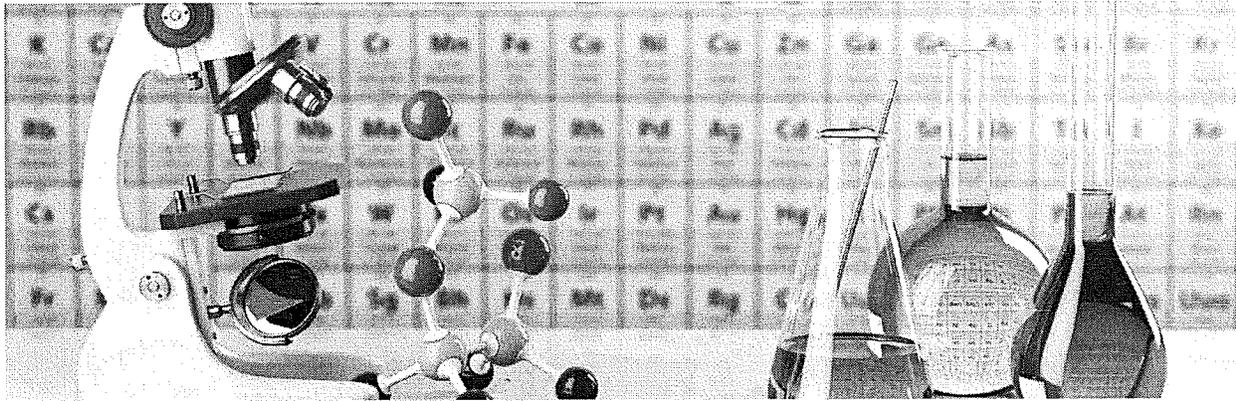


Name: _____

Chemistry



ALPHABETICAL LISTING OF THE ELEMENTS

Element	Symbol	Atomic Number	Element	Symbol	Atomic Number
Actinium	Ac	89	Mendelevium	Md	101
Aluminium	Al	13	Mercury	Hg	80
Americium	Am	95	Molybdenum	Mo	42
Antimony	Sb	51	Neodymium	Nd	60
Argon	Ar	18	Neon	Ne	10
Arsenic	As	33	Neptunium	Np	93
Astatine	At	85	Nickel	Ni	28
Barium	Ba	56	Niobium	Nb	41
Berkelium	Bk	97	Nitrogen	N	7
Beryllium	Be	4	Nobelium	No	102
Bismuth	Bi	83	Osmium	Os	76
Bohrium	Bh	107	Oxygen	O	8
Boron	B	5	Palladium	Pd	46
Bromine	Br	35	Phosphorus	P	15
Cadmium	Cd	48	Platinum	Pt	78
Calcium	Ca	20	Plutonium	Pu	94
Californium	Cf	98	Polonium	Po	84
Carbon	C	6	Potassium	K	19
Cerium	Ce	58	Praseodymium	Pr	59
Cesium	Cs	55	Promethium	Pm	61
Chlorine	Cl	17	Protactinium	Pa	91
Chromium	Cr	24	Radium	Ra	88
Cobalt	Co	27	Radon	Rn	86
Copper	Cu	29	Rhenium	Re	75
Curium	Cm	96	Rhodium	Rh	45
Darmstadtium	Ds	110	Roentgenium	Rg	111
Dubnium	Db	105	Rubidium	Rb	37
Dysprosium	Dy	66	Ruthenium	Ru	44
Einsteinium	Es	99	Rutherfordium	Rf	104
Erbium	Er	68	Samarium	Sm	62
Europium	Eu	63	Scandium	Sc	21
Fermium	Fm	100	Seaborgium	Sg	106
Fluorine	F	9	Selenium	Se	34
Francium	Fr	87	Silicon	Si	14
Gadolinium	Gd	64	Silver	Ag	47
Gallium	Ga	31	Sodium	Na	11
Germanium	Ge	32	Strontium	Sr	38
Gold	Au	79	Sulfur	S	16
Hafnium	Hf	72	Tantalum	Ta	73
Hassium	Hs	108	Technetium	Tc	43
Helium	He	2	Tellurium	Te	52
Holmium	Ho	67	Terbium	Tb	65
Hydrogen	H	1	Thallium	Tl	81
Indium	In	49	Thorium	Th	90
Iodine	I	53	Thulium	Tm	69
Iridium	Ir	77	Tin	Sn	50
Iron	Fe	26	Titanium	Ti	22
Krypton	Kr	36	Tungsten	W	74
Lanthanum	La	57	Uranium	U	92
Lawrencium	Lr	103	Vanadium	V	23
Lead	Pb	82	Xenon	Xe	54
Lithium	Li	3	Ytterbium	Yb	70
Lutetium	Lu	71	Yttrium	Y	39
Magnesium	Mg	12	Zinc	Zn	30
Manganese	Mn	25	Zirconium	Zr	40
Meitnerium	Mt	109			

NAMES, FORMULAE AND CHARGES OF SOME POLYATOMIC IONS

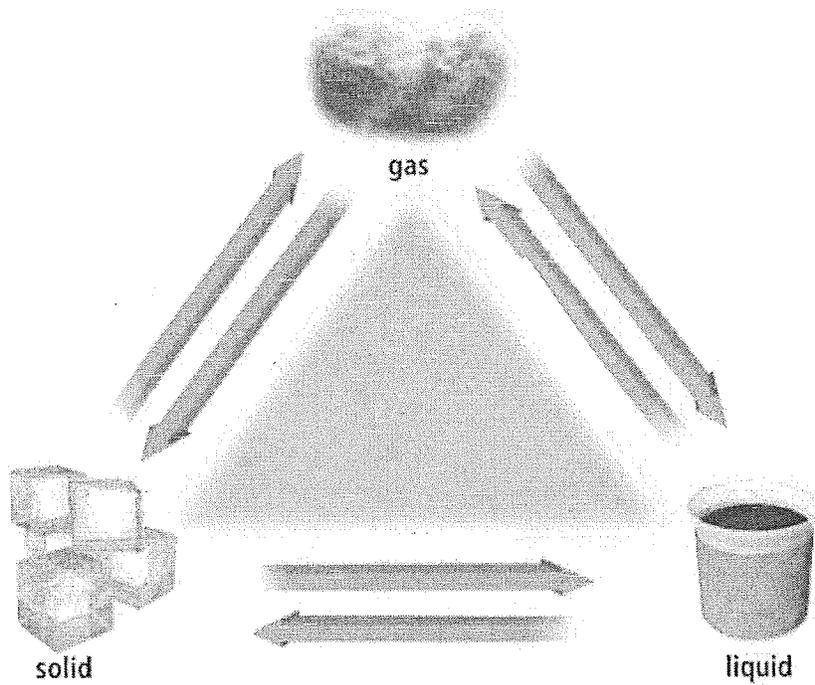
Positive Ions	Negative Ions
NH_4^+ Ammonium	CH_3COO^- Acetate
	CO_3^{2-} Carbonate
	ClO_3^- Chlorate
	ClO_2^- Chlorite
	CrO_4^{2-} Chromate
	CN^- Cyanide
	$\text{Cr}_2\text{O}_7^{2-}$ Dichromate
	HCO_3^- Hydrogen carbonate, bicarbonate
	HSO_4^- Hydrogen sulfate, bisulfate
	HS^- Hydrogen sulfide, bisulfide
	HSO_3^- Hydrogen sulfite, bisulfite
	OH^- Hydroxide
	ClO^- Hypochlorite
	NO_3^- Nitrate
	NO_2^- Nitrite
	ClO_4^- Perchlorate
	MnO_4^- Permanganate
	PO_4^{3-} Phosphate
	PO_3^{3-} Phosphite
	SO_4^{2-} Sulfate
	SO_3^{2-} Sulfite

NAMES AND FORMULAE OF COMMON ACIDS

Hydrochloric acid	HCl
Sulfuric acid	H_2SO_4
Nitric acid	HNO_3
Acetic acid	HCH_3COO

PREFIXES

1	mono
2	di
3	tri
4	tetra
5	penta
6	hexa
7	hepta
8	octa
9	nona
10	deca



Describing Physical Properties of Matter

Qualitative properties: properties that can be _____ but _____	Quantitative properties: properties that can be measured with _____

LAB: Oobleck

Describing and Investigating Matter

Name: _____

Date: _____ Blk: ____

PURPOSE

In this activity, you will thoroughly mix a solid and a liquid. You will handle the new material "oobleck" and make observations on the new properties of matter. Pay particular attention to the traits that indicate whether Oobleck is a solid, liquid or gas.

MATERIALS

1 50 mL beaker

10 mL graduated cylinder

20 mL **Chemical B**

1 stirring rod

10 mL of **Chemical A**

PROCEDURE

1. In the observation section of the lab write-up, record the properties of Chemical A and Chemical B
2. Place 20 mL of Chemical B in your beaker
3. Place 10 mL of Chemical A in your beaker
4. Use your stirring rod to thoroughly mix both chemicals together
5. Take the Oobleck out of the beaker, try the following and record your observations
 - Put the Oobleck on the table and hit it fast and hard
 - Put the Oobleck on the counter and gently place your hand on it
 - Roll the Oobleck into a ball and then gently let go of the ball
 - Put the Oobleck on the table and gently push your fingers into it
 - Put the Oobleck on the table and give it a sudden hard push with your fingers
 - Try a few things on your own ***Practice common sense here!!!

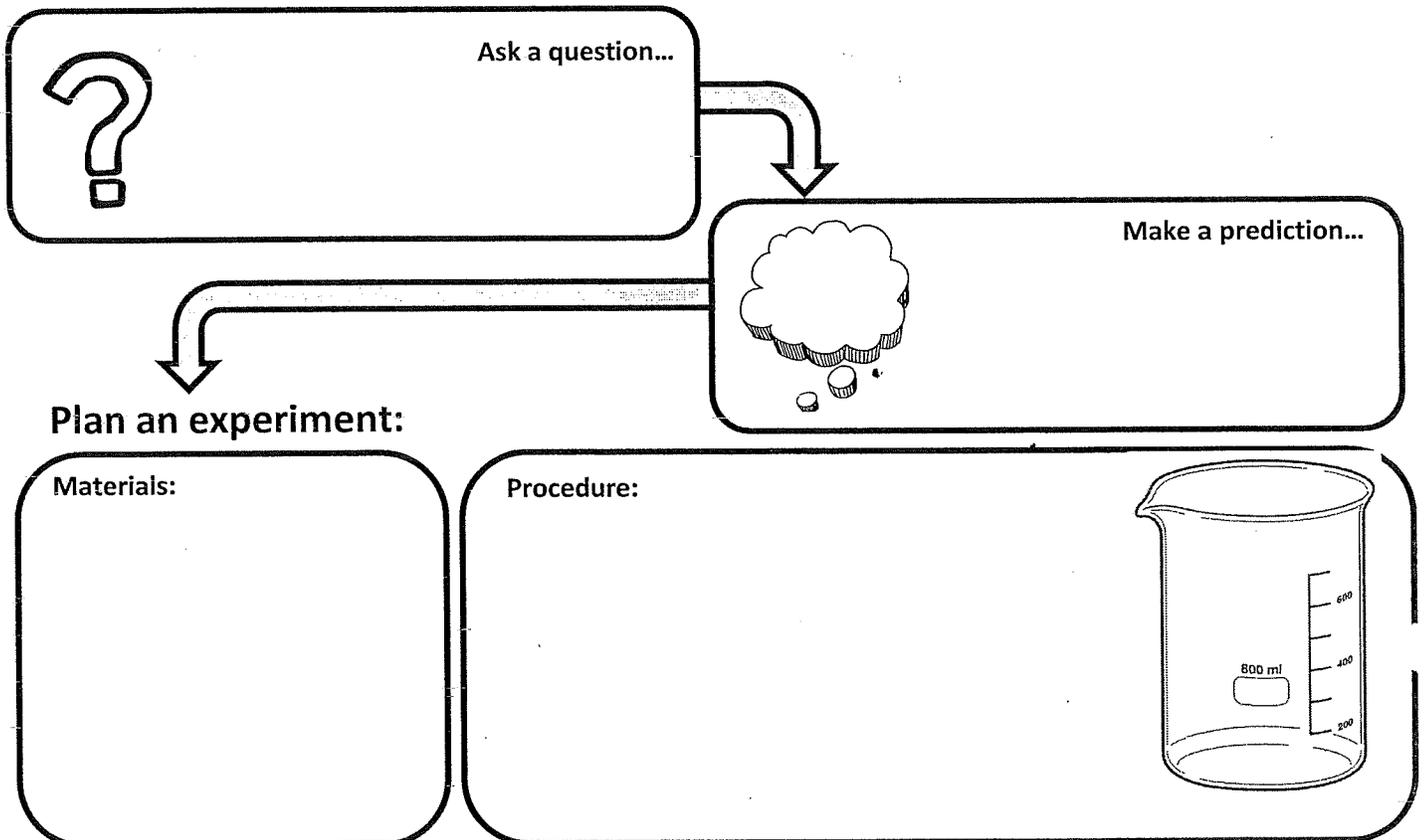
	Chemical A	Chemical B	Oobleck
Observations:			

Many of your observations above are likely qualitative properties. If given more time and resources, what quantitative properties could you investigate?

DISCUSSION QUESTIONS – answer in complete sentences.

1. Is Oobleck a liquid or a solid? Use your observations to support your response.
2. Oobleck is a **non-Newtonian fluid**. What does that mean?
3. Quicksand also acts like a non-Newtonian fluid. Based on your observations, describe how you would move if you found yourself standing on quicksand.
4. What new questions do you have about Oobleck?

Use the graphic organizer below to plan an experiment to investigate one of your questions.



The Atom

Lesson Vocabulary:

<input type="checkbox"/> Pure substance	<input type="checkbox"/> Element	<input type="checkbox"/> Compound	<input type="checkbox"/> Electrons	<input type="checkbox"/> Nucleus	<input type="checkbox"/> Proton
<input type="checkbox"/> Neutron	Subatomic Particles				

Pure Substance
 A substance that is made of one type of matter
 Examples: _____

Elements
 Composed of only _____
 _____ and cannot be broken down or
 separated into simpler substances.
 Examples: _____

Compounds
 Composed of at least _____
 _____ combined in a
 specific way
 Examples: _____

The Atom

- The _____ particle of an element that still has the identity and _____ of the element
- Made up of **subatomic particles**

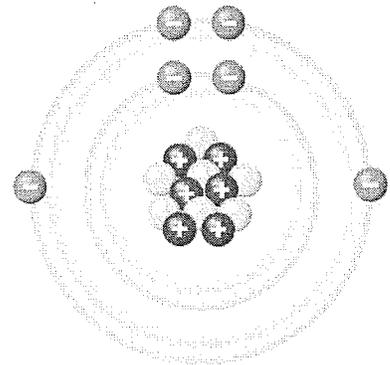
Subatomic Particles	Charge	Location
Protons		
Neutrons		
Electrons		

MASS

- _____ and _____ have much more mass than electrons (_____ more mass!)

VOLUME

- The nucleus (where the _____ and _____ are) is tiny
- The region that _____ occupy (_____ or _____) accounts for _____% of the volume of an atom



How did we come to understand the atom?

Early Ideas (pre-1800's)

- Aristotle argued that all matter is made up of different combinations of _____ and _____
- Large focus on turning common metals into more value (gold)
- Secretive investigations

John Dalton (1766 – 1844)

- Interested in the gases that make up our _____
- Suggested that particles that make up matter are like _____ that are different for different _____
- Dalton's Atomic Theory
 - All matter is made of small particles called _____
 - Atoms cannot be _____ or _____ into smaller particles.
 - All atoms of the same elements are _____
 - _____ are created when atoms of _____ join together

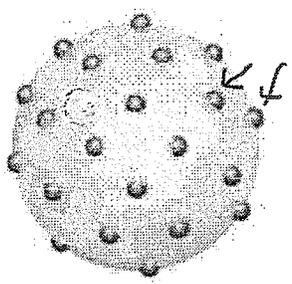
hydrogen atom



oxygen atom

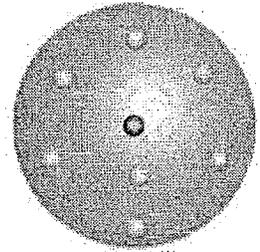
J.J. Thomson (1856 – 1940)

- Discovered the first _____ particle: the _____
- Suggested the "_____ " model of the atom;
 - A _____ ball like a bun with _____ particles embedded in it like raisins



Ernest Rutherford (1871 – 1937)

- Discovered the _____
- Suggested:
 - Most of the atom is _____ (occupied by _____)
 - Most of the _____ of the atom is concentrated in a _____ charged central core (the _____)
 - The nucleus contains _____ charged particles (_____) and particles with no charge (_____)

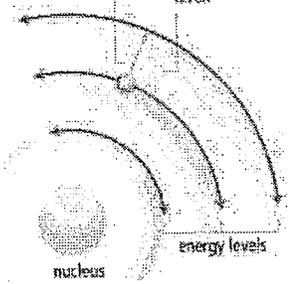


Niels Bohr (1885 – 1962)

- Made hydrogen gas glow by passing an electric current through it
- Suggested that electrons exist in specific _____ or _____ surrounding the _____
- In his experiments, electricity gave the electrons _____ to jump to _____ energy levels; when they eventually fell back to _____ energy levels, they released this _____ in the form of _____

Electricity gives the electron extra energy so it jumps to a higher energy level.

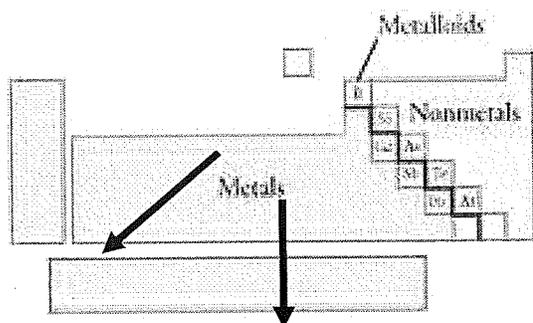
The electron releases energy in the form of light when it falls to a lower energy level.



The Periodic Table: Families and Periods

➤ Periodic table was organized by _____.

METALS (in general)

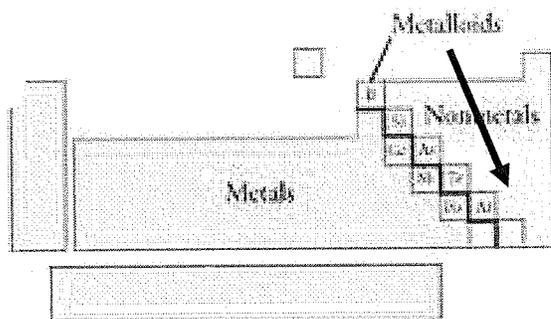


PROPERTIES OF METALS

All Metals are:

- good electrical and heat _____
- _____: can be beaten into thin sheets
- _____: can be stretched into wire
- _____ lustre (ie. Shiny)
- _____ at room temperature

NON-METALS (in general)

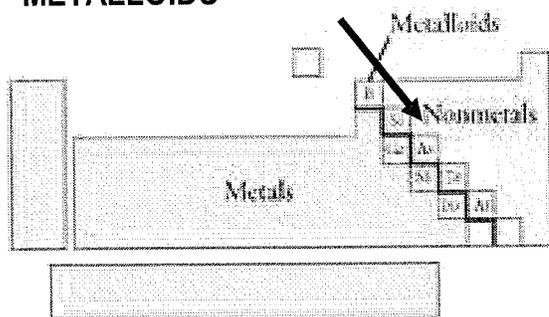


PROPERTIES OF NON-METALS

All Non-Metals are:

- gain or share valence electrons easily
- _____ of heat and electricity
- _____: breaks easily if solid
- _____: not easily stretched
- does not possess a metallic lustre
- all states at _____ temperature

METALLOIDS



PROPERTIES OF METALLOIDS

Metalloids:

- act like _____ when they react with metals
- act like _____ when they react with non-metals
- have "semi-conductor" properties

The seven metalloids are: boron, silicon, germanium, arsenic, antimony, tellurium, and polonium.

What is special about metalloids and what does this make them useful for? They can carry an electrical charge, therefore they are useful in computers and calculators.

- Vertical columns are called _____. Families share similar chemical and physical properties.
- Horizontal rows are called _____. Each period represents an orbit or shell around the nucleus.

THE FAMILIES:

1. Alkali Metals

<u>Column</u>	<u>Name</u>
Li	_____
Na	_____
K	_____
Rb	_____
Cs	_____
Fr	_____

Things to know about Alkali Metals:

- Have _____ in their outer shell.
- The single valence electron makes them the _____ reactive metals on the periodic table. Reactivity increases and you go down the list.
- So reactive with air and water they need to be stored in _____.
- Some properties of alkali metals are:

2. Alkaline Earth Metals

<u>Column</u>	<u>Name</u>
Be	_____
Mg	_____
Ca	_____
Sr	_____
Ba	_____
Ra	_____

Things to know about Alkaline Earth Metals:

- Alkaline earth metals are _____ reactive than the alkali metals.
- They have _____ in their outer shell.
- Some properties of alkaline earth metals are:

3. Halogens

Column

Name

F	_____
Cl	_____
Br	_____
I	_____
At	_____

Things to know about Halogens:

- They have _____ electron in their outer shell. This makes them the most _____ non-metals on the periodic table.
- Reactivity _____ as you go down the column making _____ the most reactive.
- Some properties of Halogens are:

4. Noble Gases

Column

Name

He	_____
Ne	_____
Ar	_____
Kr	_____
Xe	_____
Rn	_____

Things to know about Noble Gases:

- The _____ reactive elements on the periodic table. Under normal conditions, they will not react.
- They have a full _____, and are therefore very stable elements.
- No compounds with Noble Gases have been found in nature because they're not very reactive.
- The most common noble gas is Argon which makes up 0.93% of the air we breathe.

Things to know about Hydrogen:

5. Hydrogen

- It can act as either a _____ (giving away an electron), or a _____ (receiving electrons)
- Has _____ electron in its outer shell. This makes hydrogen very reactive, therefore it is almost always found in the form of a compound
- Some properties of Hydrogen are:
 - At room temperature, hydrogen is a gas
 - Extremely flammable, and makes a good fuel source.

Periodic Table Practice

Use your periodic table to answer the following questions:

1. The vertical columns on the periodic table are called _____
2. The horizontal rows on the periodic table are called _____
3. Most of the elements in the periodic table are classified as _____
4. The elements that touch the zigzag line are classified as _____
5. Elements in groups 3-12 have many useful properties and are called _____

6. Elements in this group are said to be "inert", meaning unreactive _____
7. The elements at the bottom of the table were pulled out to keep the table from becoming too long.

Elements in the first period at the bottom are known as **Lanthanides**, while the elements in the second period at the bottom are known as **Actinides**.

H																	H	He	
Li	Be																		
Na	Mg											B	C	N	O	F	Ne		
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Al	Si	P	S	Cl	Ar		
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	Ga	Ge	As	Se	Br	Kr		
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	In	Sn	Sb	Te	I	Xe		
Fr	Ra	Ac	Rf	Ra	106	107	108	109				Tl	Pb	Bi	Po	At	Rn		
Lanthanides		Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu				
Actinides		Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr				

Where do you think these names came from?

8. Explain why fluorine is the most reactive non-metal and why francium is the most reactive metal?

Atomic Theory

Name: _____

In the space below, draw and label a picture of an atom. Include as many details as you remember.

Atoms are chemically the simplest substance and cannot be broken down using chemical methods. Atoms can only be changed into other elements using nuclear methods.

An **ELEMENT** is a substance consisting of atoms which all have the **same number of** _____

The information provided on your periodic table can be used to determine the number of each subatomic particle in the atoms of that element

The **atomic number** is written in the top left of each element box. This number is unique to each element and it tells us the number of _____ that are found in an atom of that element.

13	3+
Al	
Aluminum	
27.0	

Ex. Aluminum:

Atoms are neutral (have no charge) therefore, the number of _____ = number of _____

Ex. Aluminum:

The **mass number** (in the bottom of each element box) tells us how many protons + neutrons are found in the element. You will need to round the # up or down first.

Ex. Aluminum:

Using the Periodic Table

Name: _____

- Use your periodic table to complete the following table. (Remember that: mass number = # of protons + # of neutrons)

Element	Element Symbol	Atomic #	Atomic Mass	# of protons	# of neutrons	# of electrons
Carbon		6	12			
Sodium		11	23			
			55	25		
			56		30	
					14	14
				8	8	
		52			76	
			40			18
		15	31	15		
					45	35

Follow up Questions:

- How did you calculate
 - the number of protons?
 - the number of electrons?
- How are the atoms of different elements similar?
- How are the atoms of different elements different?
- How do you think chemists decided on the symbol for each element? I.e. Carbon = C

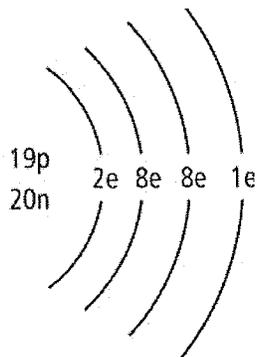
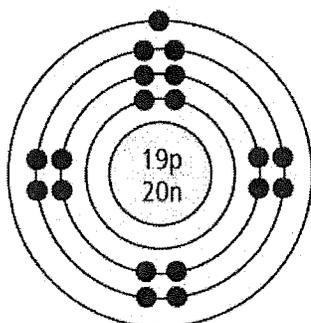
Bohr Diagrams



A Bohr diagram shows how many _____ are in each shell surrounding the nucleus.

The Bohr diagram is named after Niels Bohr, a Danish physicist who developed several models for arranging electrons in an atom.

There are a few different ways of representing an atom's electron arrangement using a Bohr diagram.



Which element is represented here?
Explain how you know this.

Energy Level (Shell)	Maximum # of electrons
1 st	
2 nd	
3 rd	
4 th	

The number of **protons** and **neutrons** are shown in the centre (the nucleus), while the **electrons** are shown in their surrounding shells.

Notice the pattern in which the electrons are drawn.

There are a maximum number of electrons that can be drawn in each shell. Look at the rows on your periodic table to help you! Complete the table to the left.

Practice together – the Bohr model of a neon atom.

The outermost shell that contains electrons is called the _____ shell and it contains the _____ electrons. It is these electrons that are involved in _____ and forming compounds. If the valence shell is full, the **atom is considered stable** and it won't form compounds.

Look at the 2 Bohr diagrams on this page. How many valence electrons are found in a neon atom and in a potassium atom? Are these atoms stable?

Practice:

Draw the Bohr diagrams for the following atoms. Indicate the number of valence electrons for each and whether or not the atom is stable.

1. Beryllium

2. Fluorine

of valence e's: _____

Stable? : _____

of valence e's: _____

Stable? : _____

3. Sodium

4. Helium

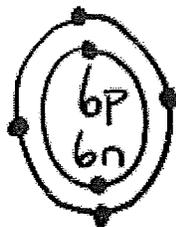
of valence e's: _____

Stable? : _____

of valence e's: _____

Stable? : _____

The Bohr diagram for carbon is shown below. Next to it is a different way to represent an atom – a Lewis diagram. Compare the two models and explain how you think they are different.

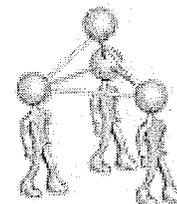


Bohr diagram



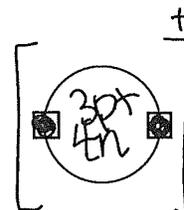
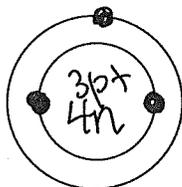
Lewis diagram

ATOMS AND IONS



What's the difference between these two models of Lithium?

(hint look at # of protons, electrons, neutrons)



ATOM – An atom is **NEUTRAL** → has an equal number of protons (+) and electrons (-)

*NO reaction has occurred – no compound or molecule formed.

IONS – Ions have a **CHARGE** → because they have lost or gained an electron to form a molecule or compound.

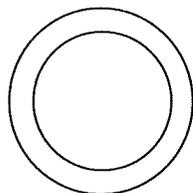
Ions do not have equal numbers of protons (+) and electrons (-), and therefore have a charge.

Negative Ions = ANIONS

Positive Ions = CATIONS

Ex. An atom of Sodium

An ion of Sodium



Ion Bohr Model: This is a Bohr model of the ion after the reaction, when the outer shell has gained or lost the necessary electrons to have a full (stable) outer shell. Add square brackets and the charge outside.

1. Mg (Magnesium)

Ion Bohr:

2. F (Fluorine)

Ion Bohr:

Practice:

1. Fill in the chart for Bohr Models

Element	Bohr Diagram of neutral atom	# electrons gained/lost	Charge on the ion	Bohr Diagram of ion
Na				
B				
N				
S				

3. Draw the following ions without drawing the atom first. Use the ion charge for each element to help you.

Note: If the ion charge is +, the electrons have been given away; if the ion charge is -, electrons have been gained

i) Nitrogen (Bohr model)

ii) Beryllium (Bohr model)

3. Ions Chart: Use the periodic table to complete the following table of ions/atoms.

Symbol	Charge	Atom or Ion ?	Number of Protons	Number of electrons
F	0			
Al ⁺³	+3			
C				
I ⁻¹				
Ar				
	+2		20	
	0		14	
	-3		7	
			1	1
			10	10
			11	10
			17	18
		Atom	2	
	+3			23
			92	89

Goal • Demonstrate your understanding of Lewis diagrams.

What to Do

1. Complete the following table.

Name of Element	Period Number	Group Number	Number of Energy Levels	Number of Valence Electrons
helium		18		
			3	3
	2			6
strontium				
		14	3	
	6	2		

2. Draw the missing Lewis diagrams in the following table. Refer to a periodic table as necessary.

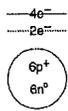
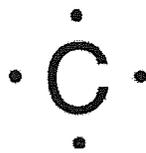
H						He:	
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar

Bohr Diagrams and Lewis Diagrams

Goal • Practise drawing Bohr diagrams and Lewis diagrams.

What to Do

Complete the following table by drawing both the Bohr diagram and Lewis diagram for each element. The first row is completed as an example.

Name of Element	Bohr Diagram	Lewis Diagram
carbon		
oxygen		
lithium		
chlorine		
magnesium		
phosphorus		

Practice:

1. Fill in the chart for Lewis Models

Element	# of Valence Electrons	Lewis Dot Diagram of Neutral Atom	# electrons gained/lost	Charge on Ion	Lewis Dot Diagram of ion
P	5		3	-3	
N					
Li					
O					
H					
He					
K					

2. Draw the following ions without drawing the neutral atom first. Use the ion charge for each element to help you.

Note: If the ion charge is +, the electrons have been given away; if the ion charge is -, electrons have been gained

i) Nitrogen (Bohr model)

ii) Beryllium (Bohr model)

iii) ~~Scandium (Lewis model)~~
omit

iv) Sulphur (Lewis model)

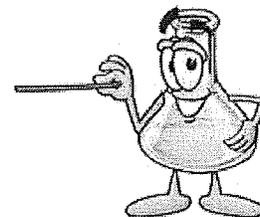
Compound Formation

When two atoms move close together, their _____ electrons interact. A chemical _____ forms between atoms if the new arrangement is _____. We know that an atom is stable when its valence (outer) shell is complete.

There are two basic types of compounds:

1. _____

2. _____



1. IONIC COMPOUNDS

2. COVALENT COMPOUNDS

In ionic bonding, one or more electrons are _____ from each atom of the metal to the atom of the non-metal.

When atoms gain or lose electrons, we know that they become electrically charged particles called **ions**. Ions of opposite charge tend to _____. This attraction creates an **IONIC BOND**. The metal has a + charge and is called a _____. The non-metal is - charged and is the _____.

The atoms of many non-metals _____ electrons with other non-metal atoms. In **covalent bonding**, atoms _____ slightly, and one or more _____ electron from each atom will **pair** together.

The pair of electrons involved in a covalent bond are called the _____. The atom's own e- pairs are called the _____ pairs.

Ex. Oxygen + sulfur share ___ electrons because they both need _____ e-'s to fill their outer shells.

A. REPRESENTING BONDING using BOHR DIAGRAMS

1. IONIC BONDS

Ex. **Sodium** and **Chlorine**

React to form the ionic compound: **Sodium chloride**

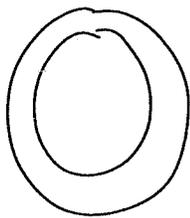
Ex. Lithium and Oxygen

React to form the ionic compound: Lithium oxide

2. COVALENT BONDS

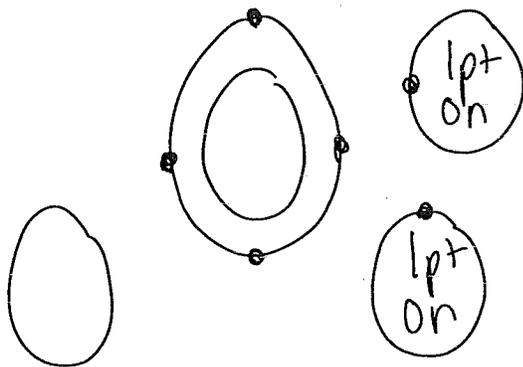
Ex. One nitrogen atom and three hydrogen atoms

React to form nitrogen trihydride – NH_3



Ex. One carbon atom and four hydrogen atoms

React to form carbon tetrahydride – CH_4



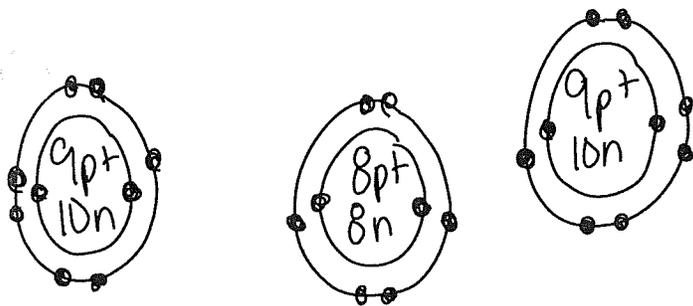
Practice: Draw the **Bohr Bonding Model** for the following compounds. **First**, determine if it is **ionic** or **covalent**. **Second**, show the transfer of electrons **using arrows**, and **third**, show the final product.

1. Beryllium and Fluorine

Covalent or Ionic? (circle one)

React to form beryllium fluoride (BeF_2)

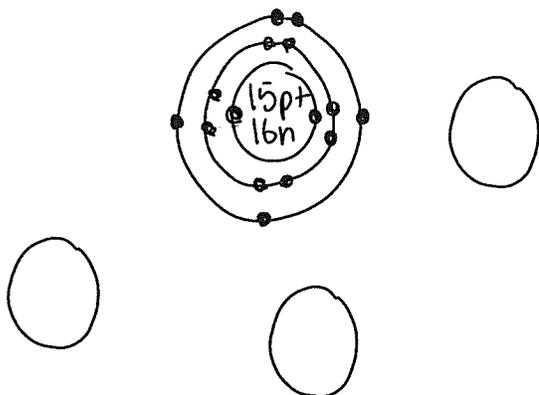
2. Oxygen and Fluorine



Covalent or Ionic? (circle one)

React to form oxygen difluoride (OF₂)

3. Phosphorus and Hydrogen



Covalent or Ionic? (circle one)

React to form phosphorus trihydride (PH₃)

4. Magnesium and Oxygen

Covalent or Ionic? (circle one)

React to form _____ (MgO)

B. REPRESENTING BONDING using LEWIS DIAGRAMS

1. IONIC BONDS

Remember that for Lewis Diagrams you only need to show the valence electrons. Also, since these are IONIC COMPOUNDS, don't forget to include the ion charges!

Ex. Lithium and Chlorine

React to form _____

Ex. Calcium and Fluorine

React to form _____

2. COVALENT BONDS

In Lewis diagrams for covalent bonds, we show the bonding pairs using a **straight line**.

Ex. Oxygen and fluorine

Ex. Carbon and chlorine

Practice: Draw the Lewis Model for the following compounds. Determine if it's covalent or ionic first.

1. Phosphorous and hydrogen

React to form: Phosphorous trihydride (PH₃)

2. Calcium and oxygen

React to form: _____ (CaO)

3. Beryllium and fluorine

React to form: _____ (BeF₂)

4. Chlorine and oxygen

React to form: _____ (Li₂O)

WRITING FORMULAS AND NAMING COMPOUNDS

There are 4 possibilities for types of compounds in grade 10 Science. Follow the flowchart to determine which type you are dealing with, and then follow the rules for that type.

i) **Covalent compound**

ii) **Ionic compound (simple)**

iii) **Ionic compound containing polyatomic groups**

iv) **Ionic compound with multivalent metals**

Step 1: Is the compound **covalent** or **ionic**?

- If covalent (non-metal + non-metal), follow the steps on the separate handout (use prefixes to indicate # of atoms, change 2nd element ending to "ide", no prefix for "one" for 1st element)
- If ionic (metal + non-metal), go to Step 2

Step 2: Is there a polyatomic group in the name or formula (hint: more than 2 elements means you have a group, or if part of the compound name isn't an element on the periodic table. The names & formulas for groups are in your data booklet)

- If there are polyatomic groups, follow instructions for these on the back sheet.
 - If not, continue to Step 3
- Ex. Sulphate, NH_4 , oxalate, NO_2 are groups

Step 3: Is there a metal with more than one combining capacity? (hint: metals after column 2 always need to be checked. If your periodic table lists more than one + charge beside the element symbol, or if the name has a Roman numeral in it, you are dealing with a multivalent element.

- If yes, follow the instructions for multivalents
 - If no, continue to Step 4.
- Ex. copper (II) oxide, copper (III) oxide, Cu^{+2} , Cu^{+3}

Step 4: You have an ionic compound with no polyatomic groups or multivalent metals. You can very easily write the name and formula. See "Simple Ionic Compounds".

Ex. sodium chloride, BeF_2

A. Practice writing formulas for the following compounds:

1. calcium fluoride

2. copper (II) chloride

3. oxygen pentachloride

4. silver carbonate

5. lead (IV)phosphate

B. Practice writing chemical names for the following Ionic Compounds

1. Mg_3P_2

2. PbO

3. $Ca(NO_3)_2$

4. PF_3

5. Hg_2O

I. Simple Ionic Compounds

Naming the Compound from the formula:

1. Name the metal (ignore subscripts)
2. Name the non-metal but change the ending to "ide" (ignore subscripts)

Ex. **CaO**

Writing the Formula from the name:

1. Write the metal symbol with its combining capacity above
2. Write the non-metal symbol with its combining capacity above
3. Use the combining capacities to determine how many atoms of each are needed to make the other "happy", or stable (full valence shells).
4. Rewrite both symbols with a subscript indicating how many atoms of each are needed.

Ex. **Lithium nitride**

II. Ionic Compounds with Polyatomic groups

**If the metal has more than one combining capacity (check periodic table), you must also use your rules for multivalent metals (for both naming and formula writing).

Naming the Compound from the formula:

1. Follow the rules for simple compounds, but use the group name instead of either the non-metal or metal, depending where it appears in the formula. (Group names are in your data book)

Ex. **Mg(HSO₄)₂**

Writing the Formula from the name:

1. Follow the rules for simple ionic compounds, but use the group formula instead of either the non-metal or metal, depending where it appears in the name. (Group names with charges are in your data book)
2. If the formula requires more than one polyatomic group, place the whole group in brackets with the subscript outside the brackets.

Ex. **Aluminum sulphate**

III. Ionic Compounds with Multivalent metals

Naming the Compound from the formula:

1. Write the name for the metal, followed with brackets.
2. Write the name for the non-metal after the brackets (change the ending to "ide")
3. The hard part is to determine which form of the metal is being used. To do this, write the combining capacity of the non-metal above its symbol. Look at the possible combining capacities of the metal and determine which one was used with the non-metal to achieve the formula you were given.
4. Write this number as a Roman numeral inside the bracket.

Ex. **CuO**

Ex. **Cu₂O**

Writing the Formula from the name:

1. Write the symbol for the metal.
2. The correct combining capacity for this metal is shown by the Roman numeral. Write the combining capacity above the symbol.
3. Write the non-metal symbol with its combining capacity above it.
4. Use the combining capacities to determine how many atoms of each are needed to make the other "happy", or stable (full valence shells).
5. Rewrite both symbols with a subscript indicating how many atoms of each are needed.

Ex. **Iron (III) nitride**

Ex. **Iron (II) nitride**

1 = I	2 = II	3 = III	4 = IV	5 = V	6 = VI	7 = VII	8 = VIII	9 = IX	10 = X
-------	--------	---------	--------	-------	--------	---------	----------	--------	--------

WRITING CHEMICAL NAMES

Only do the Ionic Compounds! Anything that is covalent put a * next to it and skip it!

Part 1 :

Chemical Formula	Chemical Name
LiBr	
HCl	
N ₂ O ₅	
Mg ₃ N ₂	
CaI ₂	
Cs ₃ P	
Ba ₂ Si	
CdO	
KF	
Na ₂ O	
BeS	

Part 2 :

Chemical Formula	Chemical Name
CuCl	
Fe ₂ O ₃	
PbO ₂	
CrS	
SO ₃	
SnF ₂	
CuS	
SnBr ₄	
MnI ₂	
AuP	
Co ₃ N ₂	
SF ₆	

Part 3 :

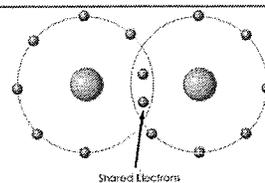
Chemical Formula	Chemical Name
HNO ₃	
P ₂ H ₆	
MgSO ₄	
K ₂ CO ₃	
Be(OH) ₂	
(NH ₄) ₂ O	
Li ₃ PO ₃	
Sr(MnO ₄) ₂	
Sc(HSO ₃) ₃	
CaCrO ₄	
AgCH ₃ COO	
CBr ₄	

Part 4 : Mixed Practice of all Naming types. Be careful, this could be tricky ☺

Chemical Formula	Chemical Name
FeF ₂	
CaH ₂	
CuCO ₃	
SnBr ₂	
Mg ₃ N ₂	
N ₂ O	
Au ₂ O ₃	
(NH ₄) ₃ P	
Hg ₂ SO ₄	
Zn(NO ₂) ₂	
Fr ₂ S	
NF ₃	

Writing the Names of Covalent Compounds

Covalent Compound → non-metal/non-metal



In a covalent compound, electrons are _____ rather than transferred.
 The **number** of atoms of each element in the molecule is shown by the chemical formula.

Example: H_2O_2 – has 2 _____ and 2 _____ atoms and **cannot be reduced to HO.**

In covalent compounds, the subscripts show the actual _____ of atoms of each element in the molecule. When we are **naming** binary covalent compounds, we use **prefixes** to indicate the number of atoms of each element that appear in the formula.

Naming Binary Covalent Compounds

STEPS	Examples	
	NO_2	N_2O_3
1. Name the left most element in the formula first. Add the correct prefix for the number of atoms. If the first element has only 1 atom, do not add a prefix.	Nitrogen # of N = 1 (no prefix as first element has only one atom)	
2. Name the second element making sure to change the ending to “ide”. Add the correct prefix for the number of atoms.	oxide (no caps) # of O = 2 (prefix is di) = dioxide	
3. Write the final formula	Nitrogen dioxide	

Prefix	Number
mono-	1
di-	2
tri-	3
tetra-	4
penta-	5
hexa-	6

Writing the Formulas for Covalent Compounds

Writing the formulas for covalent compounds is easily done. You use the prefixes to determine the number of atoms present for each element.

Writing Formulas for Covalent Compounds		
STEPS:	Ex. Carbon disulphide	Ex. Triiodine diphosphide
1. Determine the number of atoms of the left most element from prefix. Write the symbol with the # of atoms as a subscript.	C	
2. Determine the number of atoms in the second element. Write the symbol with the # of atoms as a subscript.	S ₂	
3. Write the formula for the compound.	CS ₂	

PRACTICE:

Write the names of the following compounds.

- | | |
|----------------------------------|----------------------------------|
| a) N ₂ O | b) CO ₂ |
| c) P ₂ I ₃ | d) PCl ₅ |
| e) SO ₂ | f) N ₂ O ₄ |
| g) NI ₃ | h) NO |

Write the formulas of the following compounds.

- | | |
|-----------------------------|--------------------------|
| a) nitrogen tribromide | b) sulphur hexafluoride |
| c) dinitrogen tetrasulphide | d) oxygen difluoride |
| e) carbon tetraiodide | f) sulphur trioxide |
| g) phosphorus pentabromide | h) diiodine hexachloride |
| i) difluorine tetraiodide | j) xenon hexafluoride |

Metals

Name: _____

Name the following compounds.Write the formulae for the following compounds1.) CaCl_2 _____

1.) Sodium Chloride _____

2.) AgCl _____

2.) Potassium Bromide _____

3.) MgO _____

3.) Calcium Fluoride _____

4.) NaBr _____

4.) Zinc Oxide _____

5.) Al_2O_3 _____

5.) Silver Sulphide _____

6.) KI _____

6.) Potassium Sulphide _____

7.) ZnCl_2 _____

7.) Barium Hydride _____

8.) Li_2O _____

8.) Aluminum Sulphide _____

9.) BaO _____

9.) Lithium Chloride _____

10.) KCl _____

10.) Calcium Iodide _____

11.) MgCl_2 _____

11.) Magnesium Phosphide _____

12.) AgI _____

12.) Zinc Bromide _____

13.) ZnS _____

13.) Sodium Iodide _____

14.) BaF_2 _____

14.) Aluminum Carbide _____

15.) Ca_3P_2 _____

15.) Potassium Hydride _____

16.) Na_2O _____

16.) Silver Oxide _____

17.) AlN _____

17.) Calcium Silicide _____

18.) CaCl_2 _____

18.) Zinc Nitride _____

19.) K_2O _____

19.) Lithium Nitride _____

20.) H_2S _____

20.) Barium Carbide _____

21.) Na_3N _____

21.) Sodium Hydride _____

22.) LiF _____

22.) Magnesium Fluoride _____

23.) AlCl_3 _____

23.) Calcium Sulphide _____

24.) NaCl _____

24.) Barium Chloride _____

Polyatomics

Name: _____

Name the following compounds.

Write the formulae for the following compounds

1.) CaCO_3 _____

1.) Aluminum Sulphate _____

2.) NH_4NO_3 _____

2.) Lithium Carbonate _____

3.) ZnSO_4 _____

3.) Zinc Nitrate _____

4.) HNO_3 _____

4.) Sodium Permanganate _____

5.) Mg(OH)_2 _____

5.) Calcium Hypochlorite _____

6.) LiHCO_3 _____

6.) Lithium Nitrite _____

7.) BaSO_4 _____

7.) Magnesium Acetate _____

8.) $\text{Al(ClO}_4)_3$ _____

8.) Ammonium Carbonate _____

9.) KClO_3 _____

9.) Sodium Nitrite _____

10.) NaHCO_3 _____

10.) Potassium Carbonate _____

11.) ZnCrO_4 _____

11.) Barium Sulphite _____

12.) BaCO_3 _____

12.) Zinc Phosphate _____

13.) KMnO_4 _____

13.) Magnesium Chlorate _____

14.) AgNO_3 _____

14.) Sodium Bisulphite _____

15.) Al(OH)_3 _____

15.) Aluminum Chlorate _____

16.) $\text{Na}_2\text{Cr}_2\text{O}_7$ _____

16.) Lithium Hydroxide _____

17.) $(\text{NH}_4)_3\text{PO}_4$ _____

17.) Silver Sulphite _____

18.) Na_2SO_3 _____

18.) Barium Dichromate _____

19.) Ag_2SO_4 _____

19.) Ammonium Sulphite _____

20.) KHS _____

20.) Calcium Hydroxide _____

21.) NH_4HSO_4 _____

21.) Silver Chromate _____

22.) $\text{Zn(CH}_3\text{COO)}_2$ _____

22.) Zinc Carbonate _____

Multivalent

Name: _____

Name the following compounds.

Write the formulae for the following compounds

- 1.) CuCl _____
- 2.) FeO _____
- 3.) HgBr₂ _____
- 4.) PbO₂ _____
- 5.) CrS _____
- 6.) FeCl₃ _____
- 7.) AuI _____
- 8.) Cu₂O _____
- 9.) PbS _____
- 10.) Hg₂O _____
- 11.) Fe₂O₃ _____
- 12.) AuBr₃ _____
- 13.) CrF₂ _____
- 14.) MnS _____
- 15.) SnH₄ _____
- 16.) SnF₂ _____
- 17.) CuCO₃ _____
- 18.) PbSO₃ _____
- 19.) Fe(NO₃)₃ _____
- 20.) Sn(C₂H₃O₂)₂ _____
- 21.) Cu₂SO₄ _____
- 22.) HgCrO₄ _____
- 23.) Pb(NO₃)₂ _____
- 24.) Co(OH)₃ _____
- 25.) Sn(SO₄)₂ _____

- 1.) Cobalt (II) Chloride _____
- 2.) Potassium Bromide _____
- 3.) Gold (III) Sulphide _____
- 4.) Lead(II) Fluoride _____
- 5.) Copper (I) Nitrite _____
- 6.) Manganese (III) Oxide _____
- 7.) Iron (III) Sulphide _____
- 8.) Tin (IV) Sulphide _____
- 9.) Gold (I) Chloride _____
- 10.) Copper (II) Sulphide _____
- 11.) Cobalt (III) Oxide _____
- 12.) Manganese (III) Nitride _____
- 13.) Mercury (II) Chlorate _____
- 14.) Lead (II) Dichromate _____
- 15.) Chromium (III) Nitride _____
- 16.) Manganese (III) Phosphate _____
- 17.) Tin (II) Sulphate _____
- 18.) Copper (II) Dichromate _____
- 19.) Cobalt (II) Perchlorate _____
- 20.) Iron (II) Acetate _____
- 21.) Chromium (II) Sulphate _____
- 22.) Manganese (II) Carbonate _____
- 23.) Copper (II) Hydroxide _____
- 24.) Tin (IV) Nitrate _____
- 25.) Chromium (III) Acetate _____

← not multivalent
oops ↓

Naming Covalent Compounds (prefix method)

Name _____

- 1. CO _____
- 2. CO₂ _____
- 3. SO₂ _____
- 4. NO₂ _____
- 5. N₂O _____
- 6. N₂F _____
- 7. SO₃ _____
- 8. CCl₄ _____
- 9. NO _____
- 10. N₂O₅ _____
- 11. P₂O₅ _____
- 12. ~~N₂O₅~~ C₃I₈ _____
- 13. ~~P₂O₅~~ N₄S₁₀ _____
- 14. N₂O₄ _____
- 15. CS₂ _____
- 16. OF₂ _____
- 17. PCl₃ _____
- 18. P₂Br₆ _____

- 19. Silicon Tetraiodide _____
- 20. Arsenic Trifluoride _____
- 21. Beryllium Oxide _____
- 22. Xenon Gas _____
- 23. Diphosphorous Pentoxide _____
- 24. Carbon Monoxide _____
- 25. Carbon Pentafluoride _____
- 26. Selenium Dichloride _____
- 27. Carbon Dioxide _____
- 28. Silicon Disulphide _____
- 29. Diboron Trisulphide _____
- 30. Phosphorous Trifluoride _____
- 31. Diiodine Heptaoxide _____
- 32. Phosphorous Trisulphide _____
- 33. Oxygen Difluoride _____
- 34. Chlorine Gas _____

Nomenclature (mixed types):

Name _____

Write the correct formula for each of the following:

- | | |
|--|---|
| 1. Silver Chloride _____ | 2. Zinc Sulphate _____ |
| 3. Strontium Fluoride _____ | 4. Mercury (I) Nitrate _____ |
| 5. Potassium Nitrite _____ | 6. Lead (II) Hydroxide _____ |
| 7. Oxygen Gas _____ | 8. Hydrochloric Acid _____ |
| 9. Tin(II) Bicarbonate _____ | 10. Zinc Fluoride _____ |
| 11. Tin(IV) Sulphate _____ | 12. Nitrogen Dioxide _____ |
| 13. Potassium Chlorite _____ | 14. Lead ^(II) Chloride _____ |
| 15. Chromium (II) Oxide _____ | 16. Bromine Gas _____ |
| 17. Aluminum Oxide _____ | 18. Iron (III) Iodide _____ |
| 19. Hydrogen Bromide _____ | 20. Sodium Dichromate _____ |
| 21. Iron Metal _____ | 22. Cobalt (II) Permanganate _____ |
| 23. Silicon Dioxide _____ | 24. Sodium Chlorite _____ |
| 25. Fluorine Gas _____ | 26. Sodium Hydrogen Phosphate _____ |
| 27. Rubidium Nitrite _____ | 28. Ammonium Hydrogen Sulphite _____ |
| 29. Carbon Tetraiodide _____ | 30. Hydrogen Oxide _____ |
| 31. Iron (II) Carbonate _____ | 32. Gold (III) Nitrate _____ |
| 33. Lithium Dihydrogen Phosphate _____ | 34. Iron (III) Hydroxide _____ |
| 35. Cadmium Acetate _____ | 36. Nickel Metal _____ |
| 37. Boron Hydroxide _____ | 38. Strontium Sulphate _____ |
| 39. Neon Gas _____ | 40. Barium Phosphate _____ |
| 41. Copper (II) Iodide _____ | 42. Ammonium Hydroxide _____ |
| 43. Aluminum Nitrate _____ | 44. Potassium Chromate _____ |
| 45. Silver Hydroxide _____ | 46. Iron (III) Nitrate _____ |
| 47. Sulphur Trioxide _____ | 48. Aluminum Nitrite _____ |
| 49. Iron (III) Sulphate _____ | 50. Barium Bicarbonate _____ |
| 51. Aluminum Bisulphite _____ | 52. Zinc Phosphate _____ |

- 53. Ammonium Perchlorate _____
- 55. Tin (II) Permanganate _____
- 57. Magnesium Hydroxide _____
- 59. Magnesium Bisulphate _____
- 61. Nitrogen Gas _____
- 63. Aluminum Sulphide _____
- 65. Xenon Gas _____
- 67. Mercury (I) Acetate _____

- 54. Calcium Acetate _____
- 56. Calcium Sulphide _____
- 58. Sodium Metal _____
- 60. Mercury (II) Chloride _____
- 62. Hydrogen Sulphate _____
- 64. Hydrogen Iodide _____
- 66. Lithium Bicarbonate _____
- 68. Sodium Oxide _____

Write the name of the following compounds:

- 1. AgI _____
- 3. NaOH _____
- 5. HNO₃ _____
- 7. K₂Cr₂O₇ _____
- 9. NH₄ClO₂ _____
- 11. AlPO₄ _____
- 13. CCl₄ _____
- 15. HNO₂ _____
- 17. Ca(ClO₄)₂ _____
- 19. N₂ _____
- 21. H₂S _____
- 23. MgO _____
- 25. NaClO₃ _____
- 27. SO₃ _____
- 29. Cr₂O₃ _____
- 31. Na₂CrO₄ _____
- 33. HCl _____
- 35. Cu₂SO₄ _____
- 37. Fe(ClO)₂ _____
- 39. SO₂ _____

- 2. Al₂S₃ _____
- 4. Na₂SO₃ _____
- 6. CuSO₄ _____
- 8. NI₃ _____
- 10. HBr _____
- 12. Cu(CH₃COO)₂ _____
- 14. SnSO₄ _____
- 16. RbI _____
- 18. PbCO₃ _____
- 20. KMnO₄ _____
- 22. Ca(OH)₂ _____
- 24. Pb(NO₃)₂ _____
- 26. WF₆ _____
- 28. H₃PO₄ _____
- 30. Pb(NO₃)₄ _____
- 32. NH₄OH _____
- 34. XeO₂ _____
- 36. Cu₂SO₄ _____
- 38. AuCl₃ _____
- 40. O₂ _____

Compound Names and Formula Practice Quiz

You have been tasked with marking and correcting a fellow student's naming quiz.
Identify AND correct any mistakes they may have made.

Part One - Name the following compounds:

1. MgBr_2 magnesium (II) bromide
2. $\text{Ca}(\text{CH}_3\text{COO})_2$ calcium carbonate
3. Sn_3P_4 tin phosphide
4. $(\text{NH}_4)_3\text{P}$ ammonium phosphate
5. RbF rubidium fluoride
6. MnS_2 magnesium sulfide
7. $\text{Fe}(\text{OH})_3$ iron (II) hydride
8. GaI_3 gallium (III) iodide
9. VCl_5 vanadium chloride
10. Hg_3N_2 mercury (III) nitrate
11. Ca_3P_2 calcium phosphite
12. K_2CrO_4 potassium perchlorate
13. NiS nickel (II) sulfide
14. $\text{Ca}(\text{HCO}_3)_2$ calcium bicarbonate
15. AlCl_3 aluminum chloride

Part Two – Write the formula for the following compounds: *(make corrections)*

1. zinc oxide Zn_2O_2
2. tin (II) sulfide SnS_2
3. lead (II) perchlorate $Pb(ClO_2)_2$
4. magnesium acetate $MgCH_3COO$
5. aluminum iodide Al_3I
6. ammonium sulfate $(NH_4)_2SO_4$
7. mercury (II) fluoride Hg_2F
8. manganese (II) sulfide $MnSO_3$
9. molybdenum (II) cyanide Mo_2CN
10. lithium fluoride LiF
11. cobalt (III) oxide Co_3O_2
12. aluminum hydroxide $AlOH_3$
13. calcium phosphide $Ca_3(PO_4)_2$
14. copper (II) selenide CuS
15. rubidium sulfide Rb_2S



REVIEW – MIXED NAMES AND FORMULAS

Name: _____

A. Classify each formula (ionic or covalent) and name each compound.

	Ionic or Covalent?	Chemical name
1. VO_2		
2. NO_2		
3. CrBr_2		
4. CdBr_2		
5. SBr_2		
6. $\text{Na}_2\text{Cr}_2\text{O}_7$		
7. Na_2CrO_4		
8. N_2O_3		
9. SO_3		
10. Li_2SO_3		
11. Li_2SO_4		
12. SO_2		
13. CO_2		
14. NaHCO_3		
15. PbCO_3		

B. Write the correct formula for each compound.

- | | |
|--------------------------|--------------------------|
| 1. calcium chloride | 8. barium carbonate |
| 2. sodium nitrate | 9. lead (II) carbonate |
| 3. copper (II) bromide | 10. potassium hydroxide |
| 4. aluminum sulphate | 11. carbon tetrachloride |
| 5. lead (IV) phosphate | 12. mercury (I) nitrate |
| 6. phosphorus pentoxide | 13. zinc sulphide |
| 7. copper (II) hydroxide | 14. magnesium carbonate |

C. Write the correct name for each compound.

- | | |
|---------------------------------|---------------------------------|
| 1. Al_4C_3 | 9. Co_2O_3 |
| 2. IBr | 10. CoO |
| 3. $\text{Fe}_3(\text{PO}_4)_2$ | 11. FeF_2 |
| 4. PbCrO_4 | 12. GeCl_4 |
| 5. MgO | 13. Au_2O_3 |
| 6. SbCl_5 | 14. $\text{Ni}(\text{ClO}_4)_2$ |
| 7. As_2O_3 | 15. HgSO_4 |
| 8. BaH_2 | 16. KI |