

Ionic and Covalent Compounds

National Science Education Standards

PS 1a, 1b

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What are ionic compounds?
- What are covalent compounds?

What Are Ionic and Covalent Compounds?

Many things are made of combinations of elements called *compounds*. Sugar, salt, gasoline, and chalk are all compounds. They have atoms of more than one element joined together. How are the compounds alike and how are they different?

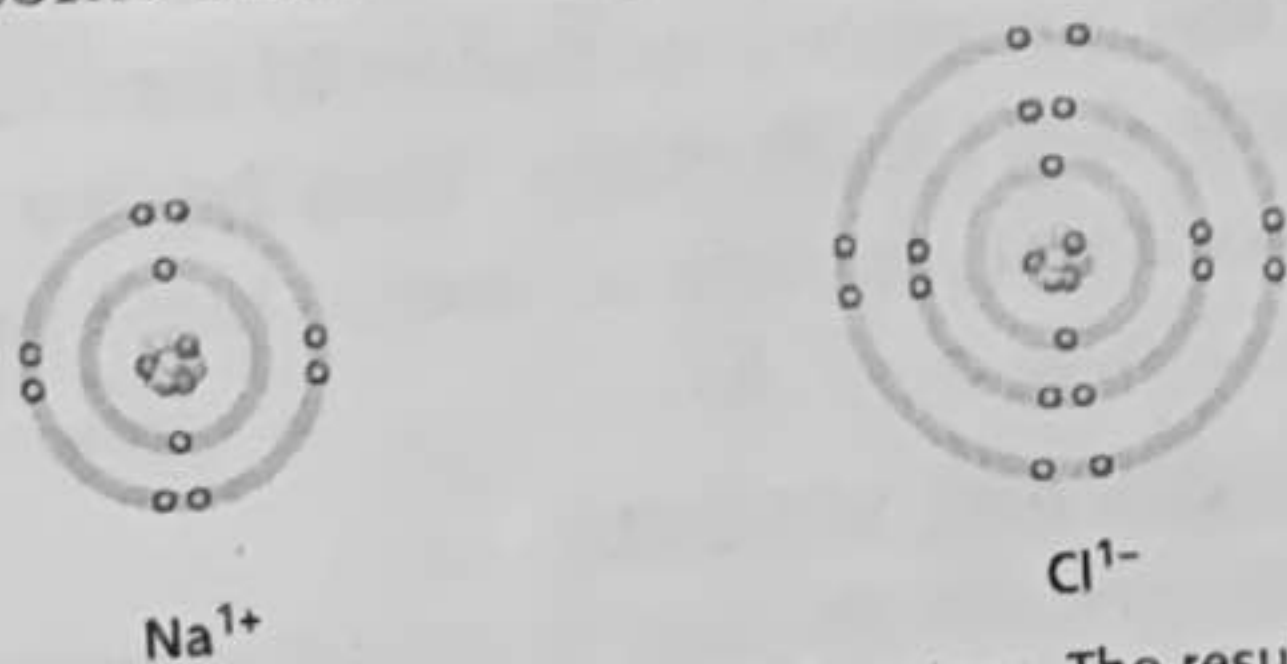
Scientists *classify*, or group, chemical compounds by the kinds of chemical bonds they have. A **chemical bond** joins atoms together to form compounds. The compounds are grouped by their bonding as either *ionic* or *covalent*.

Bonding happens between valence electrons of different atoms. *Valence electrons* are electrons in the outermost energy level of an atom. The type of compound that forms depends on what happens to the valence electrons. ✓

What Makes a Compound Ionic?

An ionic bond is an attraction between ions that have opposite charges. Compounds that have ionic bonds are called **ionic compounds**.

Ionic compounds can be formed by the chemical reaction between a metal and a nonmetal. Metal atoms become positively charged ions when electrons move from the metal atoms to the nonmetal atoms. The nonmetal atoms become negatively charged ions. ✓



A sodium atom has lost an electron to a chlorine atom. The result is a positively charged sodium ion and a negatively charged chlorine ion. The attraction of the ions is called an ionic bond.

STUDY TIP

Work in Pairs Make flash cards with all of the vocabulary words in this section. Also make flash cards of the words in *italics* in this section.

On the other side of the card, write the definition of the word. Practice saying the words and their definitions.

READING CHECK

1. **Identify** What determines the type of compound that forms when atoms bond?

what happens to the valence electrons

READING CHECK

2. **Describe** What kind of ions do metals form? What kind of ions do nonmetals form?

metals → cation (+)
nonmetals → anion (-)

SECTION 1 Ionic and Covalent Compounds *continued***What Are the Properties of an Ionic Compound?**

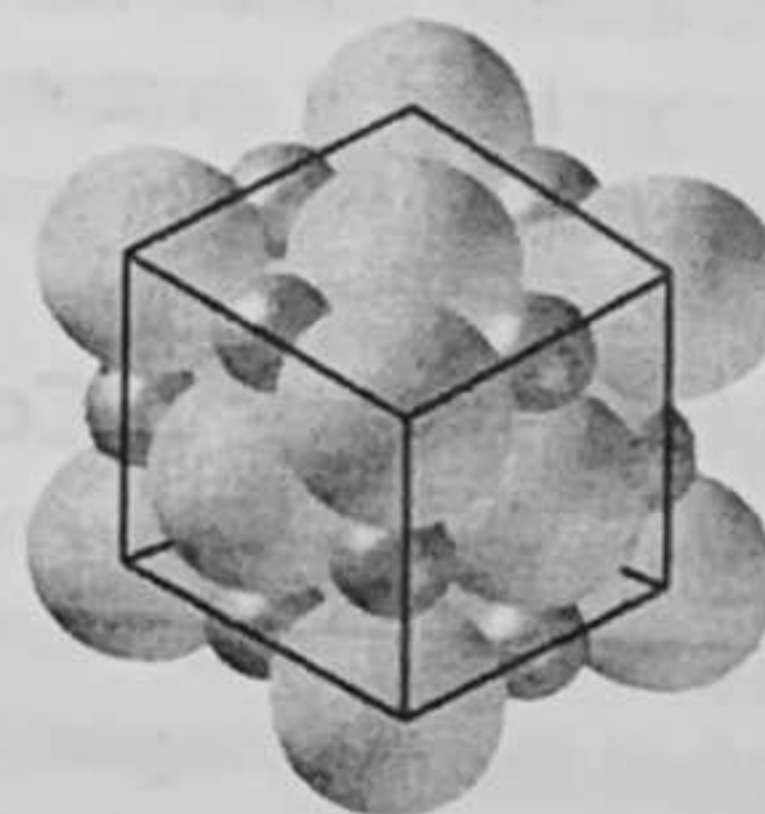
Ionic compounds form strong bonds because of the attraction between oppositely charged ions. There are several properties that tell you a compound is ionic.

IONIC COMPOUNDS ARE BRITTLE

Ionic compounds tend to be brittle at room temperature. That means they break apart when hit. They break because their ions are arranged in a pattern that happens over and over again. The pattern is called a *crystal lattice*. Each ion in a lattice bonds to the ions around it that have the opposite charge. ✓

When you hit an ionic compound, the ions move and the pattern changes. Ions that have the same charge line up and repel each other. That makes the crystals break.

Sodium chloride crystals (shown below) all have a regular cubic shape. The shape is due to the way sodium and chloride ions are arranged in the crystal lattice.



Sodium chloride crystals all have a regular cubic shape because of the way sodium and chloride ions are arranged.

IONIC COMPOUNDS HAVE A HIGH MELTING POINT

Because of the strong bonds that hold ions together, ionic compounds don't melt easily. They have a high melting point. For example, sodium chloride must be heated to 801°C before it will melt. ✓

IONIC COMPOUNDS ARE SOLUBLE

Many ionic compounds are highly *soluble* in water. That means they dissolve easily in water. Water molecules attract each of the ions of an ionic compound and pull them away from each other.

READING CHECK

3. Describe What is a crystal lattice?

the shape that ionic
compounds make
due to attractive /
repulsive charges

READING CHECK

4. Explain What causes ionic compounds to have high melting points?

the strong bonds that
holds an ionic
bond together

SECTION 1 Ionic and Covalent Compounds *continued***IONIC COMPOUNDS CONDUCT ELECTRICITY**

When an ionic compound dissolves in water, it forms a solution that can conduct an electric current. It conducts electricity because its ions are now free to move to complete an electric circuit. When ionic compounds are solids, their ions are not free to move. They will not conduct an electric current.

*electrolytes

What Makes A Compound Covalent?

Many of the compounds in your body are covalent compounds. **Covalent compounds** form when atoms share electrons. The bond that forms when atoms share electrons is called a *covalent bond*. Atoms share electrons to fill their outermost energy level. This forms a group of atoms, each having a full valence shell.

The group of atoms that make up a covalent compound is called a *molecule*. A molecule is the smallest particle that you can divide a compound into and still have the same compound. For example, if you break water down further, it isn't water anymore. It is hydrogen and oxygen.

What Are the Properties of Covalent Compounds?

The properties of covalent compounds are very different from the properties of ionic compounds. This table lists the properties of covalent compounds.

Properties of Covalent Compounds

Property	Description
Solubility in water	Some covalent compounds do not dissolve in water. For example, oil does not dissolve in water. When mixed with water, the water molecules stay together and the oil molecules stay together.
Melting point	Normally, covalent compounds have lower melting and boiling points than ionic compounds. This is due to weaker forces of attraction in a covalent compound than in an ionic compound.
Electrical conductivity	Most covalent compounds do not conduct electricity when dissolved in water. This is because most covalent compounds that dissolve in water form solutions that do not have ions.

are not soluble

low melting point

does not conduct

 READING CHECK

5. Explain Why do ionic compounds dissolved in water conduct an electric current?

ions are free to
move and complete
a circuit

STANDARDS CHECK

PS 1a A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of sample. A mixture of substances often can be separated into the original substances using one or more of the characteristic properties.

6. Identify Give three ways covalent compounds often differ from ionic compounds.

Solubility,
melting point,
conductivity

Name _____

Class _____

Date _____

NSES PS 1a, 1b

Section 1 Review

SECTION VOCABULARY

chemical bond an interaction that holds atoms or ions together

covalent compound a chemical compound that is formed by the sharing of electrons

ionic compound a compound made of oppositely charged ions

1. **Compare** How does the melting point of ionic compounds compare to that of covalent compounds?
ionic compounds have higher melting

2. **Make Inferences** Examine the table below. Use the information in the table to help you decide if the compound is ionic or covalent. Write *ionic* or *covalent* in the box next to each compound.

Compound	Property	Ionic or covalent
A	low melting point	C
B	smallest particle is a molecule	C
C	water solution conducts an electric current	I
D	high melting point	I

3. **Describe** Why do ionic compounds tend to be brittle?

ions shift and break due to repulsive forces

4. **Explain** Solid crystals of ionic compounds do not conduct an electric current. Why does the solution conduct electricity when the crystals dissolve in water?

ions are free to move to complete a circuit

5. **Describe** Describe how a metal and a nonmetal can combine by forming an ionic bond.

transfer of electrons from metal to non metal

Chemical Bonding

Ionic Bond	between a Metal and Non-Metal	(M + NM)
Covalent Bond	between a Non-Metal and Non-Metal	(NM + NM)
Metallic Bond	between a Metal and Metal	(M + M)

Determine if the elements in the following compounds are metals or non-metals. Describe the type of bonding that occurs in the compound.

Compound	Element 1 (metal or non-metal?)	Element 2 (metal or non-metal?)	Bond Type
NO ₂	N = non-metal	O = non-metal	covalent
NaCl	M	NM	I
SO ₂	NM	NM	C
PO ₄ ³⁻	NM	NM	C
MgBr ₂	M	NM	I
CaO	M	NM	I
H ₂ O	NM	NM	C
K ₂ O	M	NM	I
Cu-Zn alloy	M	M	M
O ₂	NM	NM	C
CuCl ₂	M	NM	I
NO ₂ ⁻	NM	NM	C
TiO ₂	M	NM	I
HF	NM	NM	C
Rb ₂ S	M	NM	I
Au-Ag mixture	M	M	M
Fe ₂ O ₃	M	NM	I
C ₆ H ₁₂ O ₂₂	NM	NM NM	C

Naming Molecular Compounds

How are the chemical formula and name of a molecular compound related?

Why?

When you began chemistry class this year, you probably already knew that the chemical formula for carbon dioxide was CO_2 . Today you will find out why CO_2 is named that way. Naming chemical compounds correctly is of paramount importance. The slight difference between the names carbon monoxide (CO , a poisonous, deadly gas) and carbon dioxide (CO_2 , a greenhouse gas that we exhale when we breathe out) can be the difference between life and death! In this activity you will learn the naming system for molecular compounds.

Model 1 – Molecular Compounds

Molecular Formula	Number of Atoms of First Element	Number of Atoms of Second Element	Name of Compound
ClF	1	1	Chlorine monofluoride
ClF_5	1	5	Chlorine pentafluoride
CO	1	1	Carbon monoxide
CO_2	1	2	Carbon dioxide
Cl_2O	2	1	Dichlorine monoxide
PCl_5	1	5	Phosphorus pentachloride
N_2O_5	2	5	Dinitrogen pentoxide

- Fill in the table to indicate the number of atoms of each type in the molecular formula.
- Examine the molecular formulas given in Model 1 for various molecular compounds.
 - How many different *elements* are present in each compound shown?
2
 - Do the compounds combine metals with metals, metals with nonmetals, or nonmetals with nonmetals?
nm w/ nm
 - Based on your answer to *b*, what type of bonding must be involved in molecular compounds?
covalent

3. Find all of the compounds in Model 1 that have chlorine and fluorine in them. Explain why the name "chlorine fluoride" is not sufficient to identify a specific compound.
we would not be able to tell the difference between them

- Assuming that the name of the compound gives a clue to its molecular formula, predict how many atoms each of these prefixes indicates, and provide two examples.

mono- 1
di- 2
penta- 5

Model 2 – Prefixes and Suffixes

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

Molecular Formula	Name of Compound
BCl_3	Boron trichloride
SF_6	Sulfur hexafluoride
IF_7	Iodine heptafluoride
NI_3	Nitrogen triiodide
N_2O_4	Dinitrogen tetroxide
Cl_2O	Dichlorine monoxide
P_4O_{10}	Tetraphosphorus decoxide
B_5H_9	Pentaboron nonahydride
Br_3O_8	Tribromine octoxide
ClF	Chlorine monofluoride

5. Examine the prefixes in Model 2. Fill in the numerical value that corresponds to each prefix.
6. What suffix (ending) do all the compound names in Model 2 have in common?

7. Carefully examine the names of the compounds in Model 2. When is a prefix NOT used in front of the name of an element?

-ide
first element, with just one

8. Consider the compound NO .

a. Which element, nitrogen or oxygen, would require a prefix in the molecule name? Explain your answer.

oxygen, second element

- b. Name the molecule NO .

nitrogen monoxide



9. Find two compounds in Model 2 that contain a subscript of "4" in their molecular formula.

a. List the formulas and names for the two compounds.

N_2O_4 → dinitrogen tetroxide, P_4O_{10} tetraphosphorus decoxide

b. What is different about the spelling of the prefix meaning "four" in these two names?

tetr vs tetra

10. Find two compounds in Model 2 that contain the prefix "mono-" in their names.

a. List the formulas and names for the two compounds.

Cl_2O → dichlorine monoxide
 ClF → chlorine monofluoride

b. What is different about the spelling of the prefix meaning "one" in these two names?

mon vs mono

11. Identify any remaining names of compounds in Model 2 where the prefixes that do not exactly match the spelling shown in the prefix table.

deca vs dec, oct vs octa

12. Use your answers to Questions 9–11 to write a guideline for how and when to modify a prefix name for a molecular compound. Come to a consensus within your group.

when the element is oxygen and the prefix ends with an o or a

13. Would the guideline you wrote for Question 12 give you the correct name for NI_3 as it is given in Model 2? If not, modify your guideline to include this example.

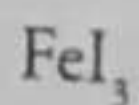
14. All of the compounds listed in Model 2 are binary molecular compounds. Compounds such as CH_3OH or PF_2Cl_3 are not binary, and compounds such as NaCl or CaCl_2 are not molecular. Propose a definition for "binary molecular compounds."

two elements, two nonmetals

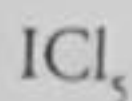
15. Collaborate with your group members to write a list of rules for recognizing and naming binary molecular compounds from their chemical formulas.



16. For each of the following compounds, indicate whether or not your naming rules from Question 15 will apply. If not, explain why the naming rules do not apply.



NO
→ ionic



yes



NO → Ionic

17. Using the rules your group developed in Question 15, name each of the following molecular compounds.

Molecular Formula	Molecule Name
PBr_3	phosphorus tribromide
SCl_4	sulfur tetrachloride
N_2F_2	dinitrogen difluoride
SO_3	sulfur trioxide
BrF	bromine monofluoride

18. Write molecular formulas for the following compounds.

Molecular Formula	Molecule Name
S_2F_{10}	Disulfur decafluoride
CCl_4	Carbon tetrachloride
OF_2	Oxygen difluoride
N_2O_3	Dinitrogen trioxide
P_4S_7	Tetraphosphorus heptasulfide



Covalent Compounds

- CO₂ 1. carbon dioxide
- N₂O₅ 2. dinitrogen pentoxide
- P₂O₅ 3. diphosphorus pentoxide
- N₂O 4. dinitrogen monoxide
- N₂O₄ 5. dinitrogen tetroxide
- PO₅ 6. phosphorus pentoxide
- CCl₄ 7. carbon tetrachloride
- P₄O₁₀ 8. tetraphosphorus decoxide
- S₂O₃ 9. disulfur trioxide
- CS₂ 10. carbon disulfide
- SO₂ 11. sulfur dioxide
- BF₃ 12. Boron trifluoride
- PO₂ 13. phosphorus dioxide
- SiCl₄ 14. silicon tetrachloride

C. NmNm

- 1) Name of 1st element (with prefix if more than one atom)
- 2) prefix for number of atoms- root of nonmetal name -ide ending

mon(o)- 1	tri- 3	penta-5	hepta-7	nona-9
di- 2	tetra- 4	hex(a)- 6	octa-8	deca-10

ex. N_2O dinitrogen monoxide; NO_2 nitrogen dioxide

Name the following:

1. SO_3 sulfur trioxide
2. $AsCl_3$ arsenic trichloride
3. N_2O_3 dinitrogen trioxide
4. P_2O_5 diphosphorus pentoxide
5. $GeCl_4$ germanium tetrachloride
6. XeF_6 xenon hexafluoride
7. SF_4 sulfur tetrafluoride
8. NO_3 nitrogen trioxide
9. SiO_2 silicon dioxide
10. CO carbon monoxide

Write formulas for the following:

11. Sulfur dioxide SO_2
12. Phosphorous trichloride PCl_3
13. Nitrogen monoxide NO
14. Carbon tetrafluoride CF_4
15. Dinitrogen pentoxide N_2O_5
16. Sulfur trioxide SO_3
17. Carbon monoxide CO
18. Phosphorous pentachloride PCl_5
19. Arsenic tribromide $AsBr_3$
20. Nitrogen triiodide NI_3

Lewis Structures Classwork

	Molecule	Lewis Structure	Bonded Atoms	Lon. Pairs	Shape	R/NP
1.	SeH_2 $6 + (1 \times 2)$ $= 8 \text{ ve}^-$		2	2	Bent	P
2.	BF_3 $3 + (7 \times 3)$ $= 24 \text{ ve}^-$		3	0	trigonal planar	NP
3.	H_2O $1 + (6)$ $= 8 \text{ ve}^-$		2	2	bent	P
4.	CCl_4 $4 + (7 \times 4)$ $= 32 \text{ ve}^-$		4	0	tetrahedral	NP
5.	NH_3 $5 + 3$ $= 8 \text{ ve}^-$		3	1	trigonal pyramidal	P
6.	AsF_5 $5 + (7 \times 5)$ $= 40 \text{ ve}^-$		5	0	trigonal bipyramidal	NP
7.	NH_2^- $5 + 2 + 1$ 8 ve^-		2	2	Bent	P

	Molecule	Lewis Structure	Bonded Atoms	Lone Pairs	Shape	P/NP
8.	CO ₂ 4 + (6 × 2) = 16 ve ⁻	$\ddot{O} = C = \ddot{O}$	2	0	linear	NP
9.	NO ₃ ⁻ 5 + (6 × 3) + 1 = 24 ve ⁻	$\left[\begin{array}{c} \ddot{O} \\ \\ \ddot{O} - N = \ddot{O} \\ \\ \ddot{O} \end{array} \right]^{-1} \leftrightarrow \left[\begin{array}{c} \ddot{O} \\ \\ \ddot{O} - N - \ddot{O} \\ \\ \ddot{O} \end{array} \right]^{-1} \leftrightarrow \left[\begin{array}{c} \ddot{O} \\ \\ \ddot{O} = N - \ddot{O} \\ \\ \ddot{O} \end{array} \right]^{-1}$	3	0	trigonal planar	NP
10.	HCN 1 + 4 + 5 = 10 ve ⁻	H - C ≡ N:	2	0	linear	P
11.	Gal ₃ 3 + (7 × 3) = 24 ve ⁻	$\begin{array}{c} \text{:I:} \\ \\ \text{Ga} \\ \\ \text{:I:} \\ \text{:I:} \end{array} \leftrightarrow \begin{array}{c} \text{:I:} \\ \\ \text{Ga} \\ \\ \text{:I:} \\ \text{:I:} \end{array} \leftrightarrow \begin{array}{c} \text{:I:} \\ \\ \text{Ga} \\ \\ \text{:I:} \\ \text{:I:} \end{array}$	3	0	trigonal planar	NP
12.	SO ₃ 6 × 4 = 24 ve ⁻	$\begin{array}{c} \text{:O:} \\ \\ \text{S} \\ \\ \text{:O:} \\ \text{:O:} \end{array} \leftrightarrow \begin{array}{c} \text{:O:} \\ \\ \text{S} \\ \\ \text{:O:} \\ \text{:O:} \end{array} \leftrightarrow \begin{array}{c} \text{:O:} \\ \\ \text{S} \\ \\ \text{:O:} \\ \text{:O:} \end{array}$	3	0	trigonal planar	NP
13.	CO ₃ ²⁻ 4 + (6 × 3) + 2 = 24 ve ⁻	$\left[\begin{array}{c} \text{:O:} \\ \\ \text{C} \\ \\ \text{:O:} \\ \text{:O:} \end{array} \right]^{-2} \leftrightarrow \left[\begin{array}{c} \text{:O:} \\ \\ \text{C} \\ \\ \text{O} \\ \\ \text{:O:} \end{array} \right]^{-2} \leftrightarrow \left[\begin{array}{c} \text{:O:} \\ \\ \text{C} \\ \\ \text{:O:} \\ \text{:O:} \end{array} \right]^{-2}$	3	0	trigonal planar	NP
14.	NCl ₃ 5 + 21 = 26	$\begin{array}{c} \text{:Cl:} \\ \\ \text{N} \\ \\ \text{:Cl:} \\ \text{:Cl:} \end{array}$	3	1	trigonal pyramidal	P

3

			Bonded Atoms	Lone Pairs	Shape	P/NP
15.	CS ₂ 4 + (6 × 2) 16 val ⁻	$\text{:S}=\text{C}=\text{S:}$	2	0	linear	NP
16.	HOCl 1 + 6 + 7 14 val ⁻	$\text{H}-\ddot{\text{O}}-\ddot{\text{Cl}}:$	2	2	Bent	P
17.	PH ₃ 5 + 3 = 8	$\text{H}-\ddot{\text{P}}-\text{H}$ H	3	1	trigonal pyramid	P
18.	SF ₆ 6 + 7(6) 48 val ⁻		6	0	octahedral	NP
19.	SO ₃ ²⁻ 6 + (6 × 3) + 2 26 val ⁻	$\left[\begin{array}{c} \text{:}\ddot{\text{O}}\text{:} \\ \\ \text{:}\ddot{\text{S}}\text{:} \\ \\ \text{:}\ddot{\text{O}}\text{:} \end{array} \right]^{-2}$	3	1	trigonal pyramid	P
20.	SF ₄ 6 + (7 × 4) 34 val ⁻		4	1	see saw	P
21.	ICl ₂ ⁺ 7 + (7 × 2) + 1 22 val ⁻	$\left[\text{:}\ddot{\text{Cl}}-\ddot{\text{I}}-\ddot{\text{Cl}}\text{:} \right]^{+}$	2	3	linear	P

	Molecule	Lewis Structure	Bonded Atoms	Lone Pairs	Shape	P/NP
22.	PCl_2F_3 $5 + (7 \times 5)$ 40ve^-		5	0	trigonal bipyramid	P
23.	SF_2 $6 + (7 \times 2)$ 20ve^-		2	2	bent	P
24.	XeF_4 $8 + (7 \times 4)$ $8 + 28$ $= 36 \text{ve}^-$		4	2	square planar	P

Nomenclature Review Worksheet
Honors Chemistry

Name: _____

I. Binary Compounds

A. Metal-Nonmetal

- 1) name of 1st element
- 2) root of name of 2nd element with -ide ending

Ex. CaO calcium oxide
K₂S potassium sulfide

Name the following:

Write formulas for the following
(Write the ions and crisscross!)

- | | |
|--|--|
| 1. NaF <u>sodium fluoride</u> | 11. Aluminum chloride <u>AlCl₃</u> |
| 2. K ₂ O <u>potassium oxide</u> | 12. Lithium sulfide <u>Li₂S</u> |
| 3. LiBr <u>lithium bromide</u> | 13. Calcium phosphide <u>Ca₃P₂</u> |
| 4. CaCl ₂ <u>calcium chloride</u> | 14. Barium fluoride <u>BaF₂</u> |
| 5. BaS <u>barium sulfide</u> | 15. Potassium oxide <u>K₂O</u> |
| 6. BaF ₂ <u>barium fluoride</u> | 16. Sodium bromide <u>NaBr</u> |
| 7. Na ₂ S <u>sodium sulfide</u> | 17. Barium nitride <u>Ba₃N₂</u> |
| 8. MgI ₂ <u>magnesium iodide</u> | 18. Lithium oxide <u>Li₂O</u> |
| 9. K ₃ N <u>potassium nitride</u> | 19. Aluminum oxide <u>Al₂O₃</u> |
| 10. BeSe <u>beryllium selenide</u> | 20. Rubidium iodide <u>RbI</u> |

B. Transition Metal-Nonmetal

- 1) name of Transition metal with Roman numeral
- 2) root of nonmetal with -ide ending

Ex. CuO copper (II) oxide
Fe₂O₃ Iron (III) oxide

Name the following:

1. CuCl copper (I) chloride

2. CuCl₂ copper (II) chloride

3. FeO Iron (II) oxide

4. MnS manganese (II) sulfide

5. Cr₂O₃ chromium (III) oxide

6. NiF₂ Nickel (II) fluoride

7. SnCl₄ Tin (IV) chloride

8. Ag₃P silver phosphide

9. ZnS zinc sulfide

10. Hg₂Cl₂ mercury (II) chloride

Write formulas for the following:

11. Mercury (II) sulfide HgS

12. Copper(II) nitride Cu₃N₂

13. Iron(III) bromide FeBr₃

14. Mercury(I) oxide Hg₂O

15. Silver fluoride AgF

16. Copper(II) oxide CuO

17. Chromium(III) oxide Cr₂O₃

18. Nickel(II) bromide NiBr₂

19. Tin (IV) sulfide SnS₂

20. Zinc oxide ZnO

- name the 2 parts (ion names)

Ex. NH_4Cl ammonium chloride
 $\text{Ca}(\text{NO}_3)_2$ calcium nitrate

Name the following:

Write the formulas for the following:

1. $(\text{NH}_4)_2\text{CO}_3$ ammonium carbonate

2. BaSO_4 barium sulfate

3. Li_2SO_3 lithium sulfite

4. CrPO_4 chromium (III) phosphate

5. $\text{NaC}_2\text{H}_3\text{O}_2$ sodium acetate

6. $\text{Ba}(\text{OH})_2$ barium hydroxide

7. $\text{Fe}(\text{NO}_3)_3$ Iron (III) nitrate

8. KCN potassium cyanide

9. SrCrO_4 strontium chromate

10. CaCr_2O_7 calcium dichromate

11. Aluminum sulfate

12. zinc nitrite

13. Magnesium chlorate

14. Sodium bicarbonate

15. Calcium hydroxide

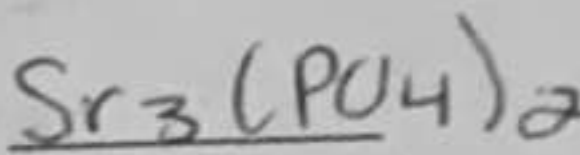
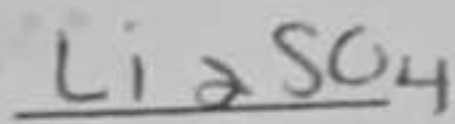
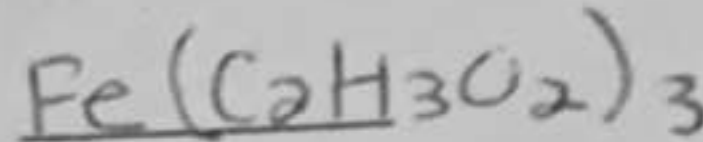
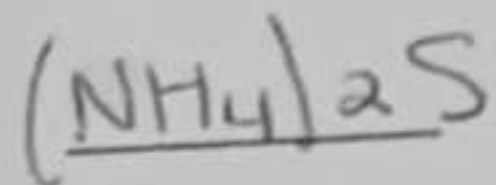
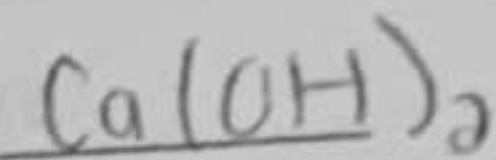
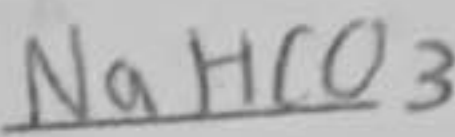
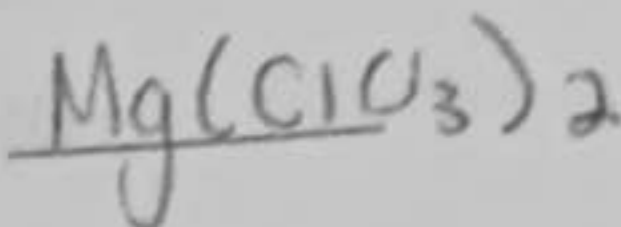
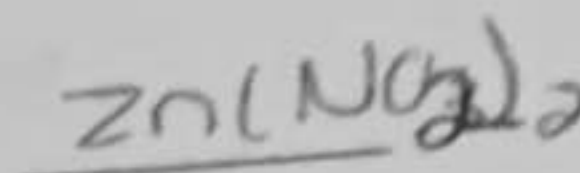
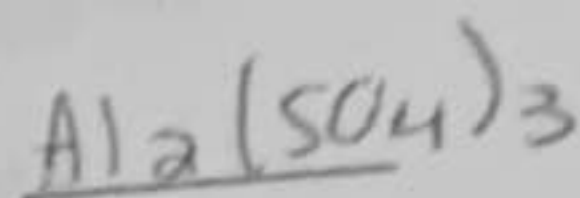
16. Copper (II) carbonate CuCO_3

17. Ammonium sulfide

18. Iron (III) acetate

19. lithium sulfate

20. Strontium phosphate



Mixed Compound Practice

Part I.

(1) Circle the Ionic Compounds (2) Write out the name for the following compounds.

1. NaCl sodium chloride

2. MnS manganese (II) sulfide

3. K_2O potassium oxide

4. CuBr_2 copper (II) bromide

5. CuBr copper (I) bromide

6. CO_2 carbon dioxide

7. PbSO_4 lead (II) sulfate

8. Li_2CO_3 lithium carbonate

9. Na_2CO_3 sodium carbonate

10. NO_2 nitrogen dioxide

11. N_2O_4 dinitrogen tetroxide

12. Ca(OH)_2 calcium hydroxide

13. NH_4Cl ammonium chloride

14. SO_3 sulfur trioxide

15. AlPO_4 aluminum phosphate

16. CCl_4 carbon tetrachloride

17. CaS calcium sulfide

18. NH_3 nitrogen trihydride

19. MgI_2 magnesium iodide

20. K_3PO_4 potassium phosphate

Part II.

(1) Circle the ionic compounds. (2) Write the formulas for the following compounds. Helpful hint: for ionic compounds write the ions with their charges first then write the final answer.

1. Ammonium phosphate $(NH_4)_3 PO_4$
2. Iron (II) oxide FeO
3. Iron (III) oxide Fe_2O_3
4. Carbon monoxide CO
5. Calcium chloride $CaCl_2$
6. Potassium nitrate KNO_3
7. Magnesium hydroxide $Mg(OH)_2$
8. Aluminum sulfate $Al_2(SO_4)_3$
9. Copper (II) sulfate $CuSO_4$
10. Lead (IV) chromate $Pb(CrO_4)_2$
11. Diphosphorus pentoxide P_2O_5
12. Potassium permanganate $KMnO_4$
13. Sodium hydrogen carbonate $NaHCO_3$
14. Zinc nitrate $Zn(NO_3)_2$
15. Aluminum sulfite $Al_2(SO_3)_3$

Mixed Ionic & Covalent Compounds

First identify if the compound is ionic (I) or covalent (C), then either name it OR write the compound.

1. I aluminum nitrate $Al(NO_3)_3$
2. I $Sr_3(PO_3)_2$ Strontium phosphite (one less "O" than phosphate = phosphite)
3. C Carbon dioxide CO_2
4. C P_4O_{10} tetraphosphorus decoxide
5. I sodium permanganate $NaMnO_4$
6. I Na_2O sodium oxide
7. C Dinitrogen pentoxide N_2O_5
8. C S_2O_3 disulfur trioxide
9. I chromium(II) sulfate $CrSO_4$
10. I Mg_3N_2 magnesium nitride
11. C Diphosphorus pentoxide P_2O_5
12. C CS_2 carbon disulfide
13. I sodium bromide $NaBr$
14. I $Al_2(SO_3)_3$ aluminum sulfite
15. C Dinitrogen monoxide N_2O
16. C SO_2 sulfur dioxide
17. I potassium nitrite KNO_2
18. I Fe_2S_3 Iron(III) sulfide
19. C Dinitrogen tetroxide N_2O_4
20. C PCl_5 phosphorus pentachloride
21. I barium hydrogen sulfate $Ba(HSO_4)_2$
22. I Al_2O_3 aluminum oxide
23. C Trinitrogen monosulfide N_3S
24. C H_2S dihydrogen ~~or~~ monosulfide
25. I nickel(III) chlorite $Ni(ClO_2)_3$
26. I $Pb(NO_3)_2$ lead(II) nitrate
27. C Carbon tetrafluoride CF_4

Review- Naming Chemical Compounds

The following are a good mix of naming and formula writing problems to help you get some practice. I will expect that you know how to name both ionic and covalent compounds in your work.

Name the following chemical compounds:

- 1) NaBr sodium bromide
- 2) $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$ calcium acetate
- 3) P_2O_5 diphosphorus pentoxide
- 4) $\text{Ti}(\text{SO}_4)_2$ titanium (IV) sulfate
- 5) FePO_4 Iron (III) phosphate
- 6) K_3N potassium nitride
- 7) SO_2 sulfur dioxide
- 8) CuOH copper (I) hydroxide
- 9) $\text{Zn}(\text{NO}_2)_2$ zinc nitrite
- 10) V_2S_3 Vanadium (III) sulfide

Write the formulas for the following chemical compounds:

- 11) silicon dioxide SiO_2
- 12) nickel (III) sulfide Ni_2S_3
- 13) manganese (II) phosphate $\text{Mn}_3(\text{PO}_4)_2$
- 14) silver acetate $\text{Ag C}_2\text{H}_3\text{O}_2$
- 15) diboron tetrabromide B_2Br_4
- 16) potassium carbonate K_2CO_3
- 17) ammonium oxide $(\text{NH}_4)_2\text{O}$
- 18) tin (IV) selenide SnSe_2
- 19) carbon tetrachloride CCl_4