AP Chemistry Summer Work

Dear AP Chemistry Student,

We'll hit the ground running on the first day of school. So you'll hit your stride as soon as school starts, you need to review and practice the skills you've learned in Chemistry class. Below are the basic skills you need to succeed in AP Chemistry.

Skills and Practice Worksheets *Complete the practice worksheets. They are worth 30 extra credit points when turned in on the first day of school.
1) Use the periodic table to predict the structure and properties of elements. **PW1** 2) Be familiar with common monatomic and polyatomic ions. (**Study Tables 1, 2 and 3**) 3) Distinguish between ionic and covalent compounds and write their chemical names and formulas. **PW 2** 4) Convert between scientific and standard notation. **PW 3** 5) Use correct significant digits and metric units. **PW 4** **6)** Do dimensional analysis and stoichiometric calculations. **PW 5** 7) Identify common types of chemical reactions, predict the products of a reaction, and write balanced chemical equations. **PW 6**

I have compiled the following videos to help you review key concepts and skills. Please watch these videos and take notes.

1. How to Take Great Notes - https://www.youtube.com/watch?v=UAhRf3U50lM

2. Periodic Table

   https://www.youtube.com/watch?v=uPkEGAHo78o

   https://www.youtube.com/watch?v=t_f8bB1kf6M

3. How to Speak the Chemical Language - https://www.youtube.com/watch?v=mlRhLicNo8Q

4. Recognizing and Classifying Chemical Reactions - https://www.youtube.com/watch?v=d58UcB_Yb2Q

5. Writing and Balancing Equations - https://www.youtube.com/watch?t=230&v=V6VdsehOE8w

6. Predicting Products - https://www.youtube.com/watch?t=267&v=P0jG2TjLyGI

7. Converting between moles, atoms, molecules (Part 1) - https://www.youtube.com/watch?v=HMAOrGpkTsQ

8. Converting between moles, atoms, molecules (Part 2) - https://www.youtube.com/watch?v=kGNtnq0kGKk

9. Calculating molar mass - https://www.youtube.com/watch?v=Qflq48Foh2w

10. Converting between grams and moles (Part 1) - https://www.youtube.com/watch?v=CMnkSb2YsXI

11. Converting between grams and moles (Part 2) - https://www.youtube.com/watch?v=0RXB8xNmJNM

12. Converting between mole and volume of gas at STP - https://www.youtube.com/watch?v=Y8e7T09SKZ0

13. Mole-Mole Stoichiometry - https://www.youtube.com/watch?v=S6UQX7ZdkTg

14. Mass-Mass Stoichiometry - https://www.youtube.com/watch?v=sTsshxcHhaI

15. Significant Digits - https://www.youtube.com/watch?v=8Tr2PZG8I5c

    https://www.youtube.com/watch?v=qW-QK9Hl2hc

16. Scientific Notation - https://www.youtube.com/watch?v=Dme-G4rc6NI

17. Solubility Rules and Precipitation Reactions - https://www.youtube.com/watch?t=327&v=2XRGrBvQTU8

If you have questions, please email me at lacanarias@esuhsd.org.

Have a great summer!

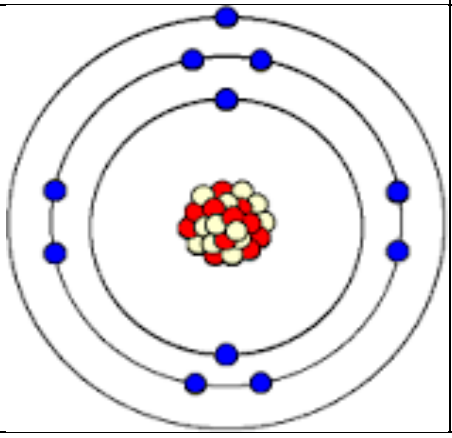
Mrs. Lacanaria

Practice Worksheet 1 – Chemical Elements and the Periodic Table

Skill: Use the periodic table to predict the structure and properties of elements.

During the AP test, you will be given a periodic table that only shows the symbol, atomic number, and atomic mass of the elements. It is therefore important that you know the names and symbols of the elements. Make sure that you can relate the atomic structure and properties of the element to its location on the periodic table.

Use the periodic table to name all elements that match the following descriptions. Write their symbols too.

Description	Element
1. forms ions with a charge of 1+	
2. unreactive gas	
3. exists as a diatomic molecule	
4. top three most electronegative elements	
5. nonmetal that forms anions with a charge of 1-	
6. has 15 protons	
7. element that tends to gain 2 electrons to become stable	
8. noble gas in period 4	
9. has an electron configuration of $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^3$	
10. has 7 valence electrons	
11. the largest atom in the alkali metal group	
12. alkaline earth metal with 4 occupied energy levels	
13. the smallest atom in period 2	
14. the only non-metal on the left side of the periodic table	
15. element represented by the this Bohr Model: 	

Practice Worksheet 2 – Chemical Names and Formulas of Ionic and Binary Covalent Compounds

Skill: Be familiar with common monatomic and polyatomic ions.

Skill: Distinguish between ionic and covalent compounds and write their chemical names and formulas.

COVALENT COMPOUNDS

Binary covalent compounds are formed when 2 ***nonmetals or metalloids*** form ***covalent*** bonds through the ***sharing*** of electrons. These compounds form **molecules**.

When naming binary covalent compounds, prefixes are used to indicate the number of atoms of each element.

1 = mono	2 = di	3 = tri	4 = tetra	5 = penta	6 = hexa
7 = hepta	8 = octa	9 = nona	10 = deca	11 = undeca	12 = dodeca

The prefix ***mono-*** is NEVER used in front of the first element. If there is only 1 atom, the *mono-* is assumed.

Study the following examples:

Example 1: Name the binary molecule, CO_2.

There are 1 carbon atom and 2 oxygen atoms in CO_2. Although there is 1 atom of carbon, the prefix *mono* will not be used because C is the first element. The prefix di- will be used to indicate the 2 atoms of oxygen. The *–ide* is always added to the root of the second element. Thus, CO_2 is named as **carbon dioxide**.

Example 2: Name the binary molecule, N_2O_3.

There are 2 atoms of nitrogen and 3 atoms of oxygen. The name of N_2O_3 is **dinitrogen trioxide**.

Example 3: Write the formula of dihydrogen monoxide.

The prefix *di-* in dihydrogen indicates that there are 2 hydrogen atoms. The prefix *mono-* in monoxide means that there is 1 atom of oxygen. Thus, the chemical formula of dihydrogen monoxide is written as **H_2O**.

IONIC COMPOUNDS

An ***ionic*** compound consists of a pair of ***cation*** and ***anion***. The cation is named first. If an element forms cations with variable charges, the charge is indicated by a Roman numeral, which is enclosed in a parenthesis. Look at ***Table 1*** for a list of these ions with variable charges. When you are writing the formulas of ionic compounds, remember: ***the charges of the ions add up to zero***. The examples shown below illustrate this point.

Example 1: What is the formula of iron(III) oxide?

The formula of the iron(III) ion is Fe^{3+}. The Roman numeral indicates the oxidation number (charge) of the iron ion.

The formula of the oxide ion is O^{2-}.

Looking at the charges of the ions, they don't add up to zero, $3+ (2-) \neq 0$.

So, we have to increase the number of each ion until their charges add up to zero.

The lowest multiple of 3 and 2 is 6.

$2(3+) = 6+$

$3(2-) = 6-$

$6 + (6-) = 0.$

For the charges of the ions to add up to zero, there should be 2 Fe^{3+} ions and 3 O^{2-} ions. We will write these numbers of ions as ***subscripts***.

Thus, the formula of iron(III) oxide is $\mathbf{Fe_2O_3}$.

Example 2: Write the formula of calcium nitrate.

The formula of the calcium ion is Ca^{2+}. Notice that there is no Roman numeral used because calcium has only one possible oxidation number.

The formula of the nitrate ion is NO_3^-.

For the charges of the ions to add up to zero, there should be 1 Ca^{2+} ion and 2 NO_3^- ions.

$2 + 2(1-) = 0$

So the formula of calcium nitrate is $\mathbf{Ca(NO_3)_2}$.

Notice that the nitrate ion is enclosed in a parenthesis. Polyatomic ions like nitrate are always treated as a unit.

Example3: Name the ionic compound, $ZnCl_2$.

The ***cation is always named first*** followed by the anion. Since zinc ion has only one possible charge, a Roman numeral is not needed.

The name of the compound is **zinc chloride**.

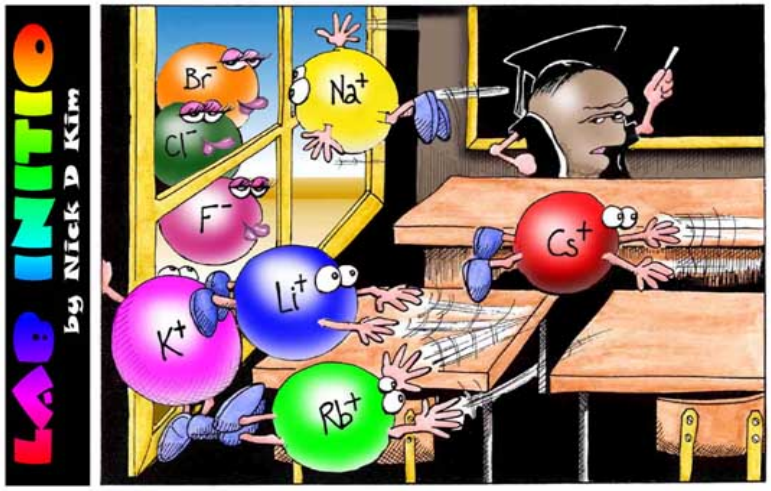
Example 4: Name the ionic compound, Cu_2O.

Copper has 2 possible charges (1+ and 2+) so a Roman numeral needs to be used.

In this compound, copper has a charge of 1+.

$2(x) + (2-) = 0 \qquad x = \frac{2}{2} = 1$

The name of the compound is **copper(I) oxide**.



"Perhaps one of you gentlemen would mind telling me just what it is outside the window that you find so attractive...?"

Classify each compound as IONIC or COVALENT and write its chemical name or formula.

	Ionic or Covalent	**Chemical Name or Formula**
1) copper(II) chloride	_____	_____
2) calcium fluoride	_____	_____
3) sodium sulfate	_____	_____
4) lead(II) sulfate	_____	_____
5) oxygen difluoride	_____	_____
6) aluminum nitrate	_____	_____
7) iron(III) oxide	_____	_____
8) dinitrogen tetroxide	_____	_____
9) sodium peroxide	_____	_____
10) sodium acetate	_____	_____
11) phosphorus pentachloride	_____	_____
12) cobalt(II) chloride	_____	_____
13) lithium hydroxide	_____	_____
14) magnesium sulfide	_____	_____

15) potassium iodide _____ _____

16) $CaSO_4$ _____ _____

17) $KClO_3$ _____ _____

18) SO_2 _____ _____

19) CCl_4 _____ _____

20) $FeCl_2$ _____ _____

21) $Zn(OH)_2$ _____ _____

22) $SrBr_2$ _____ _____

23) PCl_3 _____ _____

24) $Cu(NO_3)_2$ _____ _____

25) Ag_2O _____ _____

26) $(NH_4)_2CO_3$ _____ _____

27) Na_3P _____ _____

28) S_2O_7 _____ _____

29) PbO_2 _____ _____

30) CO _____ _____

Practice Worksheet 3 – Scientific and Standard Notation

Skill: Convert between scientific and standard notation.

Big and small numbers are often used in chemistry. Scientific notation saves you from writing a whole lot of zeros. Study the following examples in converting standard notation to scientific notation and vice versa.

Example 1: Write 602,000,000,000,000,000,000,000 in scientific notation.

In a scientific notation, there is only 1 digit before the decimal point, so the decimal point has to be moved to the left until only the number 6 is before it. (6.02)

Now, count the number of times the decimal point was moved. In this case, it took 23 times. This number becomes the exponent. When the decimal point is moved to the left, the exponent is positive.

Thus, the number is written in scientific notation as 6.02×10^{23}.

Example 2: Write 0.000 000 000 75 in scientific notation.

This time, the decimal point has to be moved to the right 10 times until there's 1 digit before it. (7.5)

When the decimal point is moved to the right, the exponent is negative.

Thus, the number is written as 7.5×10^{-10}.

A. Write the following numbers in scientific notation.

1) 120, 000 _____
2) 645, 000, 000 _____
3) 0.000 000 005 _____
4) 0.000 000 000 006 _____
5) 1, 100, 000, 000 _____
6) 70, 100, 000, 000, 000 _____
7) 0.000 000 123 _____
8) 0.031 _____
9) 0.000 000 006 345 _____
10) 899, 000, 000, 000, 000 _____

B. Write the following numbers in standard notation.

1) 6.70×10^{6} _____ 2) 7.11×10^{-8} _____

1) 7×10^{3} _____ 4) 5.05×10^{-4} _____

5) 9.1×10^{-7} _____ 6) 2×10^{8} _____

7) 4.3×10^{-5} _____ 8) 2.23×10^{2} _____

9) 8×10^{5} _____ 10) 1.3×10^{-4} _____

C. Do the following operations and write the answers in scientific notation:

1) $1.23 \times 10^{5} + 3.1 \times 10^{5}$

2) $8.3 \times 10^{-3} - 5.12 \times 10^{-3}$

3) $(5.8 \times 10^{2})\ (2.06 \times 10^{-3})$

4) $6.12 \times 10^{8} / 3 \times 10^{8}$

5) $(2.1 \times 10^{4})\ (3.25 \times 10^{5})$

6) $5.13 \times 10^{-11} + 1.2 \times 10^{-11}$

7) $(3.67 \times 10^{-4})\ (2.51 \times 10^{2})$

8) $8.55 \times 10^{5} / 5.0 \times 10^{3}$

9) $7.2 \times 10^{5} - 3.64 \times 10^{5}$

10) $9.02 \times 10^{6} - 3.165 \times 10^{6}$

Practice Worksheet 4 – Significant Digits and Metric Units

Skill: Use correct significant digits and metric units.

Make sure you know the following Sig Fig Rules by heart.

Rules for counting significant figures

1. Nonzero digits are ALWAYS significant.

The measurement 12.356 g has 5 sig. figs.

2. There are 3 classes of zeros.

(a) *Leading* zeros are NOT significant. These zeros are before non-zero digits. They only indicate the position of the decimal point.

The measurement 0.003 kg has 1 sig. fig.

(b) *Captive* zeros are ALWAYS significant. These zeros are between non-zero digits.

The measurement 1.005 g has 4 sig. figs.

(c) *Trailing* zeros are to the right of the non-zero digit. They are significant ONLY IF there is a decimal point.

The measurement 100 g has 1 sig. fig.

The measurement 100. g has 3 sig. figs.

The measurement 1.00 x 10^2 g also has 3 sig. figs.

Rules for Rounding Off Numbers

1. For ***multiplication and division***, the result is rounded off such that it has the same number of significant figures as the least precise measurement, that is, the one with the ***least number of sig. figs***.

$$D = \frac{5.00\ g}{4.5\ mL} = 1.1\ g/mL$$

The answer 1.1111 is rounded off to 2 sig. figs, because the less precise measurement (4.5 mL) has only 2 sig. figs.

2. For ***addition and subtraction***, the result has the same number of decimal places as the ***least precise measurement.***

$$Total\ length = 2.5\ cm + 3.05\ cm + 10.025\ cm = 15.6\ cm$$

The result 15.575 is rounded off to the nearest tenths because the least precise measurement (2.5 cm) has 1 decimal place.

A. How many significant figures does each of these measurements have?

1) 13.4 mL _____
2) 0.000 650 g _____
3) 4560 kg _____
4) 6.03×10^{-4} g _____
5) 1900 ^{o}C _____
6) 0.015 m _____
7) 7.0×10^{2} s _____
8) 450. m _____
9) 0.78 g/mL _____
10) 0.0821 L atm/mol K _____

B. Round off the following to the specified number of significant digits.

1) 407, 000 (2 significant digits) _____
2) 11, 000 (1 significant digit) _____
3) 0.0235 (1 significant digit) _____
4) 5.351×10^{-4} (2 significant digits) _____
5) 0.001 602 (1 significant digit) _____
6) 260,000 (1 significant digit) _____
7) 13. 023 (3 significant digits) _____
8) 561, 200 (3 significant digits) _____
9) 6.25×10^{3} (1 significant digit) _____
10) 9.152×10^{6} (2 significant digits) _____

C. Do the following calculations and round off the answers to the correct number of sig. figs. Make sure that each answer has an appropriate unit.

1. $mass\ of\ water = 1.0 \frac{g}{mL} \times 8.50\ mL$

2. $heat\ absorbed = 5.60\ g\ \left(4.184\ \frac{J}{g\ ^{\circ}C}\right)$ (35.5 °C)

3. change in temperature = 100.0 ^{o}C – 30.0 ^{o}C

4. partial pressure of a gas = 0.65 (1.00 atm)

5. $mole\ NaCl = \frac{19.3\ g}{58.44 \frac{g}{mol}}$

Practice Worksheet 5 – Dimensional Analysis and Stoichiometry

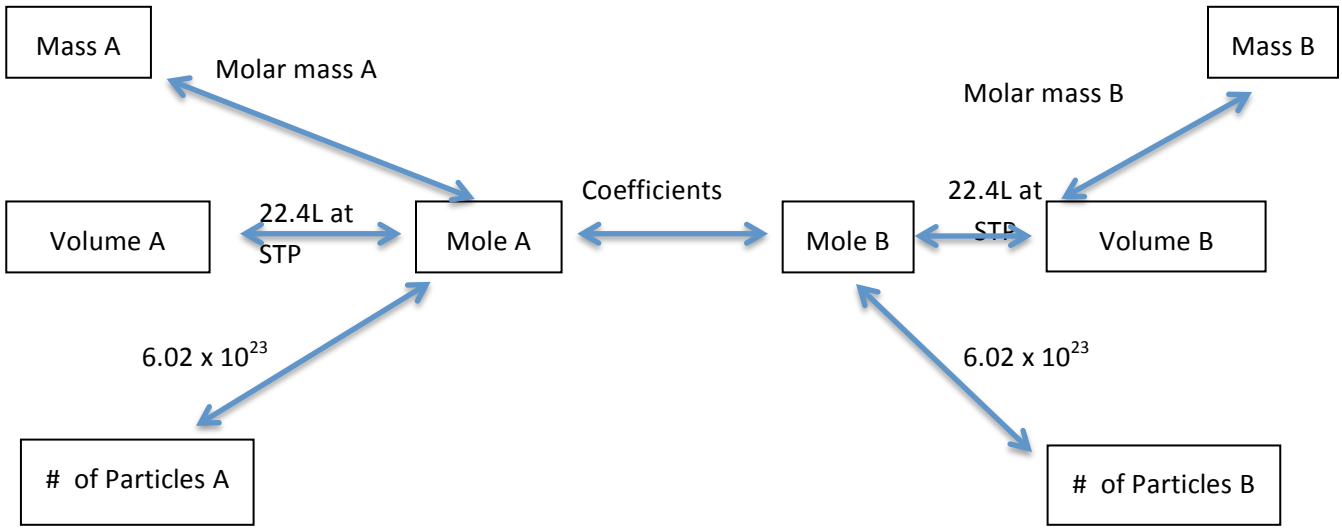
Skill: Do dimensional analysis and stoichiometric calculations.

Dimensional analysis is done by multiplying the given measurement by a ***conversion factor***. The conversion factor allows the given unit to be cancelled, leaving behind the desired (unknown) unit.

$$\text{Given unit} \times \frac{\text{desired unit}}{\text{given unit}} = \text{desired unit}$$

Stoichiometry is the calculation of the amount of reactants and products in a chemical reaction. The map shown below summarizes the different types of stoichiometric conversions.

Stoichiometry Map: Reactant A → Product B



Example 1: How many milligrams (mg) are there in 0.356 kilogram (kg)?

There are 1000g in 1 kg and 1000 mg in 1 g.

$$0.356\ \cancel{kg} \times \frac{10^3\ \cancel{g}}{1\ \cancel{kg}} \times \frac{10^3\ mg}{1\ \cancel{g}} = 356000\ mg \text{ or } 3.56 \times 10^5\ mg$$

Example 2: How many molecules are there in 56.0 g of CO_2?

The mass of 1 mole of CO_2 is 44.0g.

One mole of any substance contains 6.02×10^{23} particles.

$$56.0\ \cancel{g CO_2} \times \frac{1\ \cancel{\text{mole } CO_2}}{44.0\ \cancel{g\ CO_2}} \times \frac{6.02 \times 10^{23}\ CO_2 \text{molecules}}{1\ \cancel{\text{mole } CO_2}} = 7.66 \times 10^{23}\ CO_2 \text{ molecules}$$

Example 3: How many OH^- ions are there in 0.33 moles of $Mg(OH)_2$?

The subscript 2 in the formula $Mg(OH)_2$ shows that 1 mole of this substance contains 2 moles of OH^- ions.

One mole of any substance contains 6.02×10^{23} particles.

$$0.33 \text{ mole } Mg(OH)_2 \times \frac{2 \text{ mole } OH^-}{1 \text{ mole } Mg(OH)_2} \times \frac{6.02 \times 10^{23} \text{ } OH^- \text{ ions}}{1 \text{ mole } OH^-} = 4.0 \times 10^{23} \text{ } OH^- \text{ ions}$$

Example 4: **$2KClO_3$ (s) → $2KCl$ (s) + $3O_2$ (g)**

How many grams of potassium chloride are produced when 0.500 moles of potassium chlorate decomposes?

Based on the balanced equation, 2 moles of KCl are produced from 2 moles of $KClO_3$.

One mole of KCl has a mass of 74.5 g.

$$0.500 \text{ mole } KClO_3 \times \frac{2 \text{ mole } KCl}{2 \text{ mole } KClO_3} \times \frac{74.5 \text{ g } KCl}{1 \text{ mole } KCl} = 37.3 \text{ g } KCl$$

Example 5: **$2KClO_3$ (s) → $2KCl$ (s) + $3O_2$ (g)**

How many liters of oxygen gas may be produced when 50.0g of potassium chlorate is decomposed at STP?

The molar mass of $KClO_3$ is 122.5 g.

Based on the balanced equation, 3 moles of O_2 are produced from 2 moles of $KClO_3$.

One mole of O_2 gas occupies a volume of 22.4 L at STP.

$$50.0 \text{ g } KClO_3 \times \frac{1 \text{ mole } KClO_3}{122.5 \text{ g } KClO_3} \times \frac{3 \text{ mole } O_2}{2 \text{ mole } KClO_3} \times \frac{22.4 \text{ L } O_2}{1 \text{ mole } O_2} = 13.7 \text{ L } O_2$$

Show your work. Round off the answer to the correct number of significant digits and express it using appropriate units.

1. How many millimoles are there in 0.33 moles? (1 mol = 10^3 mmol)

2. How many molecules are there in 53.18 g of Cl_2?

3) How many moles of nitrate ions are there in:

(a) 2.5 moles of $Ba(NO_3)_2$?

(b) 60.0 g of $Fe(NO_3)_3$?

4) $2H_2O_2(l) \xrightarrow{\text{catalyst}} 2H_2O(l) + O_2(g)$

(a) How many grams of hydrogen peroxide must be decomposed to produce 3.5 moles of oxygen gas?

(b) How many moles of water can be produced from the decomposition of 24.0 g of hydrogen peroxide?

5) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

a) How many moles of nitrogen gas completely react with 16.5 moles of hydrogen gas?

b) At STP, how many liters of NH_3 gas may be produced from the reaction between 32.0g N_2 and 8.6g H_2 gas?

Practice Worksheet 6 – Chemical Reactions and Equations

Skill: Identify common types of chemical reactions, predict the products of a reaction, and write balanced chemical equations.

Common Types of Reactions

1. **Synthesis or Combination:** 2 or more reactants combine to form 1 product

   $2H_2\,(g) + O_2\,(g) \rightarrow 2H_2O\,(l)$

2. **Decomposition**: one reactant breaks up to form 2 or more products

   $2H_2O_2\,(l) \rightarrow 2H_2O\,(l) + O_2\,(g)$

3. **Combustion:** rapid reaction of a material (organic) producing carbon dioxide (or carbon monoxide) and water

   $2C_2H_2\,(g) + 5O_2\,(g) \rightarrow 4CO_2\,(g) + 2H_2O\,(l)$ complete combustion

   $2C_2H_2\,(g) + 3O_2\,(g) \rightarrow 4CO\,(g) + 2H_2O\,(l)$ incomplete combustion

4. **Single Displacement**: An active element displaces another from its compound

   $Fe\,(s) + CuSO_4\,(aq) \rightarrow FeSO_4\,(aq) + Cu\,(s)$

5. **Double Displacement:** Two ionic compounds exchange partner ions

   $Na_2CO_3\,(aq) + Cu(NO_3)_2\,(aq) \rightarrow 2NaNO_3\,(aq) + CuCO_3\,(s)$

SOLUBILITY RULES

The ***Solubility Rules*** help us determine whether an ionic compound is soluble or insoluble in water. An insoluble solid that forms from the double displacement reaction between two aqueous solutions is called a ***precipitate***. This reaction that produces the insoluble solid is called ***precipitation***. If you know the solubility rules, you can predict whether a precipitation reaction will occur or not when two aqueous (water) solutions are mixed. ***Memorize these rules.***

The following salts are **SOLUBLE** in water. Take note of the exceptions.

- Salts of alkali metals (Li^+, Na^+, K^+, Cs^+, Rb^+) and ammonium ion (NH_4^+)
- Nitrates (NO_3^-), chlorates (ClO_3^-), perchlorates (ClO_4^-) and permanganates (MnO_4^-)
- Acetates (CH_3COO^-) EXCEPT those containing silver (Ag^+) and mercury(I) (Hg_2^{2+})
- Salts of chloride (Cl^-), bromide (Br^-) and iodide (I^-) ions EXCEPT salts containing silver (Ag^+), lead(Pb^{2+}), mercury(I) (Hg_2^{2+}).
- Sulfates (SO_4^{2-}) EXCEPT $BaSO_4$, $PbSO_4$, Hg_2SO_4, $CaSO_4$

The following salts are **INSOLUBLE** in water. Take note of the exceptions.

- Hydroxides (OH^-) EXCEPT those containing alkali metals and NH_4^+. Those containing Ca^{2+}, Ba^{2+}, Sr^{2+} are moderately soluble.
- Sulfides (S^{2-}), oxides, (O^{2-}), carbonates (CO_3^{2-}), chromates (CrO_4^{2-}), phosphates (PO_4^{3-}) EXCEPT those containing alkali metals and NH_4^+

Example 1:

Tell whether Na_3PO_4, AgCl and $CaCO_3$ are soluble or insoluble.

- Na_3PO_4 is soluble. Although it is a phosphate, it contains an alkali metal.
- AgCl is insoluble. Chlorides are soluble except when the chloride ion is bonded to Ag^+, Pb^{2+} and Hg_2^{2+}.
- $CaCO_3$ is insoluble. Carbonates are insoluble except when the carbonate ion is bonded to an alkali metal ion or NH_4^+.

Example 2:

When aqueous solutions of $Fe(NO_3)_3$ and NaOH are mixed, will a precipitate (insoluble solid) form?

As the equation below shows, an insoluble solid, $Fe(OH)_3(s)$, is formed when the two aqueous solutions undergo a double displacement reaction.

$$Fe(NO_3)_3(aq) + 3NaOH(aq) \rightarrow Fe(OH)_3(s) + 3NaNO_3(aq)$$

A. Balance the following reactions and classify them as SYNTHESIS, DECOMPOSITION, COMBUSTION, SINGLE DISPLACEMENT or DOUBLE DISPLACEMENT.

(1) ___Na_2O (s) + ___H_2O (l) → ___NaOH(aq) _____

(2) ___$BaCl_2$(aq) + ___Na_2CO_3(aq) → ___NaCl(aq) + ___$BaCO_3$(s) _____

(3) ___K(s) + ___H_2O(l) → ___KOH(aq) + ___H_2(g) _____

(4) ___K_2SO_4(aq) + ___$Pb(NO_3)_2$(aq) → ___$PbSO_4$(s)+ ___KNO_3(aq) _____

(5) ___$CaCl_2$(aq) + ___$AgNO_3$(aq) → ___$Ca(NO_3)_2$ + ___AgCl(s) _____

(6) ___C_4H_8(g) + ___O_2(g) → ___CO_2(g) + ___H_2O(l) _____

(7) ___SO_2(g) + ___O_2(g) → ___SO_3(g) _____

(8) ___KBr(aq) + ___O_2(g) → ___K_2O(aq) + ___Br_2(l) _____

(9) ___N_2(g) + ___H_2(g) → ___NH_3(g) _____

(10) ___$Mg(OH)_2$(aq) + ___HCl(aq) → ___$MgCl_2$(aq) + ___H_2O(l) _____

(11) ___C_2H_5OH(l) + ___O_2(g) → ___CO_2(g) + ___H_2O(l) _____

(12) ___$MgCO_3$(s) → ___MgO (s) + ___CO_2(g) _____

(13) ___C_5H_{12}(g) + ___O_2(g) → ___CO_2(g) + ___H_2O(l) _____

(14) ___Fe(s) + ___S_8(s) → ___FeS(s) _____

(15) ___Zn(s) + ___HCl (aq) → ___$ZnCl_2$ (aq) + ___H_2(g) _____

B) Write a balanced equation for each reaction described below.

(16) When silver oxide is heated strongly, it decomposes into silver and oxygen gas.

(17) A sodium carbonate solution reacts with iron(II) nitrate solution.

(18) Magnesium combines with oxygen to form magnesium oxide.

(19) A nickel(II) chloride solution reacts with potassium hydroxide solution.

(20) Zinc reacts with copper(II)nitrate.

C. Tell whether each given ionic substance is SOLUBLE or INSOLUBLE in water.

1. $AgNO_3$	_____	11. potassium hydroxide	_____
2. $PbCl_2$	_____	12. Sodium sulfate	_____
3. $Fe(OH)_3$	_____	13. Calcium phosphate	_____
4. $CuSO_4$	_____	14. Barium sulfate	_____
5. $CaCO_3$	_____	15. Lead(II) nitrate	_____
6. NH_4Cl	_____	16. Magnesium chloride	_____
7. $Ba(OH)_2$	_____	17. Zinc nitrate	_____
8. KBr	_____	18. Potassium chromate	_____
9. AgCl	_____	19. Ammonium nitrate	_____
10. Hg_2Br_2	_____	20. Iron(III) oxide	_____

D. Tell whether a precipitation reaction will occur or not between each pair of aqueous solutions. For those pairs that react, give the products of the reaction and balance the equation.

1) $K_2SO_4(aq) + Ba(NO_3)_2(aq)$

2) $FeCl_3(aq) + NaOH(aq)$

3) $NaCl(aq) + KNO_3(aq)$

4) $LiBr(aq) + AgNO_3(aq)$

5) $NaI(aq) + Pb(NO_3)_2(aq)$

6) $K_3PO_4(aq) + MgCl_2(aq)$

7) $NH_4Cl(aq) + K_2SO_4(aq)$