repeat with a regular pattern.
    - He put them in _____, and when properties repeated he started a _____

The Early Periodic Table

- Horizontal rows (_____) has masses increasing left to right
- Vertical columns (_____) have common properties
- Gaps were left when properties did not match properties _____
- Elements were predicted to fill _____

The Current Periodic Table

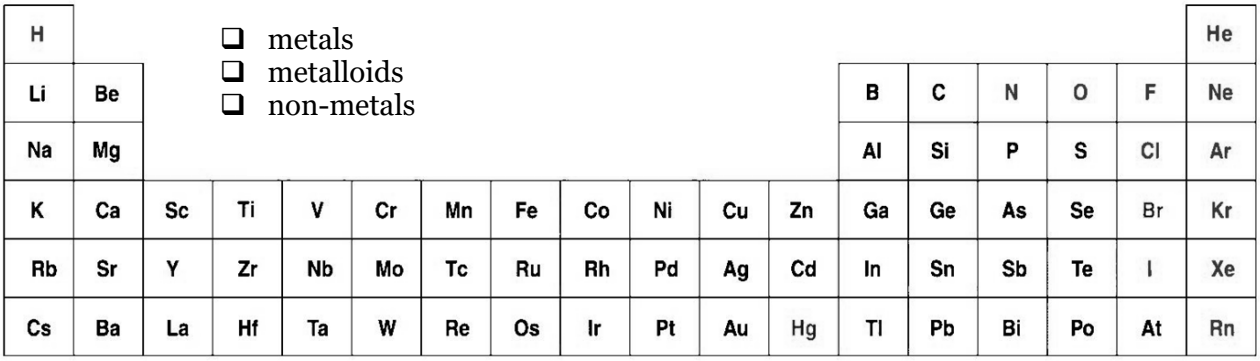
- Mendeleev's table had _____
  - His _____ evolved through the work of others
- Now, elements are ordered by _____, not _____
- The table in use today reached its current form in the _____

Properties of Elements

- All elements are different from each other, and have _____
  - These _____ can be used in identifying different elements
- Elements with similar properties are often _____
- One common grouping is _____

Metals, Non-Metals and Metalloids

- Metals are found on the left of the periodic table (except _____), non-metals on the right, and _____ in between. The _____ divides them.



Metals: :

- _____, shiny, ductile, malleable, magnetic, and good conductors of both _____
- Most are _____ at room temperature (exception: _____)

Metalloids:

- can be shiny or dull, often conduct electricity poorly, but do not conduct _____
- most are solids at _____ temperature

Non-Metals:

- Dull, not ductile, _____, non-magnetic, and _____ conductors of heat and electricity
- Some are solids, some are liquids and some are gases at _____ temperature

Homework

ASSIGNMENT #3: Getting to know The Periodic Table

This assignment is to be completed below in the space provided.

You will need to research the names and locations of these periodic table groups/families

You will also learn where the metals, non-metals and metalloids are on your periodic table.

Be sure to use ARROWS to show the direction of Groups & Periods!

*You **DO NOT** have to write in elements symbols or atomic numbers.*

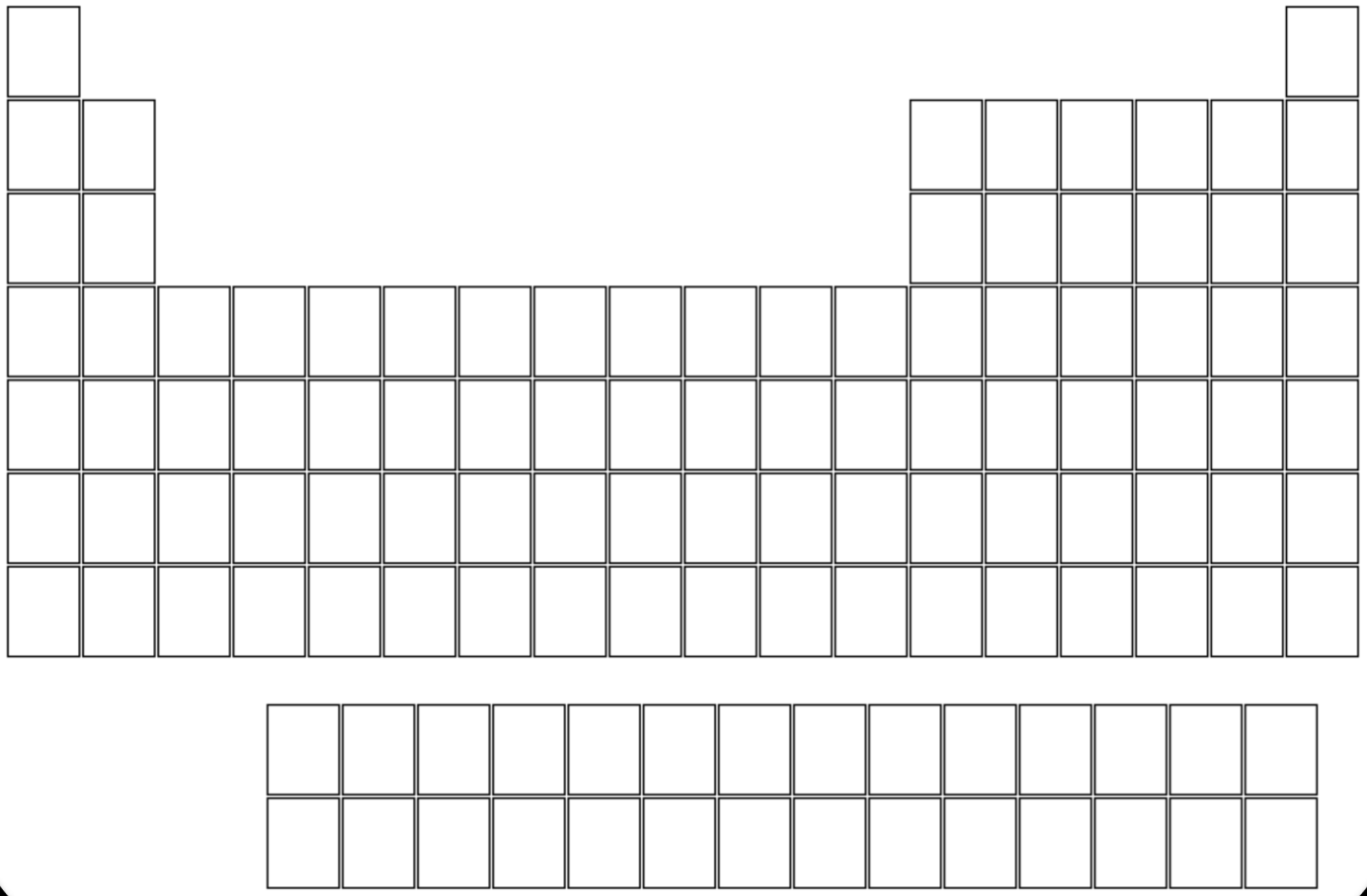
LABEL THE PERIODIC TABLE

CurlyQueScience, 2015

Identify the different parts of the Periodic Table:

- Alkali Metals: Red
- Alkali Earth Metals: Orange
- Transition Metals: Yellow
- Metalloids: Green
- Halogens: Blue
- Actinides/Lathanides: Purple
- Metals: Stripe
- Metalloids: Outline Black
- Non-Metals: Checkerbox
- Arrow showing direction of the Periods
- Arrow showing direction of Groups
- Number the Groups
- Number the Periods

PERIODIC TABLE OF ELEMENTS



Fill in the following table.

Property	Metals	Non-Metals	Metalloids
Colour/Lustre			
Ductile			
Malleable			
Magnetic			
Conductor			

Other Important Groups to Know

- You should be able to _____ these groups on the periodic table, and know their properties.

Group 1 (without H) – Alkali Metals

- Highly reactive _____(reactivity increases with _____, so as you move _____ the group they become more reactive)
- Burn spontaneously in oxygen and in _____
- _____ solids at room temperature
- _____ is part of many batteries, _____ is part of fertilizers

Group 2 – Alkaline Earth Metals

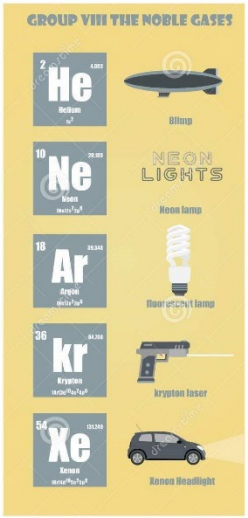
- _____ metals that will burn in oxygen and water if _____
- Solids at _____ temperature

Group 17 – Halogens

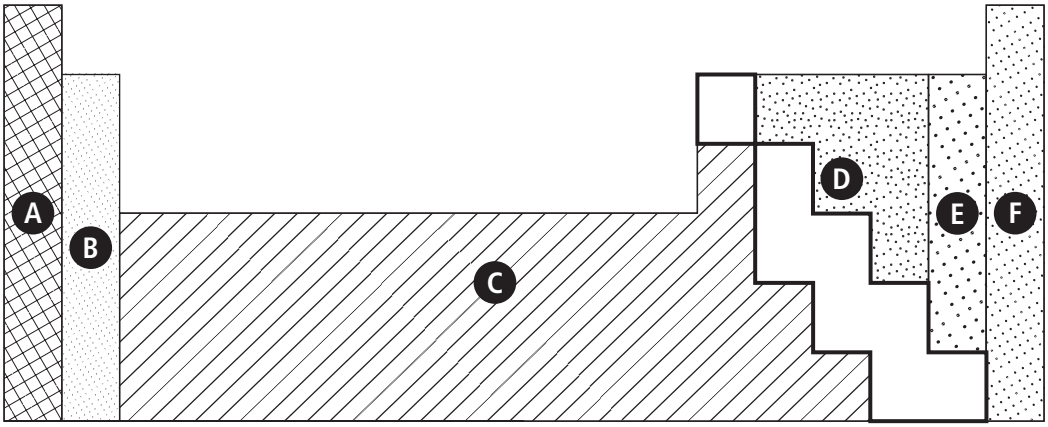
- All are highly _____ non-metals
- Fluorine and chlorine are _____, bromine is a liquid, and iodine is a _____ at room temperature
- Widely used in _____ (water, household, medical) and bleaching (clothes, paper)

Family 18 – Noble Gases

- Are the most stable and _____ elements in the table
- All are colourless _____ at room temperature
- They are used inside lights to produce different _____ (e.g. neon signs)



PRACTICE Families of elements



Use the simplified periodic table shown above to answer questions 1 to 12. To which region does each element or family belong? Place the letter corresponding to the shaded region on the blank line. You can use regions more than once.

You can use the periodic table on page 201 to help you answer these questions.

1. helium _____

2. lithium _____

3. fluorine _____

4. beryllium _____

5. halogens _____

6. noble gases _____

7. alkali metals _____

8. alkaline earth metals _____

9. non-metallic elements that are strongly reactive _____

10. metallic elements that are strongly reactive _____

11. metallic elements that are reactive _____

12. non-metallic elements that are very unreactive _____

ASSIGNMENT #4: Periodic Table Review pg 26-29
This assignment is to be completed below in the space provided.

1. The left-hand column in the chart below contains statements about various elements. Write the name and symbol for the element each statement refers to.

Description of Element	Name of Element	Symbol
It is the only gas in group 1.		
This inert gas is in period 3.		
There is no heavier member of group 2.		
This element is the lightest of the halogens.		
Group 16 contains this reactive non-metal gas.		
The atomic mass of this metal is about 56.		
Period 6 contains this group 2 metal.		
This is the only liquid halogen.		
This metallic element is liquid at room temperature.		
Photosynthesis produces this element.		
This is the lightest element in period 2.		

2. For each group, decide **which element does not belong** with the rest. Explain why.
   a. Si Ge Sn P _____
   b. Ti S Pt Fr _____
   c. N C Sn Xe _____
   d. Sr F Cd I _____

3. Which one of the elements **does not** have the properties held by the rest of the group?
   a. Cs Ba K Na _____
   b. Ca Cd Hg Zn _____

Review Questions.

1. What is a family? _____
2. What is a period? _____
3. What is the **symbol** for the following elements?
    a. Magnesium _____
    b. Potassium _____
    c. Iron _____
    d. Copper _____
4. What are the **names** of the following elements?
    a. C _____
    b. Cl _____
    c. Au _____
    d. Sr _____
5. In what **period** are the following elements found?
    a. He _____
    b. Ge _____
    c. Rb _____
    d. I _____
6. In what **group** (family name) are the following elements found?
    a. Sulfur _____
    b. Ca _____
    c. Iodine _____
    d. Fe _____
7. List two atoms from each of the following groups:
    a. Halogen _____
    b. Noble Gas _____
    c. Alkali metal _____
    d. Alkaline Earth Metal _____
8. What is the symbol for silver? _____
9. Ni is the symbol for what element? _____
10. State the period number(s) that contain only eight elements: _____

Using the periodic table

Vocabulary	
average atomic mass	metalloids
atomic number	multiple ion charge
electrons	noble gases
families	non-metals
good	periodic table
halogens	periods
ions	poor
ion charge	properties
metals	

Use the terms in the vocabulary box to fill in the blanks. You can use each term more than once. You will not need to use every term.

1. The _____ organizes the elements according to their physical and chemical _____.

2. The periodic table is divided into seven horizontal rows called _____ and 18 vertical columns called _____.

3. _____ appear on the left side of the periodic table. These elements are _____ conductors of heat and electricity.

4. _____ appear on the right side of the periodic table. These elements are _____ conductors of heat and electricity.

5. The _____ form a zigzag staircase arrangement on the periodic table. These elements have properties similar to both _____ and _____.

6. The _____ refers to the number of protons that an atom has in the nucleus.

7. The _____ is the weighted average of the masses of the atoms of an element.

8. A(n) _____ is an electric charge that forms on an atom when it gains or loses electrons.

9. Some metals, like platinum and cobalt, form _____ in more than one way. In other words, they have a(n) _____.

The periodic table and chemical properties

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.	
Term	**Descriptor**
1. _____ halogens **2.** _____ noble gases **3.** _____ alkali metals **4.** _____ alkaline earth metals	**A.** most reactive metals **B.** most reactive non-metals **C.** have properties of both metals and non-metals **D.** most unreactive elements **E.** includes beryllium and magnesium

Circle the letter of the best answer.

5. What is the name of a horizontal row in the periodic table?

A. column

B. family

C. period

D. group

6. Which of the following are metalloids?

I.	silicon
II.	boron
III.	neon

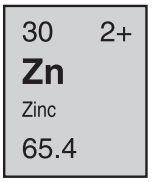
A. I and II only

B. I and III only

C. II and III only

D. I, II, and III

Use the following diagram to answer questions 7 and 8.



7. What does the "30" refer to?

A. ion charge

B. average atomic mass

C. atomic number

D. family number

8. What does the "2+" refer to?

A. ion charge

B. average atomic mass

C. atomic number

D. family number

9. To which of the following groups does oxygen belong?

A. gas

B. metal

C. metalloid

D. non-metal

10. Which of the following is the same as the atomic number of an element?

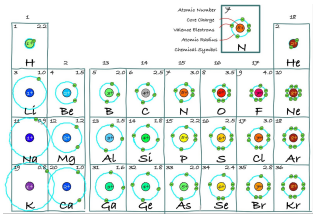
A. number of protons

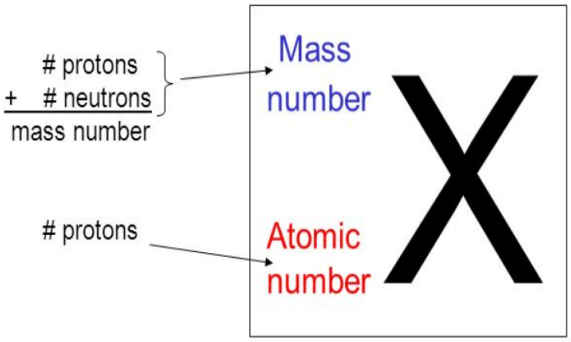
B. number of neutrons

C. number of electrons

D. number of ion charges

PART D: THE BOHR MODEL





Using Standard Atomic Notation

- On the upper left of the element symbol is the **atomic** _____*(rounded to the nearest whole number)*
- On the lower left of the element symbol is the **atomic** _____ *(number of protons).*

Ex. Consider the element gold. Its symbol is Au. Its mass number is 197 and its atomic number is 79.

Written in standard atomic notation it becomes: $^{197}_{79}Au$

Write the standard atomic notation for germanium, uranium, and colbalt.

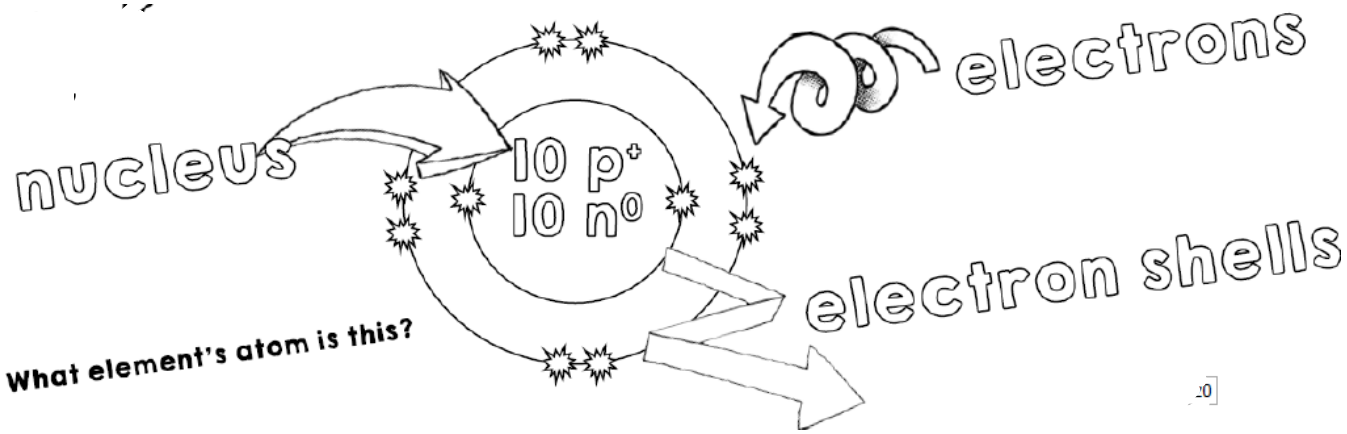
Modeling Atoms with Bohr Diagrams

- Atoms are so _____ that in order to study them, we need to create _____
- The current atomic model is known as the _____
  - Electrons are always moving in 3D space around the _____
- The model that we will learn today represent the atom at _____
  - It's a way of representing the _____ of electrons in the "cloud"
- It's important to remember that an atomic model is a _____ version of an atom, and it's completely _____ in terms of _____

Bohr Diagrams

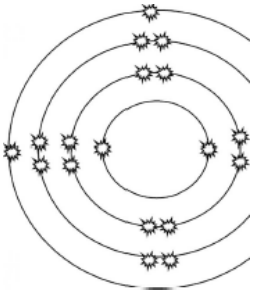
- A Bohr diagram is a diagram that shows how many _____ are in each shell surrounding the nucleus.
- Named in honour of _____, a Danish physicist who developed several models for showing the arrangement of electrons in atoms.
- There are three main background questions to explore before we start drawing Bohr diagrams.

1. _____ of a Bohr Diagram



2. How does an Electron's _____ Correspond to its _____?

- Imagine climbing a _____. As you go up each rung, you gain more and more _____
  - This is similar to the way in which electrons have _____ energy as they orbit _____ from the nucleus
- The shells of an atom are named _____, _____, _____, and _____ going from _____ to furthest from the _____



3. How do _____ Fill the _____?

NOTE: Once the atoms get larger than Calcium (#20) things start to get more complicated!

Electrons fill the ___ shell (level 1) first. The K shell is ___ when it has ___ TWO electrons.

Remaining electrons fill the ___ shell (level 2) next. The L shell is ___ when it has EIGHT ___.

Any ___ electrons fill the ___ shell (level 3) next. For the first ___ elements, the M shell is full when it has EIGHT electrons.

SHELL	LEVEL	# of electrons to be 'FULL'

2 8 8

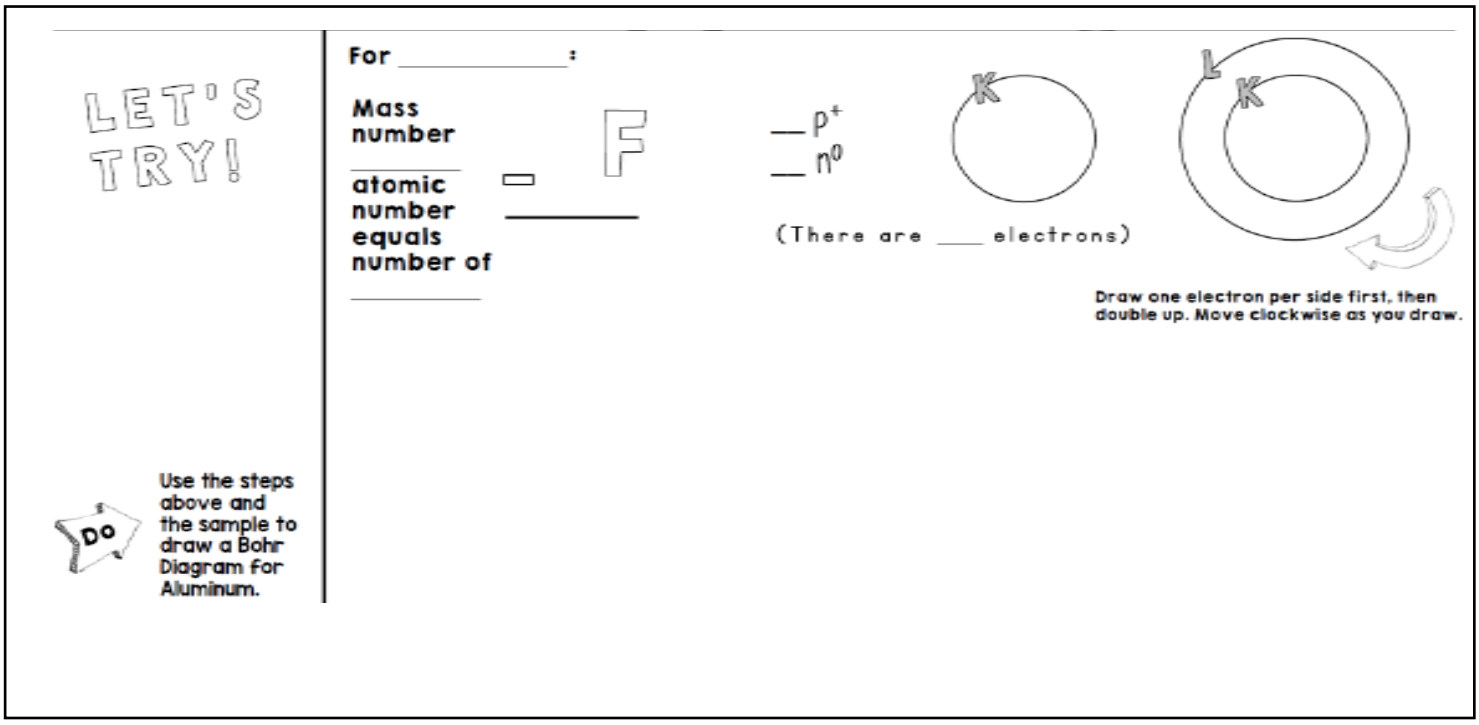
DO Fill in the table above.

(After element #20, the M and N shell can actually hold 18 and 32 electrons...but for now we won't worry about that.)

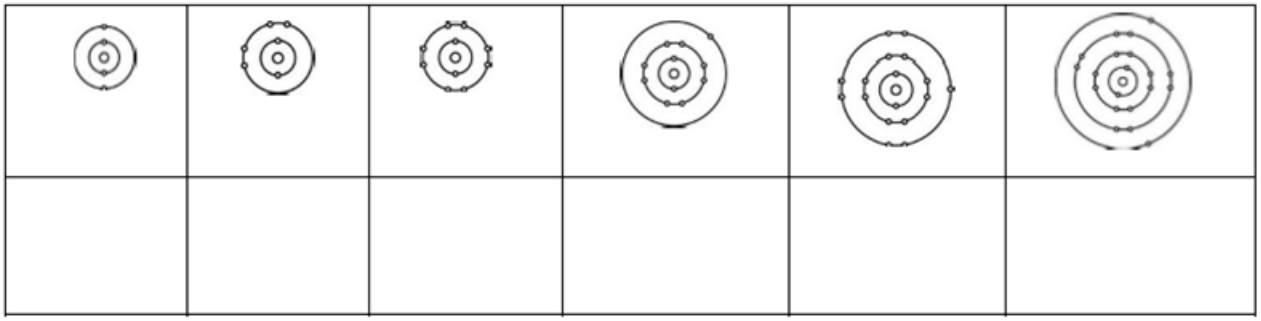
If there are _____ remaining electrons, they fill the ___ shell (level 4). The N shell is full when it has EIGHT electrons.

Drawing a Bohr Diagram

1. Write the element's _____ with the _____ at the TOP left and the _____ at the BOTTOM left
2. _____ the number of _____ in the atom. Write the number of protons (p^+) and neutrons (n^0) as the _____
3. _____: How many electrons does the _____ atom have?
4. _____ the K shell. Fill the K shell with the first _____ electrons. Make your electrons nice and _____!
5. Continue drawing each shell and _____ with electrons until you have accounted for all the atom's electrons.



In the diagram below, **identify the elements** by the Bohr model diagrams are shown. Write the symbols of the elements in the spaces provided.



PART E: VALENCE ELECTRONS

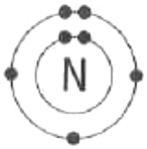
- The electrons in the _____ shell. These are the electrons that participate in chemical _____.
- ***Valence electrons*** can be shared or _____ by another atom.
- Noble gases do not react unless under _____ conditions. This is because their valence shell is _____.
- An atom that has lost valence electrons is a _____ ion.
- An atom that has gained valence electrons is a _____ ion.

For the following Bohr diagrams, answer the following questions:

Number of protons _____ Number of electron shells _____

Number of electrons _____ Number of valence electrons _____

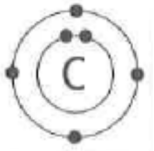
Ion or Atom _____



Number of protons _____ Number of electron shells _____

Number of electrons _____ Number of valence electrons _____

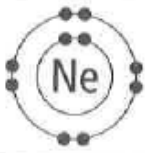
Ion or Atom _____



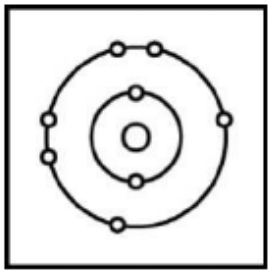
Number of protons _____ Number of electron shells _____

Number of electrons _____ Number of valence electrons _____

Ion or Atom _____



The following Bohr model diagram represents an oxygen atom.
Examine the diagram, then answer the following questions:



a) Why is this not a stable electron arrangement?

b) What would make this atom stable?

c) Use a different colored pen to adjust the diagram so that it shows a stable electron arrangement.

Bohr Model Scavenger Hunt Answer Sheet

For each problem, write the name of the Bohr model in the boxes below.
You may need to reference a periodic table to help you.

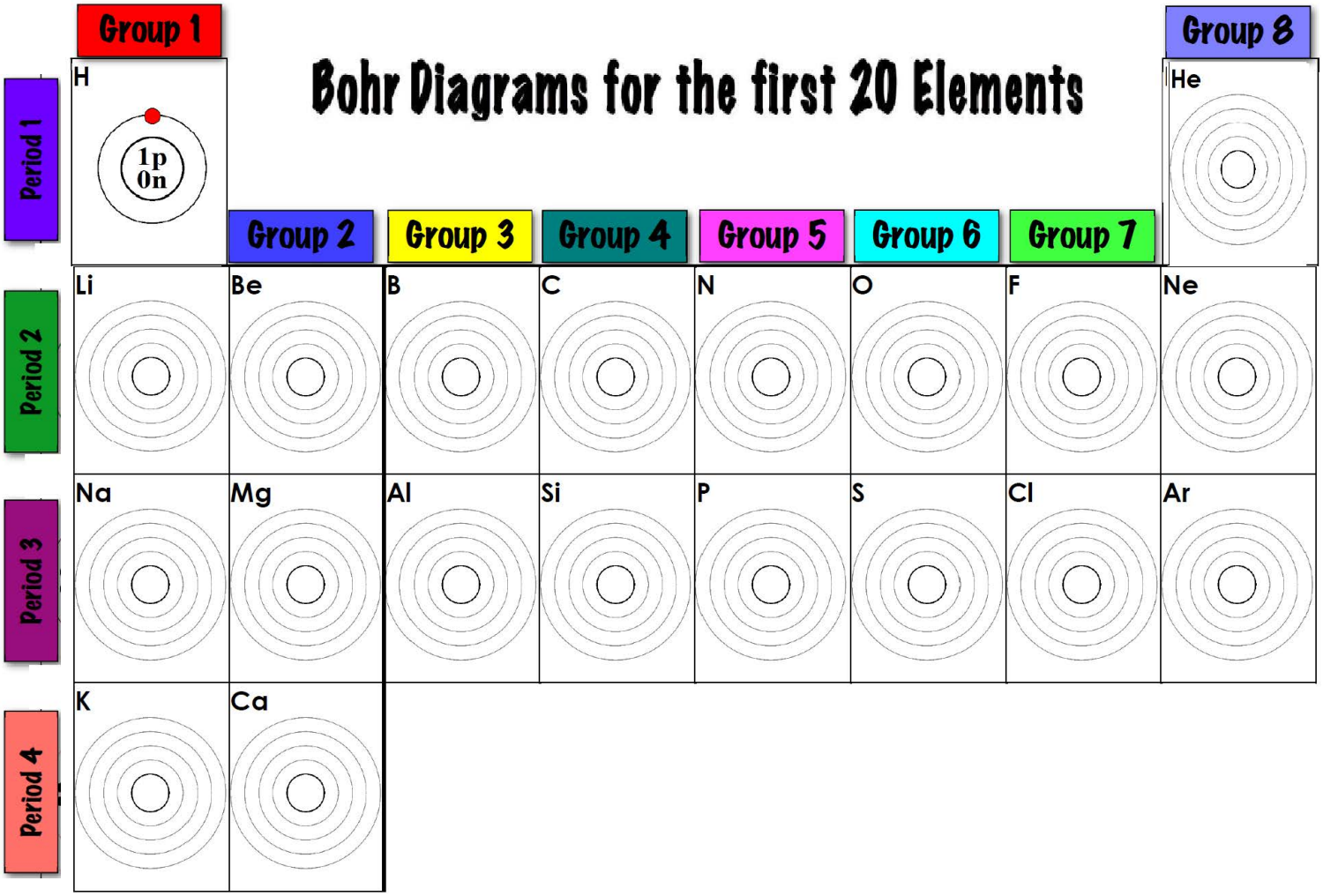
*start here!

*end here!

ASSIGNMENT #5:Bohr Model Practice, Worksheet pages 36-37
This assignment is to be completed below in the space provided.

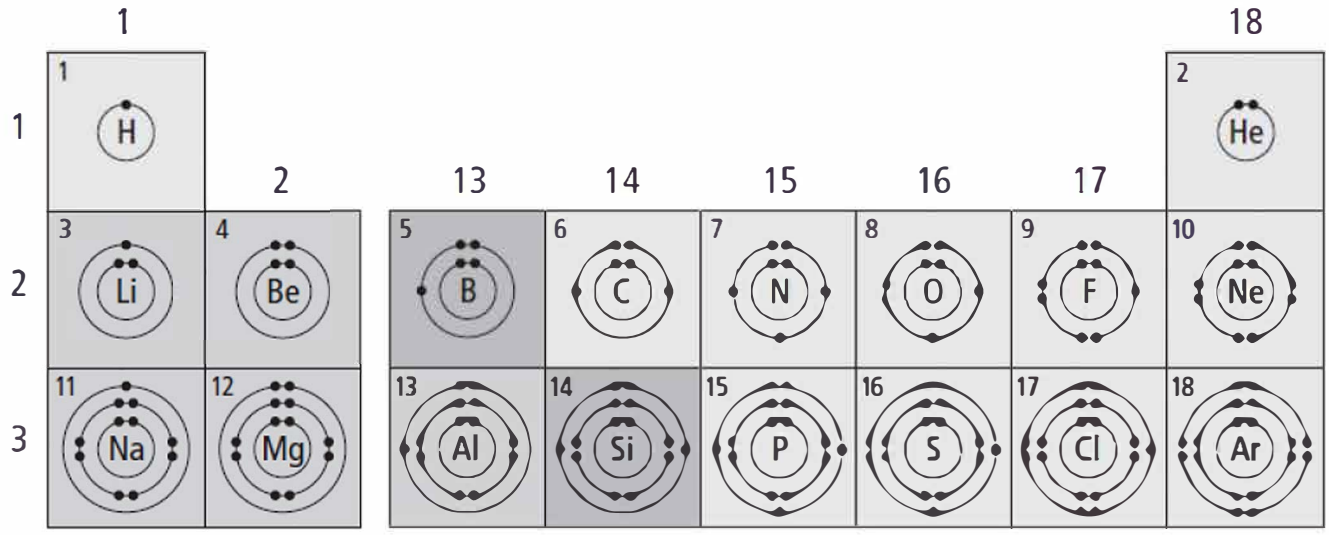
Use the innermost circle as the nucleus, and fill the electron shells with the correct number of electrons for each of the first 20 elements in the Periodic Table.

eg. Hydrogen has been completed for you as an example.



1. What is the pattern between the number of ***valence electrons*** and the group number of the periodic table?

2. What is the pattern between the number of ***electron shells*** and the period number of the periodic table?



Drawing Bohr model diagrams

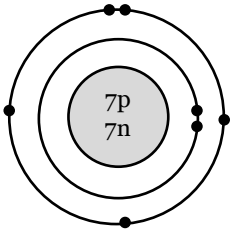
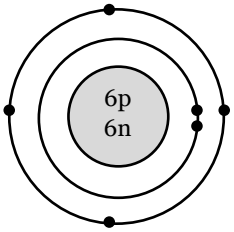
1. Refer to the Bohr model chart **ABOVE** to help you complete the following table. Some answers are provided for you. (Hint: Remember that the maximum number of electrons in the first three shells is 2, 8, and 8.)

Atom/ion	Atomic number	Number of protons	Number of electrons	Number of electron shells
neon atom	10	10	10	2
fluorine atom	9			
sodium atom				
argon atom				
chlorine atom				
potassium atom				

2. Use the table above to draw the Bohr model diagram for the following atoms and ions.

Argon atom	Chlorine atom	Potassium atom

Use your periodic table to answer the following.

	a. number of protons _____
	b. number of electron shells _____
	c. number of electrons _____
	d. number of electrons in outer shell _____
	e. element _____
	a. number of protons _____
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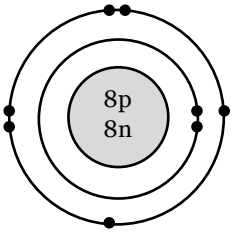
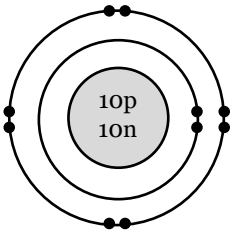
	a. number of protons _____
	b. number of electron shells _____
	c. number of electrons _____
	d. number of electrons in outer shell _____
	e. element _____
	a. number of protons _____
	b. number of electron shells _____
	c. number of electrons _____
	d. number of electrons in outer shell _____
	e. element _____

These four elements are all in the same horizontal row (period) of the periodic table. What is the ***same*** about electron shells for elements in the same period?

_____

_____

_____

What is ***different*** about the electrons in the outer shell for elements in the same period?

_____

_____

_____

PART F: PERIODIC TABLE TRENDS

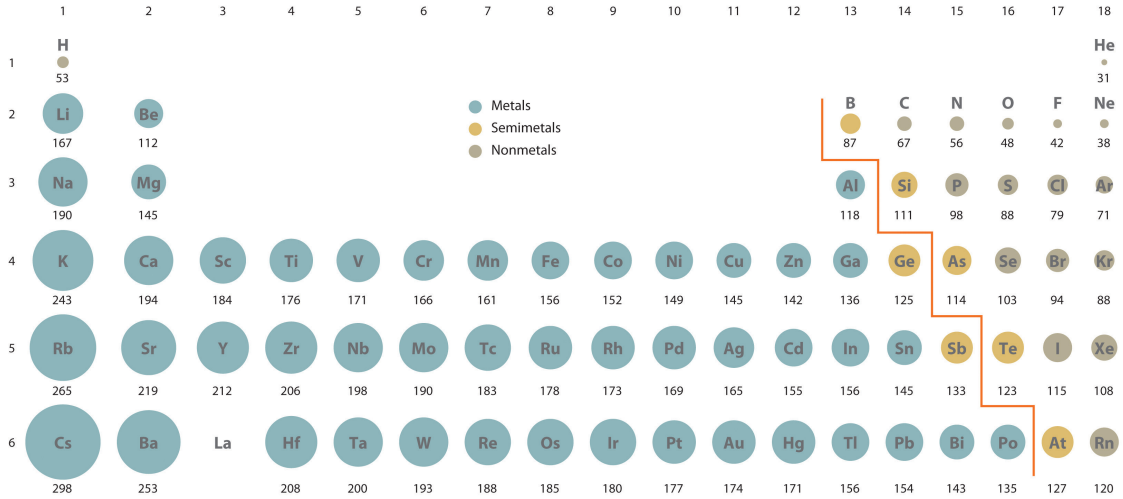
In chemistry the term _____ refers to a regular pattern in the properties of elements based on their atomic structure.

This is the pattern that Mendeleev predicted. When the pattern repeated, he began a new_____.

The periodic table is a powerful tool for analyzing trends in _____ and _____.

ATOMIC SIZE TRENDS:

Observe the sizes of the atoms in each group and period shown in the diagram below.
Do you see a pattern?



1. Atomic size _____ moving DOWN a group/column.
    - as you move ***down*** a _____, elements have atoms with _____ energy _____.
    - the _____ the number of electron shells, the _____ away from the nucleus the ***valence electrons*** are
    - if the electrons are farther away, the atom is _____.

2. Atomic size _____ moving LEFT to RIGHT across a period/row.
    - elements have _____ numbers of electrons in their _____ shells as you move LEFT to RIGHT.
    - as the number of electrons increases, so does the number of _____ in the nucleus.
    - the attraction between the n_____ valence electrons and the p_____ nucleus is ***very strong.***
    - with each electron added, the outer shell is pulled _____ to the nucleus and the atomic size _____

REACTIVITY TRENDS:

Compare what happens when ***potassium (A)*** and ***sodium (B)*** are added to water:

You can see that the reaction is _____ vigorous and violent in 'A', water + potassium.

Why is this the case?

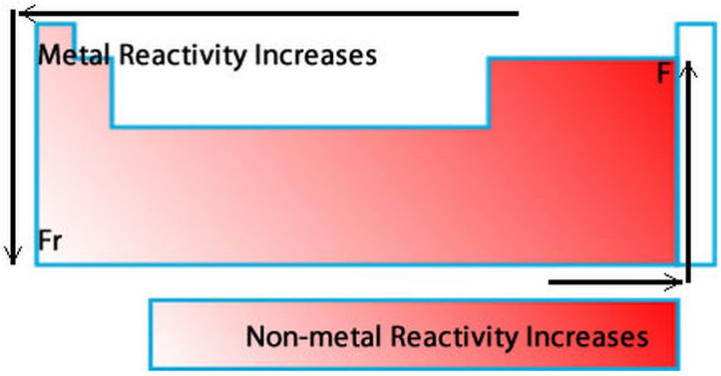
What is ***similar*** about potassium and sodium? _____

What is ***different*** about potassium and sodium? _____

- Because _____ valence electrons are farther away from the nucleus than the electrons in a _____ atom, the attraction to the nucleus is _____.
- Electrons further from the nucleus require _____ energy *(are easier)* to remove.
- The adding and removing of electrons is what is involved in c_____ r_____.
- This is why we would say that _____ is ***more reactive*** than _____.

This pattern repeats throughout the periodic table with the ***exception of the noble gases.***

- the noble gases have a FULL valence shell, they are stable and _____



PRACTICE

1. Explain why atoms get larger down a group on the periodic table:

2. Explain why atoms get smaller from LEFT to RIGHT across a periodic table:

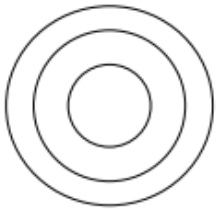
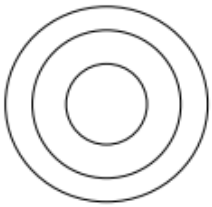
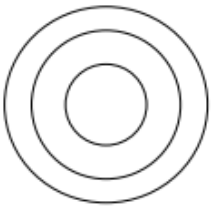
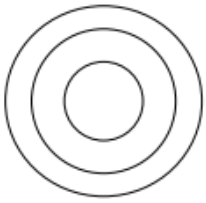
3. Why is an alkali metal MORE reactive than an alkaline-earth metal in the same period?

ASSIGNMENT #6 :Bohr Model Review Worksheet pg 40
This assignment is to be completed below in the space provided.

Bohr Model Review Worksheet

Use the description sheet and the periodic table to help you complete the following Bohr models.

1. How many electrons can each shell hold?
   a. 1^{st} = _____
   b. 2^{nd} = _____
   c. 3^{rd} = _____

Element	Atomic #	Atomic Mass	Protons	Neutrons	Electrons	Bohr Model
Carbon	6		6	6		
Hydrogen	1	1				
Lithium	3		3		3	
Magnesium	12	24				
Boron	5	11