

## AP Chemistry Summer Assignment

Hello and welcome to AP Chemistry.

The following assignment will be a helpful review for a few topics learned in chem 1.

You ***Must*** learn the common polyatomic ions and solubility rules provided on the next page.

The attached assignment covers chapter 1, 2 and part of chapter 3.

On my school website look in the folder labelled **Summer Review Material Webpage**. It contains screencasts that will help with the summer assignment. Other helpful sites;

- <http://www.mychemistrytutor.com>
- <http://www.chemmybear.com/groves/apchem.html>
- <http://www.bozemanscience.com/ap-chemistry/>

When you return in September there will be an exam on: ***Mole Conversion*** (excluding gas volume)  
***Polyatomic ions***  
***Solubility Rules***  
***Naming Chemical Formulas***

Email me if any questions arise.

Dr. C

### Selected Polyatomic Ions

Formula	Name	Formula	Name
$\text{H}_3\text{O}^+$	hydronium	$\text{CrO}_4^{2-}$	chromate
$\text{Hg}_2^{2+}$	mercury(I)	$\text{Cr}_2\text{O}_7^{2-}$	dichromate
$\text{NH}_4^+$	ammonium	$\text{MnO}_4^-$	permanganate
$\left. \begin{array}{l} \text{C}_2\text{H}_3\text{O}_2^- \\ \text{CH}_3\text{COO}^- \end{array} \right\}$	acetate	$\text{NO}_2^-$	nitrite
$\text{CN}^-$	cyanide	$\text{NO}_3^-$	nitrate
$\text{CO}_3^{2-}$	carbonate	$\text{O}_2^{2-}$	peroxide
$\text{HCO}_3^-$	hydrogen carbonate	$\text{OH}^-$	hydroxide
$\text{C}_2\text{O}_4^{2-}$	oxalate	$\text{PO}_4^{3-}$	phosphate
$\text{ClO}^-$	hypochlorite	$\text{SCN}^-$	thiocyanate
$\text{ClO}_2^-$	chlorite	$\text{SO}_3^{2-}$	sulfite
$\text{ClO}_3^-$	chlorate	$\text{SO}_4^{2-}$	sulfate
$\text{ClO}_4^-$	perchlorate	$\text{HSO}_4^-$	hydrogen sulfate
		$\text{S}_2\text{O}_3^{2-}$	thiosulfate

#### Solubility Rules

The following are always soluble with anything

Group I metals

Ammonium  $\text{NH}_4^+$

Nitrate  $\text{NO}_3^-$

Acetate  $\text{C}_2\text{H}_3\text{O}_2^-$

Hydrogen carbonate  $\text{HCO}_3^-$

Chlorate  $\text{ClO}_3^-$

Partial solubility- the following are soluble with everything except

Halides ( $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ )

$\text{Ag}^+$ ,  $\text{Pb}^{2+}$ ,  $\text{Hg}_2^{2+}$

Sulfates ( $\text{SO}_4^{2-}$ ) - Hungry seniors always bake peanut butter cakes

$\text{Hg}_2^{2+}$   $\text{Sr}^{2+}$   $\text{Ag}^+$   $\text{Pb}^{2+}$   $\text{Ca}^{2+}$

The following are soluble with Group I metals,  $\text{NH}_4^+$  and...

Hydroxides ( $\text{OH}^-$ ) - Seniors bake cakes

$\text{Sr}^{2+}$   $\text{Ba}^{2+}$   $\text{Ca}^{2+}$

Chromate ( $\text{CrO}_4^{2-}$ ) - Make cakes

$\text{Mg}^{2+}$   $\text{Ca}^{2+}$

### Mole Conversions

1 Mole = Formula Mass (g) =  $6.02 \times 10^{23}$  molecules, atoms, particles = 22.4 L of gas @ STP  
(AKA Molar Mass)

Please Define the Following (primarily chapter 1)

Pure substance

Element

Compound

Law of Constant Composition

Law of Definite Proportions

Physical Property

Chemical Property

Physical Change

Chemical Change`

1. Use factor labeling method to convert the following:

a. 50.0mL = \_\_\_\_ liters.

$$? \text{ L} = 50.0 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 0.0500 \text{ L (to 3 significant figures)}$$

b. 650 in = \_\_\_\_ meters

c. 4 years= \_\_\_\_ seconds.

d. 200 liters = \_\_\_\_ ml

2. Classify each of the following as units of mass, volume, length, density, energy, or pressure.

a.Kg

b. Liter

c. m<sup>3</sup>

d. mm

e. kg/m<sup>3</sup>

f. Joule

g. atm

h. cal

i.Torr

J. g/ml

3. Most laboratory experiments are performed at room temperature at 25°C. Express this temperature in:

a. °F

b. K

4. How many significant figures are in each of the following?

a. 1.9200 mm

b. 0.0301001 kJ

c. 6.022 x10<sup>23</sup> atoms

d. 460.000 L

e. 0.000036 cm<sup>3</sup>

f. 10000

g. 1001

h. 0.001345

i. 1.0.0101

J. 3.02 x 10<sup>4</sup>

k. 3.21 x 10<sup>-2</sup>

5. Write the number 1200 three ways: to 2, 3, and 4 significant figures
6. Record the following in correct scientific notation:
- 4,050,000,000 cal     $4.05 \times 10^9$  cal
  - 0.000123 mol
  - 0.00345 Å
  - 700,000,000 atoms
7. Calculate the following to the correct number of significant figures.
- $1.270 \text{ g} / 5.296 \text{ cm}^3$
  - $12.235 \text{ g} / 1.010 \text{ L}$
  - $12 \text{ g} + 0.38 \text{ g}$
  - $170 \text{ g} + 2.785 \text{ g}$
  - $2.1 \times 3.2102$
  - $200.1 \times 120$
  - $17.6 + 2.838 + 2.3 + 200.$
8. A cylinder rod formed from silicon is 46.0 cm long and has a mass of 3.00 kg. The density of silicon is  $2.33 \text{ g/cm}^3$ . What is the diameter of the cylinder? (the volume of cylinder is given by  $V = \pi r^2 h$ , where r is the radius and h is the length)
9. Give the chemical symbols for the following elements:
- |            |             |             |             |              |
|------------|-------------|-------------|-------------|--------------|
| a. Carbon  | b. sulfur   | c. Titanium | d. Nitrogen | e. Helium    |
|            |             |             |             |              |
| f. Krypton | g. Fluorine | h. Scandium | i. Arsenic  | J. Potassium |
|            |             |             |             |              |
| k. Sodium  | l. chloride | m. Iron     | n. Zinc     |              |

10. A container has a volume of  $1.05 \times 10^3 \text{ cm}^3$ . When filled with gas, the mass of the container + gas is 837.6 g. The mass of the container alone is 836.2 g. To the correct number of significant figures, what is the density of the gas?  $D=m/v$
11. Classify each of the following as to pure substances or mixtures. If an item is a mixture, specify if it is heterogeneous or homogeneous.
- |               |                     |
|---------------|---------------------|
| (a) concrete  | (e) air             |
| (b) seawater  | (f) tomato juice    |
| (c) magnesium | (g) iodine crystals |
| (d) gasoline  | (h) a nickel        |
12. How would you separate a mixture of granulated sugar and beach sand of comparable grain size?
13. Label each of the following as either a **physical process** or a **chemical process**.
- |                                 |  |
|---------------------------------|--|
| a. Corrosion of aluminum metal. | f. Milk turning sour.                              |
| b. Melting of ice.              | g. Burning of paper.                               |
| c. Pulverizing an aspirin.      | h. Forming of frost on a cold night.               |
| d. Digesting a candy bar.       | i. Bleaching of hair with $\text{H}_2\text{O}_2$ . |
| e. Explosion of nitroglycerin.  | j. A copper wire is hammered flat.                 |

14. A solid white substance A is heated strongly in the absence of air. It decomposes to form a new white solid substance B and a gas C. The gas has exactly the same properties as the product obtained when carbon is burned with excess oxygen. What can you say about whether solids A and B and the gas C are elements or compounds?
15. In the process of attempting to characterize a substance, a chemist makes the following observation: The substance is a silvery white, lustrous metal. It burns in air, producing an intense white light. It reacts with chlorine to give a brittle white solid. The substance can be pounded into thin sheets or drawn into wires. It is a good conductor of electricity. Which of these characteristics are physical and which are chemical properties?
16. Why do we call  $\text{Ba}(\text{NO}_3)_2$  barium nitrate, but we call  $\text{Fe}(\text{NO}_3)_2$  iron(II) nitrate?
17. Write the formula of the following compounds? (google → "formula writing")
- a. Calcium sulfate.
  - b. Ammonium Phosphate
  - c. Lithium Nitrite
  - d. potassium perchlorate.
  - e. Barium Oxide
  - f. Zinc sulfide.
  - g. Sodium Perbromate
  - h. Calcium Iodide
  - i. Aluminum Carbonate
18. Convert **6.75 atm** to: (Using **factor-labeling** method) (google → "pressure conversions")
- a. torr
  - b. kilopascals
  - c. mm of Hg

Define the following (primarily Chap 2)

Dalton

Thomson

Millikan

Becquerel

Curie

Chadwick

Atomic number

Atomic mass

Average atomic (isotopic) mass

Mass spectrometer

Structural formula



How many grams of methane ( $\text{CH}_4$ ) are present in 5.6 moles of methane gas?  
(Using the factor labeling method)

What is the difference between?

a. Chlorine and Chloride


b. Sodium atom and Sodium ion


How many grams of methane ( $\text{CH}_4$ ) are present in 5.6 moles of methane gas?  
(Use the factor labeling method)

19. Nitrogen (atomic mass=14.00674) has two isotopes, N-14 and N-15, with atomic masses of 14.00031 amu and 15.0001 amu, respectively. What is the percent abundance of N-15?  
(google → "atomic mass isotope abundance")

20. Write the number of protons and electrons?

	Protons	Neutrons	Electrons
a. P <sub>4</sub> molecule			
b. a PCl <sub>5</sub> molecule			
c. a P <sup>3-</sup> ion			
d. P <sup>5+</sup> ion			

21. Mercury has an atomic mass of 200.59 amu. Calculate the

a. Mass of  $3.0 \times 10^{10}$  atoms

b. Number of atoms in one nanogram of Mercury

22. Calculate the molar masses (g/mol) of

a. Ammonia (NH<sub>3</sub>)

b. Baking soda (NaHCO<sub>3</sub>)

c. Osmium Metal (Os)

23. List the following as diatomic molecule, molecular compound, ionic compound, atomic element.

a.  $F_2$

f.  $CO_2$

k.  $O_2$

b.  $Cl_2$

g.  $H_2$

l.  $I_2$

c. C

h. Ag

m. CO

d. NaCl

i. Rust ( $Fe_2O_3$ )

n.  $K_2CO_3$

e. KF

j. MgO

24. White gold is an alloy that typically contains 45.0% by mass gold and the remainder is platinum. If 154 g of gold are available, how many grams of platinum are required to combine with the gold to form this alloy?

25. What is the empirical formula of a compound that contains 53.73% Fe and 46.27% of S ?  
(Google → "empirical formula percent ")

26. Determine the number of molecules present in 4.56 mol of nitrogen ( $N_2$ ).  
(Google → "mole conversions ")

Atoms?

27. A hydrated compound has an analysis of 18.29% Ca, 32.37% Cl, and 49.34% water. What is its formula? (Google → "percent empirical formula")

28. Name the 4 types of **general inorganic reactions** with example of each?

29. Define Acid, base and salt? Give two examples of each.

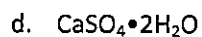
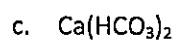
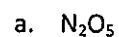
Acid-

Base-

Salt-

30. The hormone, thyroxine is secreted by the thyroid gland, and has the formula:  $C_{15}H_{17}NO_4I_4$ . How many milligrams of Iodine can be extracted from 15.0 Grams of thyroxine? (hint...mass% I)

31. Determine the **formula weight** (aka molar mass) for the following:



32. Determine the empirical formula of the compounds with the following compositions by mass:

a. 10.4 % C, 27.8% S , 61.7 % Cl

b. 21.7 % C, 9.6 % O, and 68.7 % F

33. Common Polyatomic Ions *(Please provide in the following)*

Name	Formula with charge	Name	Formula with charge
a) Acetate		b) Ammonium	
c) Carbonate		d) Chlorate	
e) Chlorite		f) Chromate	
g) Cyanide		h) Dichromate	
i) Dihydrogen Phosphate		j) Dihydrogen Phosphate	
k) Hydrogen Carbonate		l) Hydrogen Sulfate	
m) Hydrogen Sulfite		n) Hypochlorite	
o) Hydroxide		p) Nitrate	
q) Nitrite		r) Oxalate	
s) Perchlorate		t) Permanganate	
u) Peroxide		v) Phosphate	
w) Sulfate		x) Sulfite	
y) Thiosulfate			

34.

Common Acids	Formula	Common Acids	Formula
Hydrochloric Acid		Phosphoric acid	
Perchloric acid		Periodic Acid	
Carbonic acid		Sulfurous Acid	
Nitrous acid		Sulfuric Acid	
Nitric Acid		Hypochlorous Acid	
Chlorous Acid		Chloric Acid	

Symbol with charge

36. **Common ions of transition elements**
- | Ion Name | Ion |
|----------|-----|
|----------|-----|

- a) Chromium(III)
- b) Manganese(II)
- c) Iron(II)
- d) Iron(III)
- e) Cobalt(II)
- f) Nickel(II)
- g) Copper(II)
- h) Zinc
- i) Silver
- j) Cadmium
- k) Mercury(II)

37. One way to remove Nitrogen Oxide (NO) from smokestack emissions is to react it with ammonia:



a. 12.3 mol of NO reacts with \_\_\_\_\_ mol of ammonia

b. 5.87 mol NO yields \_\_\_\_\_ mol nitrogen.

38. Name the following covalent compounds:

a.  $\text{CO}_2$

f.  $\text{SF}_6$

b.  $\text{P}_4\text{S}_{10}$

g.  $\text{CH}_4$

c.  $\text{NI}_3$

h.  $\text{C}_2\text{H}_6$

d.  $\text{PCl}_5$

i.  $\text{C}_3\text{H}_8$

e.  $\text{CCl}_4$

39. Define **Oxidation number**.

Find the **Oxidation number** of

a. Carbon in  $\text{CO}_2$

c. Phosphorus in  $\text{PO}_4^{3-}$

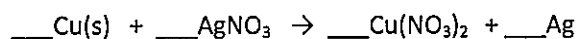
b. Sulfur in  $\text{H}_2\text{SO}_4$

d. Manganese in  $\text{MnO}_4^{2-}$



40. What mass of copper is required to replace silver from 4.00g of silver nitrate dissolved in water?

(Google→"stoichiometry")



41. Write the chemical formulas for the following compounds:

a. Calcium Carbonate

g. Magnesium Acetate

b. Ammonium Phosphate

h. Potassium cyanide

c. Sodium Chloride

i. Zinc(II) Nitrate

d. Sodium Oxide

j. Iron(III) Phosphate

e. Calcium Sulfate

k. Nickel (II) Fluoride

f. Sodium Nitrite

b. Law of multiple proportion

42. Strontium consists of four isotopes with masses and their percent abundance of 83.9134 amu (0.5%), 85.9094 amu (9.9%) , 86.9089 amu (7.0 %) , and 87.9056 amu (82.6 %). Calculate the atomic mass of Sr ? (Google→ "atomic mass calculation")