

Part A – Monatomic Binary Ionic Compounds

	Learning Targets	I CAN
1	Define Nomenclature and explain why it is important.	
2	Recall the basic concepts of ionic bonding.	
3	Locate the metalloid line and determine if an element is a metal or a non-metal.	
4	Define Monatomic Binary Ionic Compounds.	
5	Write and name Monatomic Binary Ionic Compounds.	
6	Determine the formula of an ionic compound from analyzing its name.	

Part B – Binary Ionic Compounds with Transition Metals

7	Determine if a metal is an alkaline metal or a transition metal.	
8	Locate transition metals on the periodic table and acknowledge that they have various charges.	
9	Explain how Roman Numerals are used when determining the charge on a transition metal.	
10	Write formulas for Binary Ionic compounds with transition metals and name them.	
11	Determine the Name of Binary Ionic Compounds with Transition metals when given the formula.	
12	Determine the Formula of Binary Ionic Compounds with Transition metals when given the name.	

Part C- Polyatomic Binary Ionic Compounds

13	Define polyatomic ions, monatomic ions, and locate polyatomic ions on the chart.	
14	Distinguish between monatomic binary compounds and polyatomic binary compounds.	
15	Interpret the meaning of a subscript written outside of parentheses.	
16	Write formulas for compounds containing polyatomic ions.	
17	Name compounds containing polyatomic ions.	
18	Determine the charges on the elements of a compound by analyzing the formula or name.	
19	Use the nomenclature flow chart to identify compounds and their names.	
20	Describe the properties of all ionic compounds	

Part D – Covalent Binary Compounds

21	Recall basic facts about covalent bonds.	
22	Distinguish between a covalent compound and molecular compound.	
23	Name binary covalent compounds .	
24	Determine the formula of a covalent compound when given the name.	
25	Determine if a compound is ionic or covalent.	
26	Compare and contrast ionic bonds and covalent bonds.	
27	Use the nomenclature flow chart to identify compounds and their names.	

Part A – Monatomic Binary Ionic Compounds

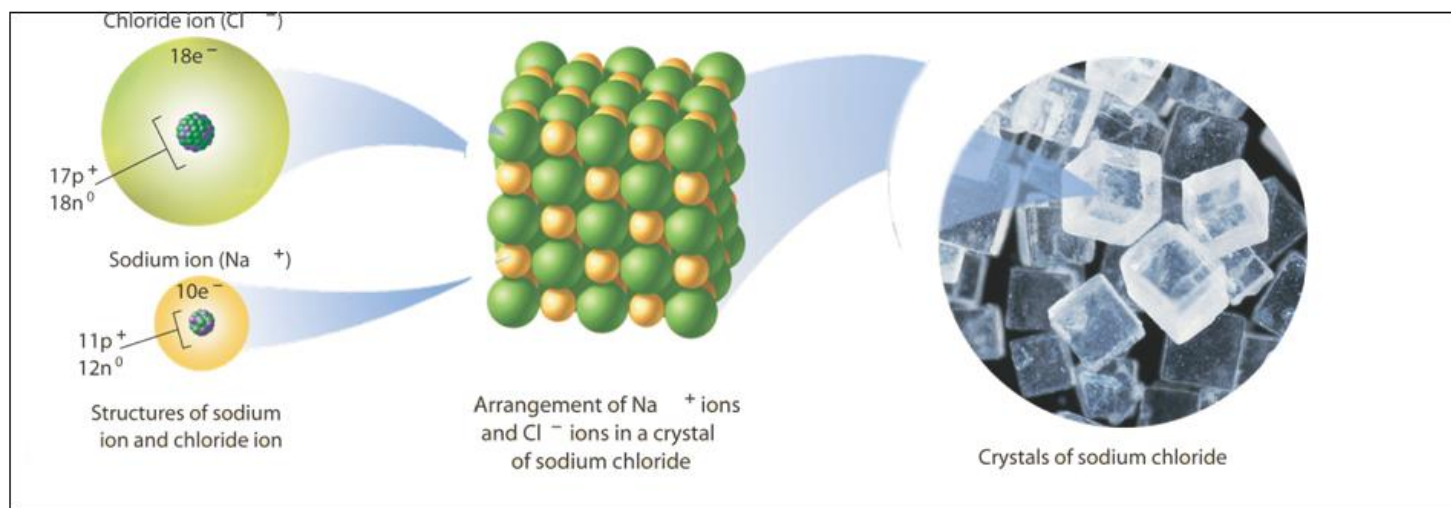
Nomenclature	Compound	Atom	Element	Proton	Neutron
Electron	Chemistry	Octet rule	Criss cross method	Binary compound	Valence electron
Stable	Metal	Non-metal	Charge	Ionic bond	Ionic compound
Ion	Cation	Anion	Octet	Overall charge	salt
Superscript	Subscript	Noble gas	Metalloid line	Monatomic	suffix

Target 1 - Define Nomenclature and explain why it is important.

- A. Nomenclature – method for determining the _____ of a compound.
- B. Since atoms (elements) can form millions of different compounds, a proper naming system is needed.
- C. Chemistry is complicated and requires a learned language.
- D. In order to communicate the various ways in which elements combine to form compounds, humans have developed chemical _____.
- E. Nomenclature is important because humans need a way to communicate chemistry to each other (spoken and written)

Target 2 - Recall the basic concepts of ionic bonding.

- A. Atoms with a charge are called _____ – cations are positive and anions are negative.
- B. Ions of opposite charge will attract each other and form an ionic bond.
- C. Ionic bonds have ___ parts – a cation and an anion.
- D. Compounds that have 2 parts to them are called _____ compounds (bi =2)
- E. Ionic bonding – force of attraction that holds ions together due to opposite charges.
- F. When ions come together to form ionic bonds, they form ionic _____.
- G. Ionic compounds are formed by metals (+) and non-metals (-).
- H. When ionic compounds form, the overall charge of the compound will always be _____.
- I. Ionic compounds are also called “_____.”
- J. Ionic compounds are also called binary compounds (bi = 2; cation and anion)



☺ Questions

1. What is a cation? _____
2. What is an anion? _____
3. What do you know about ions with opposite charges? _____
4. What is an ionic compound? _____
5. What is a salt? _____
6. What is the difference between a salt and an ionic compound? _____
7. What is a binary compound? _____

Target 3 - Locate the metalloid line and determine if an element is a metal or a non-metal.

- A. The metalloid line is the _____ line that is located to the right of the periodic table.
- B. Elements to the left of the metalloid line are metals.
- C. Elements to the right of the metalloid line are _____.

	Element	Symbol	Metal or Non		Element	Symbol	Metal or Non
1	Sulfur			6		F	
2	Sodium			7		Cu	
3	Oxygen			8		K	
4	Phosphorus			9		I	
5	Tungsten			10		Fe	

Target 4 – Define Monatomic Binary Ionic Compounds

- The phrase “monatomic binary ionic compound” can sound _____.
- These terms must be broken down.
- Mono – refers to the number “_____.”
- Atomic – refers to an atom
- Binary – refers to 2 things connected
- Ionic – refers to atoms with a _____
- Compound – refers to atoms that are bonded together.
- So a monatomic binary compound is when 2 ions of different _____ bond together.
- For example, NaCl is monatomic binary ionic compound; it has 2 individual ions bonded together.

Target 5 – Write and name Monatomic Binary Ionic Compounds

- Binary ionic compounds are _____ that contain 2 parts.
 - Cation
 - Anion
- Example: Sodium chloride contains 2 parts and therefore is a binary ionic compound (NaCl)
- Writing binary ionic compounds – there are 2 simple rules.
 - The _____ is always written **first**.
 - The anion is always written _____.
- Naming binary ionic compounds – there are 2 simple rules.
 - Say the name of the cation – by its exact name
 - Say the name of the anion, but add “_____” as a suffix.
- Example: NaCl – this compound is called Sodium chloride.

Complete the chart – underneath each symbol, write “metal” or “non-metal”

	Element	Element	Formula	Name	Charge on Compound
1	Li	Cl			
2	Li	O			
3	Ca	Cl			
4	Mg	S			

5	Mg	N			
6	Mg	O			
7	Li	F			
8	Na	S			

Target 6 – Determine the formula of an ionic compound from analyzing its name.

Notes

☺ Questions

1. List 3 facts about ionic compounds.

2. What is a binary ionic compound? _____

3. List the cation and the anion Sodium Chloride. _____

4. Why does the word “chloride” appear when naming this compound (NaCl)?

Part B – Ionic Binary Compounds with Transition metals

Alkaline metal	Transition metal	Periodic table	Roman Numeral	Formula
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Target 7 – Determine if a metal is an alkaline metal or a transition metal.

A. Alkaline metals are located in the “s” block.

B. Transition metals are located in the “d” block.

	Element	Symbol	Alkaline or trans		Element	Symbol	Alkaline or trans
1	Calcium			6		U	
2	Cobalt			7		Li	

3	Gold			8		W	
4	Magnesium			9		Sr	
5	Nickel			10		Cs	

Target 8 - Locate transition metals on the periodic table and explain why they can have various charges.

- A. So far we have dealt with ionic compounds involving basic alkali metals – _____.
- B. Remember from earlier that _____ metals are those elements in the center of the periodic table containing “d” orbitals.
- C. Transition metals will form ionic compounds too.
- D. Because transition metals have d orbitals, they are not always _____.
- E. Each transition metal can have a couple of different charges.
- F. For example, Iron can have 2 different charges _____.

Target 9 – Explain how Roman Numerals are used when determining the charge on a transition metal.

- A. A Roman numeral will indicate the _____ on a transition metal.
- B. Example: Copper can have a +1 charge OR a +2 charge.
- C. A transition metal’s charge is always written as a Roman numeral in _____.
- D. Example: Copper (II) has a ____ charge
- E Example: Copper (I) has a +1 charge
- F. To keep matters simple, we will just learn the charges on some common transition metals. Learning the rules and why are not part of this course.

WRITE THESE ON YOUR PERIODIC TABLE.

Cu	Fe	Co	Mn	Au	Pb	Sn	Cr	Pt	Ti	Ni	Ag	W	V	U
+1	+2	+2	+2	+1	+2	+2	+2	+2	+3	+2	+1	+4	+4	+5
+2	+3	+3	+3	+3	+4	+4	+3	+4	+4	+3	+2	+5	+5	+6

Roman Numerals 1-10

1	2	3	4	5	6	7	8	9	10

	Symbol	Element	Charge	Roman Numeral	Symbol	Element	Charge	Roman Numeral
1	Pb (II)				Pb(IV)			
2	Mn(III)				Mn(II)			
3	Sn (II)				Sn(IV)			

Target 10 - Write formulas for binary ionic compounds with transition metals and name them.

Complete the chart – underneath each symbol, write “metal” or “non-metal”

	Element	Element	Charges	Formula	Name	Charge on compound
1	Pb (II)	F				
2	Mn(III)	Cl				
3	Sn (II)	O				
4	U (VI)	Cl				
5	V (IV)	I				
6	Ni(III)	N				
7	Au(III)	Cl				
8	Pb(IV)	S				

Target 11 – Determine the Name of Binary Ionic Compounds with Transition metals when given the formula.**Reverse criss cross**

	Formula	Charge on transition metal	Name
1	MnCl₂		
2	MnF₃		
3	AuCl₃		
4	UF₅		
5	Pb₃N₂		
6	CuF		
7	Cr₃P₂		
8	W₃N₅		

Target 12 – Determine the Formula of Binary Ionic Compounds with Transition metals when given the name.

	Name	Charges on ions	Formula
1	Iron (II) Oxide		
2	Iron (III) Oxide		
3	Manganese (II) Fluoride		
4	Manganese (III) Fluoride		
5	Lead (II) Phosphide		
6	Lead (IV) Phosphide		
7	Gold (III) Sulfide		
8	Silver (II) Chloride		

Part C - Polyatomic Binary Ionic Compounds

Polyatomic ion	Bleach	Conductor	Properties	Brittle
Sock	Covalent bond	Covalent compound	Molecular compound	Prefix

Target 13- Define Polyatomic Binary Compound and locate polyatomic ions on the chart.

- Remember from earlier that an element with a charge is called an ion.
- Also remember that a compound is a substance where 2 or more elements are _____.
- Compounds can have charges too – these are called _____.
- Polyatomic ion – Compound with a charge (positive or negative).
- Example: Phosphate is common polyatomic ion. Phosphate has the formula PO_4 and a charge of -3
- Phosphate is commonly written like this: _____
- Notice the superscript and the subscript.
- Many compounds in _____ natural world are found as polyatomic ions.
- You will be given a chart of all of the _____ polyatomic ions.
- Polyatomic binary compound – Compound that contains 2 parts – usually a metal and a polyatomic ion.



☺ Questions

1. What is a compound? _____
2. What is a polyatomic ion? _____
3. How is a polyatomic ion different from a monatomic ion? _____
4. What is the formula for phosphate? _____
5. What is a superscript? _____
6. What is a subscript? _____
7. If you need information about polyatomic ions, where should you look? _____
8. What is a polyatomic binary compound? _____

Target 14 – Distinguish between monatomic binary compounds and polyatomic binary compounds.

- A. Monatomic binary compounds will have only 2 elements – at cation and an anion.
- B. Polyatomic binary compounds will have more than 2 elements – yet still have a cation and an anion.

Complete this chart -

	#Elements	Mono or poly		#Elements	Mono or poly		#Elements	Mono or poly
AuCl ₃			BaSO ₄			Be ₃ (PO ₄) ₂		
Pb(C ₂ H ₃ O ₂) ₂			MnCl ₂			Cu(PO ₄) ₂		
Pb ₃ N ₂			MnF ₃			CuF		
Mn(C ₂ O ₄) ₃			Cu(NO ₃) ₂			Ba (NO ₃) ₂		
KMnO ₄			UF ₅			Pb ₃ (C ₂ O ₄) ₃		

Target 15 - Interpret the meaning of a subscript written outside of parentheses.

- A. In order to understand polyatomic compounds, you must learn how to interpret subscripts written outside of parentheses.
- B. To determine the final charge of a polyatomic ion with a subscript, you multiply the charge (superscript) by the subscript.
- C. These are best learned by doing.

	Name of polyatomic ion	Formula of polyatomic ion	Charge	Subscript	Write it	Number of ions	Final charge
1	Chlorate			2			
2	Hydroxide			2			
3	Cyanide			3			
4	Azide			4			
5	Sulfite			2			
6	Peroxydisulfate			3			

7	Phosphate			2			
8	Sulfate			1			

Target 16 - Write formulas for compounds containing polyatomic ions.

- A. Remember that ionic compounds are formed when 2 or more _____ are bonded together (salts).
- B. Ionic compounds can be formed with polyatomic ions.
- C. Example: Chlorate has the formula of _____ and a charge of -1
1. Chlorate would be written like this : ClO_3^{-1}
 2. Notice the superscript and the subscript.
 3. Also remember that the _____ is always first.
 4. If you were to combine Magnesium (+2) and Chlorate (-1) the formula would be

Notes

Target 17 - Name compounds containing polyatomic ions

- A. Naming polyatomic compounds are easy.
1. Say (or write) the name of the cation.
 2. Say (or write) the name of the anion.
- B. Example: NaClO_3
1. The cation is Sodium
 2. The anion is Chlorate
 3. The name of this compound is Sodium chlorate.
- C. Bleach: Bleach is common household chemical that is used for removing color and whitening clothing. Bleach also kills germs and is useful for cleaning kitchens and bathrooms.
- D. Bleach is really a mixture of water and Sodium Hypochlorite (NaClO)

© Questions

1. What is the cation for bleach _____
2. What is the anion for bleach? _____
3. What kind of mixture is bleach? _____

	Cation	Anion	Formula of Compound	Name	Charge on compound
1	Mg	ClO_3			
2	Ca	S_2O_3			
3	B	PO_4			
4	Al	HCO_3			
5	Li	ClO_3			
6	Ca	NO_2			

Target 18 – Determine the charges on the elements of a compound by analyzing the formula or name.

Notes – reverse Criss Cross

Target 19 – Use the nomenclature flow chart to identify compounds and their names.

- A. Flow chart is on the back side of your polyatomic ions chart.
- B. Your flow chart will be available to you during a test – do a good job creating it.

Target 20 - Describe the properties of all ionic compounds

- A. Ionic compounds form _____ when in solid form. *Ask about extra credit opportunities.*
- B. Ionic compounds have high melting temperatures (some at 800 °C)
- C. Ionic compounds will conduct electricity when melted or _____ in water.
- D. Ionic compounds, in solid form, are _____.

Part D – Covalent Binary Compounds

Target 21 - Recall basic facts about covalent bonds.

- A. _____ are not limited to bonds formed by metals and non-metals.
- B. On many occasions, non-metals will bond with other non-metals. (Oxygen bonds with Nitrogen)
- C. In a covalent bond, atoms will _____ electrons to complete the octet.
- D. Covalent Bond – A bond formed by the sharing of electrons between atoms – usually non-metals.
- E. Even though hydrogen is placed in group 1 with (alkali metals), it has behaviors similar to the elements in group 7 (_____).
- F. Therefore, in most cases, Hydrogen has properties of a _____.

Target 22 - Distinguish between a covalent compound and molecular compound.

- A. Covalent compound – Compound that is held together by covalent bonds.
- B. Molecular compound – Compound that is held together by covalent bonds.
- C. In other words, a covalent compound and a molecular compound are the _____.

Target 23- Name binary covalent compounds.

- A. Binary compound – (bi =2) a compound that contains _____ different parts.
- B. Prefix - description that comes before a word or symbol. For example, “tri” is the prefix in tricycle.
- C. A prefix in the name of a _____ covalent compound tells how many atoms are present in each molecule of a compound.
- D. There are 4 simple rules to remember**
 1. Check to see if the compound is molecular and contains only non-metals.
 2. If the first element in the compound has only 1 atom, the prefix of “mono” is not used.
 3. In all other cases, each element will receive a prefix.
 4. The second element in a binary covalent compound will always receive an ending of “ide” (suffix)

Chemical prefixes

Prefix	Mono	Di	Tri	Tetra	Penta	Hexa	Hepta	Octa	Nona	deca
Number	1	2	3	4	5	6	7	8	9	10

	Formula	Name
1	CO	
2	CO₂	
3	N₂O₃	
4	SF₆	
5	SiF₄	
6	NCl₃	
7	BCl₃	
8	N₂H₄	
9	N₂O₃	
10	CS₂	
11	Cl₂O₇	
12	N₂O₅	
13	CCl₄	
14	Cl₂O	
15	SiO₂	
16	PI₃	

Target 24 - Determine the formula of a covalent compound when given the name.

	Name	Formula
1	Iodine tribromide	
2	Oxygen difluoride	
3	Chlorine dioxide	
4	Hydrogen moniodide	
5	Dinitrogen trioxide	
6	Disulfur hexachloride	
7	Pentaphosphorus hexafluoride	
8	Iodine pentafluoride	
9	Tetraphosphorus decoxide	
10	Carbon disulfide	
11	Disulfur dichloride	
12	Carbon tetrachloride	
13	Diphosphorus trioxide	
14	Iodine trifluoride	

Not all covalent compounds (molecular compounds) follow the simple rules as discussed in class. To further your understanding, you might explore the properties of “coordinate covalent bonding” **discussed on pages ----

☺ Questions

1. What is a binary compound? _____
2. When is the prefix “mono” not used? _____
3. What kinds of compounds are listed on this worksheet? _____
4. How can you tell if a compound is ionic or covalent?

5. What is water’s real name? _____
6. Do all covalent compounds follow the rules discussed in class? _____
7. Where should you look if you want to learn more? _____

Target 25 – Determine if a compound is ionic or covalent.

	Ionic or cov		Ionic or cov		Ionic or cov
MgCl ₂		Fe ₂ O ₃		P ₂ O ₅	
NO		SF ₆		CoI ₂	
AlF ₃		CaCl ₂		Al ₂ S ₃	
P ₂ Cl ₃		KMnO ₄		S ₂ F ₄	
Na ₂ SO ₄		PCl ₃		P ₃ Cl ₈	

Target 26 - Compare and contrast ionic bonds and covalent bonds.

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Target 27 - Use the nomenclature flow chart to identify compounds and their names.

- A. Flow chart is on the back side of your polyatomic ions chart.
- B. Your flow chart will be available to you during a test.

	Formula	Name
1	MgCl₂	
2	FeCl₂	
3	FeCl₃	
4	Mg (NO₃)₂	
5	Na₂ SO₄	
6	NO	
7	N₂O	
8	AlF₃	
9	Fe₂ C₂H₃O₂	
10	P₂Cl₃	

Below this point is extra stuff and probably not necessary

Objective 14 - Write/recognize formulas for matter and give a specific atom count (this might not be necessary until chemical reactions)

	Name	Formula	Specific atom count	Total number of atoms
1	Water	H ₂ O		
2	Sugar (glucose)	C ₆ H ₁₂ O ₆		
3	Carbon dioxide	CO ₂		
4	Salt	NaCl		

Add covalent bonding reminders, formulas, naming, done....

Extras for ionic/criss cross method

Practice

	Cation	Charge	Anion	Charge	Symbols with superscripts	Formula	Overall charge
1	Mg		F				
2	Li		S				
3	K		O				
4	Ca		F				
5	B		F				
6	Mg		Cl				
7	K		P				
8	Na		Cl				
9	Be		S				
10	Mg		P				

☺ Questions

1. What causes an ionic bond? _____
2. What is a cation? _____
3. What is an anion? _____
4. What is a superscript? _____
5. What is a subscript? _____

3. transition metals and bonding
4. Polyatomics
5. Mixture of all of them – introduce the chart thing
6. Recap what covalent bonding is
7. formulas and nomenclature
8. all together