

AP Chemistry Summer Assignment

The goal of this assignment is to make sure that everyone has the fundamentals that they will need to be successful in Chemistry II & AP Chemistry. You should have had all of this material in your general Chemistry course. I just want to make sure that you have refreshed your memory before we delve into the higher level chemistry topics. I have tried to include most of the rules and equations, etc. for solving these problems. After completing this assignment, you will be expected to know these. Have a great summer! I look forward to delving into some exciting chemistry next year!!!

Show all work on Math Problems!!!**Significant Figures and Calculations (*all math problems will require the use of sig figs)**

<u>Rules for Determining the Number of Significant Figures:</u>	<u>Rules for Calculating with Significant Figures</u>
<ol style="list-style-type: none"> Nonzeros are always significant. Sandwiched zeros and zeros to the right of a decimal <u>are</u> significant. <ol style="list-style-type: none"> Ex. 504 and 4002 and 4.0003 Ex. 33.00 and 4.10 Zeros used as placeholders are <u>not</u> significant. <ol style="list-style-type: none"> Ex. 0.0043 and 0.06 Ex. 800 	<ol style="list-style-type: none"> Do not round until you get to the final answer (5 or higher rounds up). Adding & Subtracting: Use the least number of decimal places. <ol style="list-style-type: none"> Ex. $6.5 + 3.22 = 6.7$ (one decimal place) Multiplying & Dividing: Use the least number of significant figures. <ol style="list-style-type: none"> Ex. $11.3 \times 240 = 2700$ (two significant figures)

- $5.3 \times 800 =$ _____
- $0.0062 + 4.05 =$ _____
- $6.02 \times 10^{23} \times 4 =$ _____
- $5.032 - 4 =$ _____

Unit Conversions - Metric & Temperature (Use sig figs!)

Memorize these!	1 L = 1000 mL (milli)	1 L = 1×10^6 μ L (micro)
	1 kg = 1000 g (kilo)	1 m = 1×10^9 nm (nano)
	1 m = 100 cm (centi)	K = $^{\circ}$ C + 273

- 60 kg = _____ g
- 62 cm = _____ m
- 1.5 mL = _____ L
- 5.3 L = _____ μ L
- 6.2×10^4 nm = _____ m
- 30° C = _____ K
- 500 K = _____ $^{\circ}$ C

Density = mass / Volume (Use sig figs!)

- What is the density of an object that has a mass of 5 g and occupies 5 cm³? _____
- What is the mass of a 5 L gas that has a density of 2.3 g/L? _____
- What is the volume of a 0.03 g object that has a density of 4.8 g/mL? _____

Atomic Theories – Bohr, Chadwick, Dalton, Democritus, Milikan, Rutherford, Schrodinger (electron cloud model), Thomson

- 1) Who coined the term “atom”? _____
- 2) Who first discovered subatomic particles? _____
- 3) Who used the cathode ray tube to discover the electron? _____
- 4) Who created the Plum Pudding model? _____
- 5) Who discovered the mass and charge of an electron using the oil drop experiment? _____
- 6) Who used the gold foil experiment to discover the nucleus and to determine that the atom is mostly empty space? _____
- 7) Who discovered the neutron? _____
- 8) Who said that electrons orbit the nucleus like planets orbit the sun (Planetary model) and electrons occupy energy levels? _____
- 9) Who said that we cannot know the exact location of electrons, but we do know the probability of finding an electron in a certain place? _____

Atomic Number, Mass Number, Isotopes

Atomic number = # of protons; Mass Number = # of protons and neutrons;

Isotopes of an element have a different number of neutrons which gives them different masses.

- 1) How many protons, neutrons, and electrons are in $^{50}\text{Cr}^{3+}$? ___ p+, ___ n, ___ e-
- 2) How many protons, neutrons, and electrons are in $^{80}\text{Br}^{1-}$? ___ p+, ___ n, ___ e-
- 3) How many protons, neutrons, and electrons are in Te-127? ___ p+, ___ n, ___ e-
- 4) Circle the two that are isotopes: $\begin{matrix} 59Z \\ 42Z \end{matrix}$, $\begin{matrix} 59Z \\ 23Z \end{matrix}$, $\begin{matrix} 61Z \\ 42Z \end{matrix}$

Electron Configuration – Energy levels and sublevels

Hint: $1s^2 2s^2 \dots$ etc.

- 1) What is the electron configuration for a Nitrogen atom? _____
- 2) What is the electron configuration for a Magnesium ion? _____
- 3) How many valence electrons does this atom have: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^2$? _____

Periodic Trends – radius, ionization energy, electron affinity (electronegativity), oxidation states

- Atomic Radius (size): Top to Bottom – increases because you are adding energy levels; Left to Right – decreases because you add protons which pulls in the electrons closer.
- Ionization Energy (energy needed to remove an e-): Highest = He, Lowest = Fr
- Electron Affinity (Electronegativity; pull for e-): Highest = F, Lowest = Fr
- Oxidation States = Charges

- 1) Use the following elements: K, Ca, Sn, I
 - a. Which has the smallest radius? _____
 - b. Which has the largest radius? _____
 - c. Which has the greatest electron affinity? _____
 - d. Which has the smallest electron affinity? _____
 - e. Which has the greatest ionization energy? _____
 - f. Which has the lowest ionization energy? _____
- 2) Give the oxidation number of each of the elements below:
 - a. Strontium: _____
 - b. Nitrogen: _____
 - c. Gallium: _____
 - d. Argon: _____

Naming Ionic and Covalent Compounds

Ionic (Metal + Nonmetal, or polyatomic ion)– change the ending to –ide (except for polyatomic ions), include Roman Numerals if the first element is a transition metal (not Ag, Cd, or Zn) or if it is Sn or Pb.

Covalent (Nonmetal + Nonmetal): use prefixes; change ending to –ide.

- 1) $\text{Mg}(\text{NO}_3)_2 =$ _____
- 2) $(\text{NH}_4)_2\text{SO}_4 =$ _____
- 3) $\text{S}_2\text{O}_4 =$ _____
- 4) $\text{NO}_3 =$ _____
- 5) $\text{CuNO}_3 =$ _____
- 6) $\text{PbSO}_4 =$ _____
- 7) $\text{CrO}_2 =$ _____

Naming Acids

Polyatomic ion ends in –ate → -ic acid

Polatomic ion ends in –ite → -ous acid

Ends in just an element (-ide) → hydro- -ic acid

- 1) HCl : _____
- 2) H_2SO_4 : _____
- 3) HNO_2 : _____
- 4) HBr : _____
- 5) HNO_3 : _____
- 6) H_3PO_4 : _____

Write Formulas from Names

Ionic: criss-cross charges to find subscripts; reduce to simplest ratio

Covalent: the prefixes give you the subscripts

Acids: Start with an “H”, choose appropriate anion, criss-cross

- 1) Dinitrogen tetroxide: _____
- 2) Chromium (VI) sulfide: _____
- 3) Magnesium oxide: _____
- 4) Calcium cyanide: _____
- 5) Lead (II) sulfate: _____
- 6) Ammonium carbonate: _____
- 7) Phosphorus tribromide: _____
- 8) Hydrofluoric acid: _____
- 9) Acetic acid: _____
- 10) Sulfurous acid: _____

Mass Percent (Percent Composition)

Put the mass of the element (multiplied by the number of atoms) over the mass of the total compound and multiply by 100.

- 1) What is the mass percent of oxygen in $\text{Sr}(\text{NO}_3)_2$? **Show your work here:**

- 2) What is the mass percent of Cu in copper (II) nitrate? **Show your work here:**

Empirical & Molecular Formulas

Empirical Formula (simplest ratio): Change the percent to grams. Convert grams to moles. Divide by the smallest number of moles. The numbers are the subscripts.

Molecular Formula (a multiple of the empirical formula): You will be given the molecular mass. Divide the molecular mass by the mass of the empirical formula. Multiply the subscripts by the number you get.

- 1) What is the empirical formula if the mass percents are 75% Carbon and 25% Hydrogen?

- 2) What is the molecular formula of the above compound if the molecular weight is 64 g/mol?

Balancing Chemical Equations & Types of Chemical Reactions

Complete the following reactions, balance, and label the type.

1. _____ Zn + HCl →
2. _____ Al(OH)₃ + Fe₂S₃ →
3. _____ C₃H₆ + O₂ →

Stoichiometry

1. How many liters of H₂O are produced from 8.3 g of O₂ and excess hydrogen at STP according to the following reaction: $O_2 + 2H_2 \rightarrow 2H_2O$

2. What mass of sodium chloride is produced when chlorine reacts with 0.29g of sodium iodide according to the following reaction: $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$

Molarity

1. What is the molarity of a solution of HCl with 20 moles in 500 mL?
2. How much volume would be needed to make a 3.0 Molar solution of NaOH if you dissolve 50 grams into water?
3. How many grams of iron (II) oxide would be needed to make a 1.5 M solution with 800 mL of water?
4. How much volume would be needed to dilute 2 liters of a 6.0 M solution of HCl to 3.0 M?

Gas Laws – Combined, Ideal

1. A gas has a pressure of 120 kPa and a volume of 45 L. If the temperature remains constant, but the volume is reduced to 20 L, what is the final pressure?
2. If 1.5 moles of a gas are put into a container that holds 20 L at a temperature of 25°C, what pressure (in atm) would it be?
3. A gas has a temperature of 30°C and it occupies a space of 600 mL at 580 torr. If its conditions change so that it is at STP, what is the final volume?
4. A sample of oxygen has a pressure of 1.3atm, a sample of hydrogen has a pressure of 0.8atm, and a sample of nitrogen has a pressure of 1.5atm. If all three gases are combined into a single container, what would the total pressure of the gas mixture be?
5. A gas at constant volume experiences a pressure change from 2.1 atm to 780 torr. If the final temperature was 20°C, what was the initial temperature?