

Unit 1 Chemistry - Naming



Name: _____

Unit 1 Evaluation

Notes filled in	Assignments completed	Answers corrected	Total
$\overline{2}$	$\overline{6}$	$\overline{2}$	$\overline{10}$

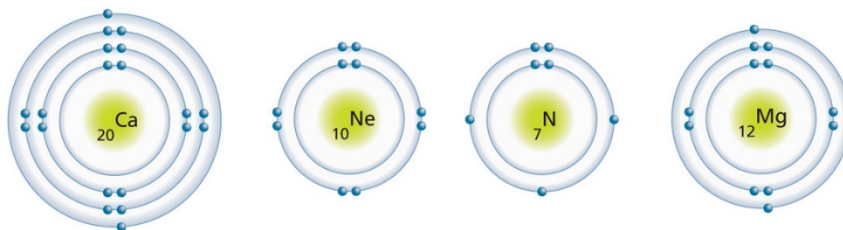
Things to remember in this chapter.....

1.1 Atomic Theory

Elements and Atoms

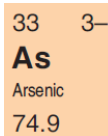
- Matter is made of _____ and every _____ has its own unique type of _____
 - Elements are identified by names and chemical symbols.
- Atoms have a structure that determines their properties.
 - Every atom is composed of three types of subatomic particles:

 - The _____ in the outer shell of an element's atoms determines the _____ of the element.



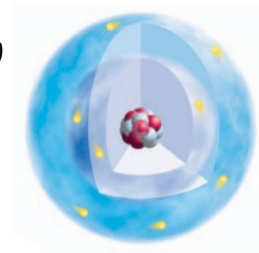
Subatomic Particles

- Proton**
 - _____ charge (in _____)
 - Unique # for each element = _____
 - Mass = 1 atomic mass unit (_____)
- Neutron**
 - no charge/ _____ (in _____)
 - Mass equal to proton (_____)
 - * _____ + _____ = _____
 - Atomic mass = _____ mass of all atoms of the element
 - To find neutrons: mass – atomic number
 - Arsenic =
 - Arsenic-73 =



- **Electron**

- _____ charge, Mass = _____ of proton
- Outside nucleus in _____ (*orbitals or energy levels*)
- Max. # in shells: _____
- Atoms contain an _____ of protons and electrons.
- _____ form when the number of _____.
- The # of electrons in the outer shell determines the properties of the element.



Bohr Diagrams

- Shows _____ around the nucleus.
 - Place _____ of element as nucleus
 - Start with _____ shell
 - _____ before going on to next
 - After first shell, place each electron as _____
- Outer most shell is called _____

lithium	fluorine
hydrogen	sulfur

Periodic Table

- The Periodic Table organizes elements in different ways.
 - _____ are found on the left, _____ on the right, and metalloids in between.
 - Chemical _____ are arranged in _____ groups.
 - Chemical _____ are arranged in _____ rows.

- | | | | |
|-----------------|--------|----|--------------|
| Atomic Number | 8 | 2- | ← Ion charge |
| Chemical Symbol | O | | |
| Chemical Name | Oxygen | | |
| Atomic Mass | 16.0 | | |

- _____ – 1st column (except H), _____ metals, *even react with water*
- _____ - 2nd column, also very reactive
- _____ – middle of Periodic Table, varied properties, varied ion charge
- _____ – 2nd column from right, most reactive non-metals
- _____ – Last column on right, _____
- Trick: to find valence electrons: _____ (except for transition metals)

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1.1 Atomic Theory - Assignment

1. Give the chemical symbols for the following elements:

(a) strontium

(g) samarium

(b) tin

(h) sulfur

(c) nitrogen

(i) hydrogen

(d) antimony

(j) neon

(e) chlorine

(k) selenium

(f) scandium

(l) iodine

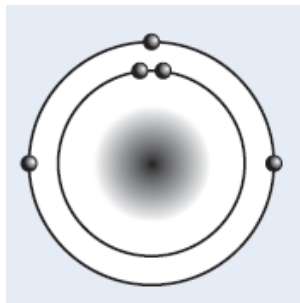
2. Use the Bohr Theory of the atom to complete the Table below.

Subatomic particle	Mass, compared to a proton (larger, smaller, the same)	Charge (+ or -)	Location in the atom
proton	1 amu		
		-1	
			in the nucleus

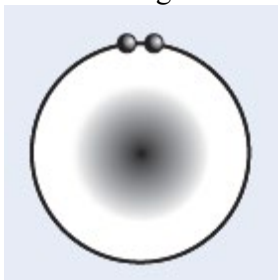
3. Complete the Table below.

Atom	Number of protons	Number of neutrons	Number of electrons
nitrogen-14			
bromine-79			
lithium-7			
phosphorus-31			

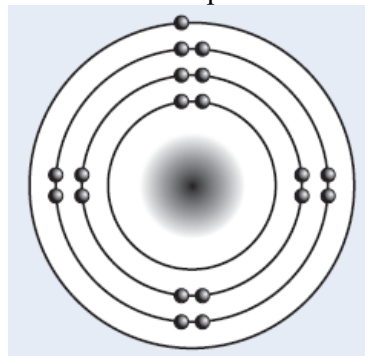
4. Which element does each of the following Bohr diagrams of neutral atoms represent?



a)



b)



c)

5. Draw the Bohr diagrams for atoms of

(a) carbon	(b) boron
(c) sulfur	(d) aluminum

6. What is the name of the family that each of the following elements belong to:

- a) Calcium:
- b) Bromine:
- c) Potassium:
- d) Argon:

7. What is the name of the family that is the least reactive?

8. What is the name of the family that is the most reactive?

9. The Group number is indicated at the top of each column of the Periodic Table, from Group 1 at the left to Group 18 at the right. How many electrons are there in the outermost shell of the elements in each of the following group numbers?

(a) 1	(d) 14
(b) 2	(e) 17
(c) 13	(f) 18

10. How many electrons are in an atom of the element with atomic number 24?

11. Consider a neutral atom that has 17 electrons.

- (a) How many protons does it have?
- (b) What is its atomic number?
- (c) Which element is it?

12. List the following for an atom with 33 proton and 42 neutrons:

- (a) the name of the element
- (b) the atomic number
- (c) the number of electrons
- (d) the mass number

13. Use proper vocabulary to label the diagram.

(a) _____	<table border="1"> <tr> <td>22</td> <td>4+</td> </tr> <tr> <td>Ti</td> <td>3+</td> </tr> <tr> <td colspan="2">Titanium</td> </tr> <tr> <td colspan="2">47.9</td> </tr> </table>	22	4+	Ti	3+	Titanium		47.9		(e) _____
22		4+								
Ti		3+								
Titanium										
47.9										
(b) _____	(f) _____									
(c) _____										
(d) _____										

14. Examine the periodic table for the element below and complete the blanks.

35	—
Br	
Bromine	
79.9	

- | | |
|---------------------------|-------------------------------|
| (a) atomic number _____ | (b) average atomic mass _____ |
| (c) ion charge _____ | (d) number of protons _____ |
| (e) name of element _____ | (f) number of neutrons _____ |

15. Complete the following table for the different atoms and ions. The first two rows have been completed to help you.

Element Name	Atomic Number	Ion Charge (Common)	Number of Protons	Number of Electrons	Number of Neutrons
potassium	19	1+	19	19	20
phosphorus	15	3-	15	15	16
	3				
		2+	20		
nitrogen		3-			
	5				
argon				18	
	13				
chlorine					
			11		

16. Draw the Bohr diagrams for atoms of

(a) argon	(b) sodium
(c) beryllium	(d) phosphorus

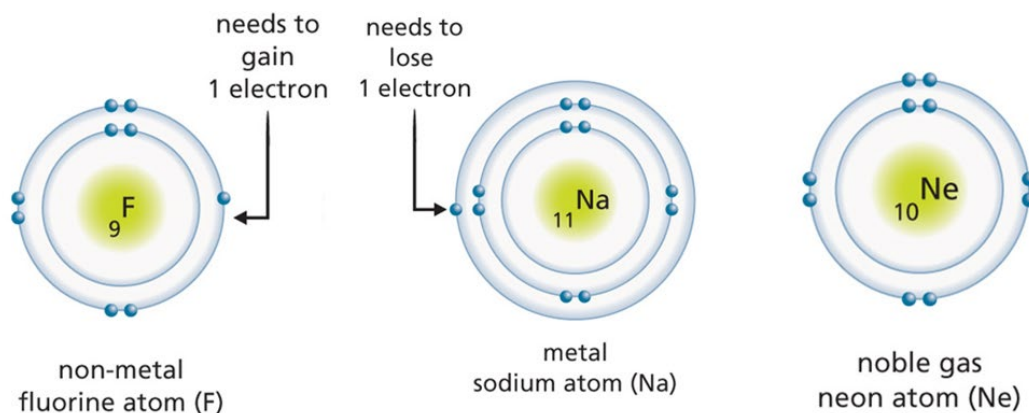
1.2 Chemical Bonding

Atoms and Compounds

- **Atoms**
 - Found in the periodic table
 - _____ of an element
- **Compounds**
 - _____ of atoms bonded together
- **How Atoms Form Compounds**
 - Bonding based on _____
 - Want _____ (valence shells) with same # of valence electrons as _____
 - Two types of bonding: _____ (metal + non-metal) and _____ (non-metal + non-metal)

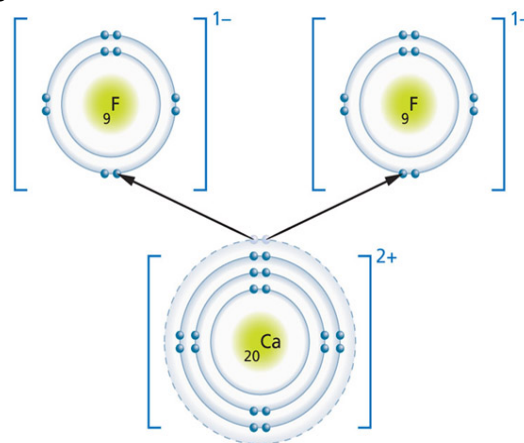
Ionic Bonding

- **Atoms**
 - Atoms are _____, they have the _____ number of _____
 - Atoms become more _____ with _____
 - Atoms cannot do this on their own, to become more stable they _____
- **Ions**
 - *In ionic bonds electrons are transferred from a _____ to a _____
 - Result: _____ due to difference in number of electrons



Fluorine ion	Sodium ion
--------------	------------

- A _____ is a force that holds atoms together
- **Ionic bonds:** _____
- _____ of valence electrons occurs
- strong attraction of _____ charged ions holds ions together
- **Ex.** CaF_2
 - Ca gives up 2 e^- (1 to each F)
 - Ca^{2+} is attracted to 2 F^- ions
- Note e^- lost = e^- gained



Predict charge from Periodic Table

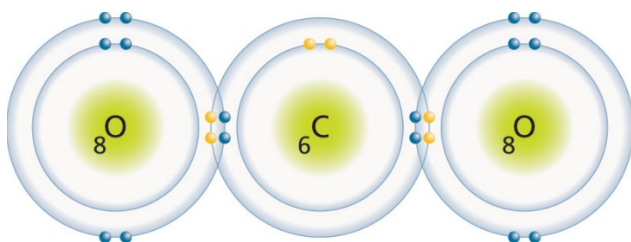
- Use element symbols with charge *sign and number
 - E.g.
- **metals** form _____
 - alkali metals (group 1) →
 - alkaline earth (group 2) →
- **non-metals** form _____
 - halogens (group 17) →
 - **hydrogen** →

Properties of ionic compounds

- Strong bonds
- Form _____ of alternating + and – ions
- Definite crystal shape
- _____ (& boiling points)
- Hard and _____
- _____ when dissolved in H_2O

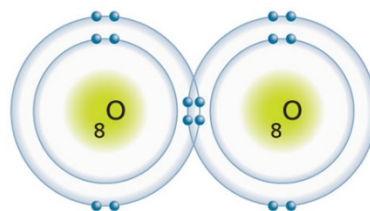
Covalent Bonds

- Covalent bonds: _____
- _____
- forms _____
 - Molecule = _____
 - Compound = _____
- For example CO_2
 - Each atom has full outer shells



Diatomic Molecules

- By pairing up, both atoms have full orbitals
- Seven elements pair up as _____
- _____
- _____
- Note: these are molecules but NOT compounds



Properties of Covalent Compounds

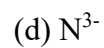
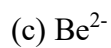
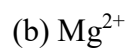
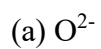
- Crystals have variable shape
- _____ points (and boiling points)
- _____ when dissolved in H_2O (do not separate into ions)

TYPE OF SUBSTANCE	SMALLEST PARTICLE
ELEMENT	
IONIC COMPOUND	
COVALENT COMPOUND	

1.2 Chemical Bonding - Assignment

1. What is a valence electron?

2. Draw Bohr diagrams of the following:



3. Draw Bohr diagrams of a magnesium atom bonding with fluorine atoms. What type of bonding occurs?

Type of bond: _____

4. Complete the following table. Note that the name of a NON-METALLIC ion ends in -IDE while the name for a METALLIC ion uses the full name of the metal.

	ION NAME	ION SYMBOL	NUMBER OF PROTONS	NUMBER OF ELECTRONS	NUMBER OF ELECTRONS LOST OR GAINED	SAME # OF ELECTRONS AS WHAT NOBLE GAS?
ex	fluoride	F ⁻	9	10	gained one	neon
1			53	54		
2			16		gained two	
3	potassium				lost one	
4		Ca ²⁺				
5			35	36		
6		Sr ²⁺				
7		H ⁺				(none)
8			8		gained two	
9			12		lost two	
10	aluminium			10		
11			34	36		
12		H ⁻				
13	lithium				lost one	
14		Rb ⁺				
15			17	18		

5. Draw Bohr diagrams of two hydrogen atoms bonding with an oxygen atom by sharing electrons to form a water molecule. What type of bonding occurs?

Type of bond: _____

6. (a) What do we call the smallest particle of an element?
(b) What do we call the smallest particle in a compound with ionic bonds?
(c) What do we call the smallest particle of a covalently bonded compound?
7. What is a compound?
8. What is a molecule?
9. What do we call a physical force that holds atoms together?
10. List all the Diatomic/Polyatomic Molecules
11. Explain the difference between an ionic bond and a covalent bond.
12. (a) What laboratory procedure allows you to test if a compound is ionic or covalent?
(b) What results would you expect?
13. Explain why the melting points of ionic compounds and molecular compounds differ.

1.3 Ionic Compounds: Formulas and Naming

Ionic Compounds: Chemical Formulas

- **Chemical Formula**
 - shorthand method of representing a _____
 - describes the proportions of the component elements
 - Total ion charge =
- **Binary Ionic Compounds**
 - ionic compounds with only _____
 - _____
 - Use _____ to show numbers of each element needed
- **Formulas for Binary Ionic Compounds**
 - Need symbol and ion charge
 - Balance ion charges to complete formula.
 - _____
- Ex1) potassium with nitrogen
- Ex 2) calcium with oxygen
- Ex 3) aluminum with sulfur

- Multivalent element – can form ions with _____ (transition metals)
 - E.g. Copper can be + 1 or +2
- You will be told which one to use in each situation
- Ex 4) Copper (I) and Oxygen

- Ex 5) Manganese (III) and Sulfur

Ionic Compounds: Naming

- The chemical names are derived from the _____
- Remember _____ ion names end in _____
 - For example: $\text{NaCl} = \underline{\hspace{2cm}}$
 $\text{K}_2\text{O} = \underline{\hspace{2cm}}$
 - Note: No subscripts in the name
- For _____ metals use _____ to show the charge on the ion
 - Cu^+ and $\text{O}^{2-} = \underline{\hspace{2cm}}$
 - Mn^{3+} and $\text{S}^{2-} = \underline{\hspace{2cm}}$
 - Note: Roman Numeral *is* the ion charge
- Ex 6) Determine the chemical formula for Sodium Nitride
- Ex 7) Determine the name for SnO_2

1.3 Ionic Naming - Assignment

1. Write the ions, formula and name in each column. The first one has been done for you.

Combine	Ions and Charges	Formula	Name
Calcium and Chlorine	Ca^{2+} Cl^{-}	CaCl_2	calcium chloride
Magnesium and Nitrogen			
Potassium and Oxygen			
Aluminum and Sulphur			
Beryllium and Bromine			
Lead (II) and Silicon			
Copper (I) and Phosphorus			
Zinc and Oxygen			
Mercury (II) and Iodine			
Iron (III) and Nitrogen			
Calcium and Fluorine			
Barium and Carbon			
Silver and Oxygen			
Iron (II) and Iodine			

2. Fill in the blanks:

A. Write the chemical formula for the binary ionic compounds formed between the following elements:

1. potassium and iodine _____
2. zinc and chlorine _____
3. aluminum and nitrogen _____

B. Name the following binary ionic compounds.

1. NaF _____
2. CaCl_2 _____
3. Al_2S_3 _____
4. AgBr _____
5. Li_3N _____
6. BaS _____

C. Write the correct chemical formula for the following binary ionic compounds.

1. manganese (IV) oxide _____
2. aluminum oxide _____
3. copper (II) bromide _____
4. zinc iodide _____
5. silver sulfide _____
6. iron (III) nitride _____

D. Name the following binary ionic compounds. (Some may need Roman Numerals)

1. ZnF _____
2. CaO _____
3. AlCl_3 _____
4. CuBr_2 _____
5. FeI_3 _____
6. Au_2O_3 _____

1.4 Polyatomic Ions naming

Formulas for Polyatomic Ions

- Groups of atoms that _____
- Have special names and formulas

NAMES, FORMULAE AND CHARGES OF SOME POLYATOMIC IONS

Positive Ions	Negative Ions		
NH ₄ ⁺ Ammonium	CH ₃ COO ⁻ Acetate	HCO ₃ ⁻ Hydrogen carbonate, bicarbonate	NO ₂ ⁻ Nitrite
	CO ₃ ²⁻ Carbonate	HSO ₄ ⁻ Hydrogen sulphate, bisulphate	ClO ₄ ⁻ Perchlorate
	ClO ₃ ⁻ Chlorate	HS ⁻ Hydrogen sulphide, bisulphide	MnO ₄ ⁻ Permanganate
	ClO ₂ ⁻ Chlorite	HSO ₃ ⁻ Hydrogen sulphite, bisulphite	PO ₄ ³⁻ Phosphate
	CrO ₄ ²⁻ Chromate	OH ⁻ Hydroxide	PO ₃ ³⁻ Phosphite
	CN ⁻ Cyanide	ClO ⁻ Hypochlorite	SO ₄ ²⁻ Sulphate
	Cr ₂ O ₇ ²⁻ Dichromate	NO ₃ ⁻ Nitrate	SO ₃ ²⁻ Sulphite

- Mostly negative ions e.g. _____
- _____ polyatomic ion _____
- If subscript is needed after a polyatomic ion, the ion must be in _____
- Example 1: Aluminum Sulphate
- Example 2: Tin (IV) Sulphate
- Example 3: Sodium Carbonate

Naming Compounds with Polyatomic Ions

- Just use the polyatomic ion names (most end in –ite or –ate)
- $(\text{NH}_4)_2\text{S}$
- Na_2CO_3
- $\text{Fe}(\text{OH})_3$

Try it!

- Example 4: Lithium Carbonate
- Example 5: Calcium Permanganate
- Example 6: $\text{Mg}_3(\text{PO}_4)_2$

1.4 Polyatomic Ions and Covalent Compounds - Assignment

1. Write either the chemical formula or name for these ionic compounds with **polyatomic ions**.

(a) sodium acetate	(b) PbCrO_4	(c) barium acetate
(d) CaSO_4	(e) mercury(II) chlorite	(f) Li_3PO_4
(g) bismuth(V) phosphate	(h) $(\text{NH}_4)_2\text{SO}_4$	(i) rhenium(VII) permanganate
(j) $\text{Co}(\text{ClO}_4)_2$	(k) copper(II) hydrogen carbonate	(l) $\text{Fe}_2(\text{SO}_4)_3$
(m) chromium(II) hydrogen sulphide	(n) $\text{Ba}(\text{ClO})_2$	(o) titanium(IV) nitrite

2. First **classify** each of the following ionic compounds as (B) **binary**, (M) **multivalent**, or (P) **polyatomic (combinations can exist)**. Then write either the chemical formula or chemical name.

(a) potassium acetate	(b) PbF_2	(c) calcium acetate
(d) Li_2O	(e) copper(II) chlorite	(f) Na_3PO_4
(g) lithium phosphide	(h) $(\text{NH}_4)_2\text{SO}_4$	(i) rhenium(VII) nitride
(j) CaCl_2	(k) lead(II) hydrogen carbonate	(l) Cr_2S_3
(m) iron(II) hydrogen sulfide	(n) PbBr_4	(o) tin(IV) nitride

1.5 Covalent Compound Naming

Covalent Compounds: Chemical Formulas and Naming

- Molecular () compounds - non-metal atoms to bond.
- Atoms combine in different ratios, () e.g. NO, N₂O, NO₂
- Chemical formulas for molecular compounds come from their chemical names (and vice versa) based on a .

Prefix	Number	Prefix	Number
	1		6
	2		7
	3		8
	4		9
	5		10

- Formulas: prefix tells of each atom.
- Names: add prefix according (omit "mono" on first element only)

Chemical name	Name describes	Chemical formula
carbon dioxide		
sulfur trioxide		
dinitrogen tetraoxide		
dichlorine monoxide		

Try it!

Formula	Name
CO ₃	
C ₂ O	
P ₂ O ₅	
	Silicon tetrabromide
	Sulfur hexafluoride
	Dinitrogen monoxide
H ₂ O	
NH ₃	
CH ₄	

1.5 Covalent Compounds - Assignment

1. Name the following molecular compounds based on the formula.

1. BF_3 _____

2. N_2H_4 _____

3. SO_3 _____

4. CS_2 _____

5. CBr_4 _____

6. I_4O_9 _____

7. N_2O_3 _____

8. IBr _____

2. Write the correct formula for the following molecular compounds based on the name.

1. chlorine dioxide _____

2. xenon tetrafluoride _____

3. disulfur tetroxide _____

4. arsenic pentachloride _____

5. dihydrogen monosulfide _____

6. tetraphosphorus hexoxide _____

7. dichlorine monoxide _____

8. diiodine heptoxide _____

3. Write either the chemical formula or chemical name for these molecular compounds:

(a) nitrogen monoxide	(b) SiO_2	(c) boron monoxide
(d) P_2O_5	(e) tellurium dibromide	(f) CO_2
(g) dinitrogen tetroxide	(h) SeF_2	(i) carbon disulfide
(j) AsBr_4	(k) arsenic trioxide	(l) S_2O_5
(m) sulfur dioxide	(n) CS_2	(o) tetraphosphorus decaoxide

Chemistry Unit 1 Review Assignment

1. Complete the following table of atoms

Name of Element	Symbol	Number of Protons	Number of Electrons	Number of Neutrons
silicon - 29				
	Au			
		24		29
			11	
chlorine - 32				
	Sn			54
		19		20
			15	18

2. What happens if the number of protons changes in an element? Explain

3. Choose 5 colours to complete the legend and then shade in the appropriate chemical family on the Periodic Table below

Legend:

- ☐ Halogens
- ☐ Noble Gases
- ☐ Alkali Metals
- ☐ Alkaline-Earth Metals
- ☐ Transition Metals

4. Draw the Bohr Model for each of the following atoms.

a. Argon

b. Silicon

c. Oxygen

d. Chlorine

5. Which chemical family contains atoms with the greatest number of paired electrons in the outermost electron shell?

- A. halogens
- B. noble gases
- C. alkali metals
- D. alkaline earth metals

6. Which of the following correctly orders families of elements from most reactive to least reactive?

- A. halogens > noble gases > alkali metals
- B. alkaline earth metals > alkali metals > noble gases
- C. alkali metals > alkaline earth metals > noble gases
- D. noble gases > alkaline earth metals > alkali metals

7. Draw a bohr diagram of P^{3-}

8. Draw a bohr diagram of MgF_2
9. Draw a bohr diagram of OF_2
10. Describe a compound vs a molecule
11. List all the Diatomic/Polyatomic Molecules
12. Explain the difference between an ionic bond and a covalent bond.

13. Write either the chemical formula or chemical name for these binary ionic compounds:

(a) strontium sulfide	(b) CaCl_2	(c) lithium bromide
(d) K_2O	(e) beryllium oxide	(f) Li_2Se
(g) potassium phosphide	(h) Ca_3N_2	(i) calcium arsenide
(j) MgF_2	(k) scandium oxide	(l) Na_2S
(m) magnesium oxide	(n) ZnCl_2	(o) sodium nitride

14. Write either the chemical formula or chemical name for these ionic compounds with multivalent elements:

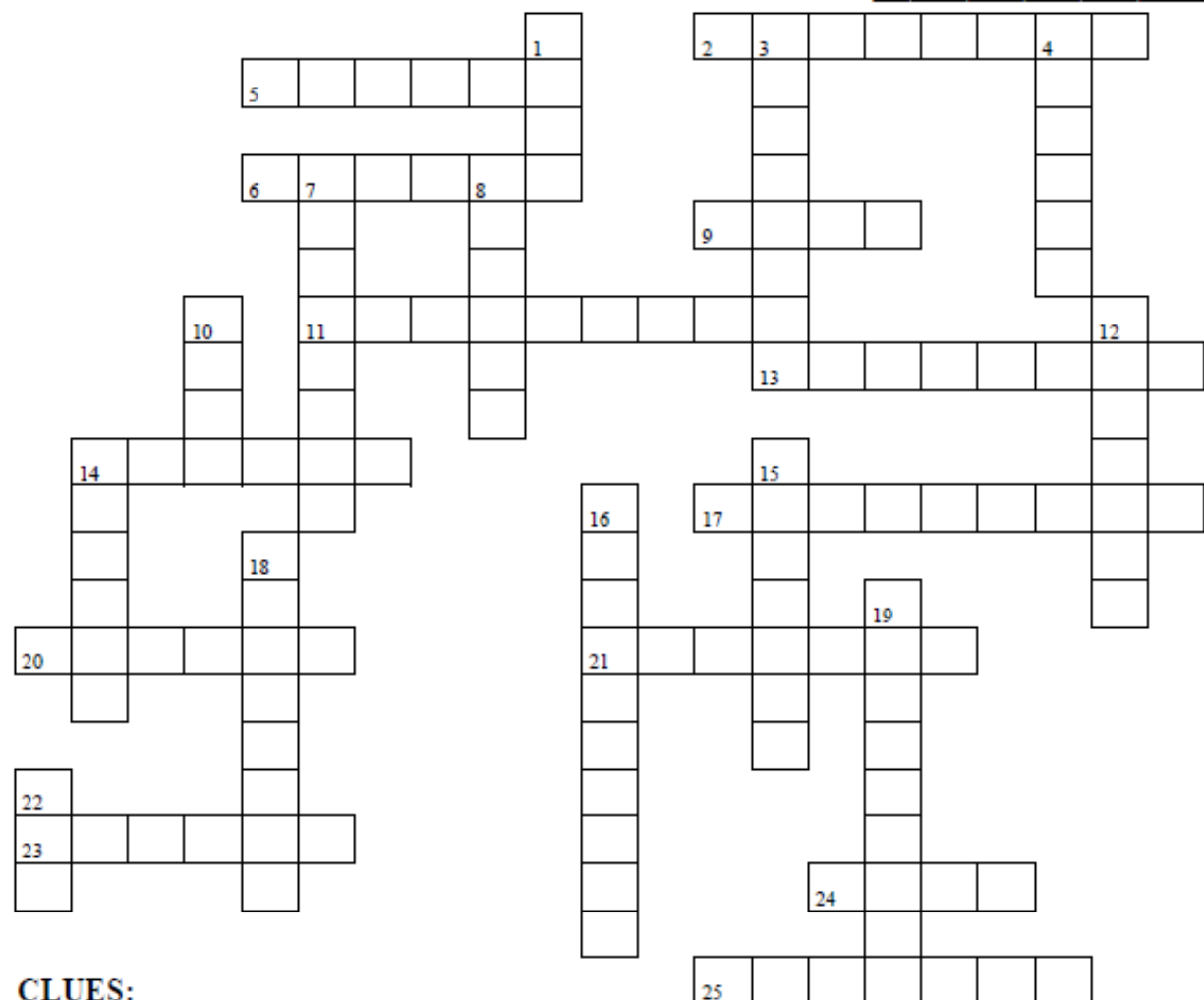
(a) molybdenum(III) sulphide	(b) PbCl_2	(c) rhodium(IV) bromide
(d) Cu_2O	(e) mercury(II) oxide	(f) Tl_2Se
(g) bismuth(V) phosphide	(h) PbF_4	(i) rhenium(VII) arsenide
(j) CoF_2	(k) copper(I) telluride	(l) Fe_2S_3
(m) niobium(V) iodide	(n) PtBr_4	(o) titanium(IV) nitride

Formula of compound	Name of compound
CuCl_2	copper(II) chloride
MnSe_2	
NO	
	dinitrogen tetroxide
CuBr_2	
	aluminum nitrite
	lead(IV) dichromate
	nitrogen dioxide
N_2O_3	
	iron(III) nitride
FeO	
	nickel(III) bromide
AgClO_2	
	rubidium phosphate
CS_2	
	tetraphosphorus decoxide
	phosphorus pentabromide
Sn_3N_2	

Formula of compound	Name of compound
	gold(I) iodide
MnS	
OF_2	
NaHCO_3	
	manganese(IV) sulfite
	nitrogen trichloride
	lead(IV) fluoride
AuI_3	
$\text{Cu}(\text{OH})_2$	
	copper(I) phosphide
CO	
Au_2CrO_4	
	iron (III) sulfate
S_2F_{10}	
CCl_4	
$\text{Sr}(\text{ClO}_3)_2$	
	sulfur trioxide
NI_3	

Periodic Table Puzzle

Name _____



CLUES:

Down:

1. I have 26 protons.
3. I am not really an alkali metal, but since I have only 1 electron I behave like them.
4. I am a metal with 28 electrons.
7. I am a member of the boron family and am the most abundant metal in the Earth's crust.
8. I am a gas with 8 protons and 8 neutrons.
10. I am a member of the carbon family often mistaken for the end of your pencil.
12. I am a metal that is liquid at room temperature.
14. My atomic number is 47 and I am used to make photographic film.
15. I have 20 neutrons and am found in your teeth and bones.
16. I am a member of the nitrogen family with 16 neutrons.
18. I am a gas with a mass number of 19.
19. I am the first element in the fourth period used in making fertilizer.
22. You can find me in the carbon family in the fifth period.

Across:

2. My atomic mass is 35.453.
5. I have 2 electrons in the first shell, 8 in the second shell, and 6 in the third shell.
6. I am the head of the carbon family known as the "basis of life".
9. My atomic number is 79.
11. I am a transition metal with 25 electrons.
13. I make up 78% of the air and am found in the 15th group.
14. I am a silvery white metal used to make salt.
17. I am a member of the alkaline earth metals used to make fireworks and medicines.
20. I am a noble gas with 2 electrons.
21. I am the 2nd most abundant element in the Earth's crust and have 14 neutrons.
23. I am a member of the halide family with an atomic number of 53.
24. I am a transition metal with 30 electrons useful in making paint.
25. I am the only element in the halide family that is a liquid.