

AP Chemistry Summer Packet #1

**Learning Target 1 – I can count the number of significant figures in a measurement.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. Pg 13-16

Wikipedia: Significant Figures

1) Count the number of significant figures in the following measurements:

a) 2.71 g \_\_\_\_ b) 0.00047 kg \_\_\_\_ c)  $7.0 \times 10^5$  m \_\_\_\_ d) 1,030 L \_\_\_\_

e) 150 pencils \_\_\_\_ f) 37500 g \_\_\_\_ g) 0.1010 cm \_\_\_\_

**Learning Target 2 – I can convert numbers to scientific notation while applying significant figures.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. Pg 13-16

Wikipedia: Significant Figures

2) Express each of the following in proper scientific notation (Pay attention to sig figs and units)

a) 0.000125 m \_\_\_\_\_ b) 155.0 mL \_\_\_\_\_

c) 123,030,000 kg \_\_\_\_\_ d)  $481.9 \times 10^{-9}$  cm \_\_\_\_\_

**Learning Target 3 - I can add, subtract, multiply, and divide with the correct number of significant figures.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. Pg 13-16

Wikipedia: Significant Figures

3) Calculate the correct answer with proper units and sig figs for each of the following:

a)  $12 \text{ g} + 0.677 \text{ g} + 86.33 \text{ g} =$  \_\_\_\_\_

b)  $(355.78 \text{ g}) / (0.056 \text{ g}) =$  \_\_\_\_\_

c)  $97.34 \text{ mL} - 34.1 \text{ mL} =$  \_\_\_\_\_

d)  $14.68 \times 5 =$  \_\_\_\_\_

4) Perform the following calculations with scientific notation and report your answer with the correct number of significant figures.

a)  $0.14 \times (6.02 \times 10^{23}) =$  \_\_\_\_\_

b)  $(9.875 \times 10^4) - (9.795 \times 10^4) \times 100 \% =$  \_\_\_\_\_ (assume 100 is exact)  
 $9.875 \times 10^4$

c)  $(3.8 \times 10^{-12} + 4.0 \times 10^{-13}) =$  \_\_\_\_\_  
 $(4 \times 10^{12} + 6.3 \times 10^{13})$

**Learning Target 4 – I can use conversions to solve dimensional analysis problems.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. Pg 16-19  
2,3,4 or 5

Google: Dimensional Analysis [links](#)

- 5) Solve the following problems using conversions and dimensional analysis.
- a) A large railroad car is filled with 1745 gallons of milk. The car springs a leak in the bottom, and milk starts dripping out at a rate of 204.84 mL/sec. If the train is traveling at a speed of 65.4 miles per hour, calculate how many miles it will travel before all the milk has drained out of the car.  
(1 gal = 3.78 L, 1 mile = 5280 ft, 1 in = 2.54 cm)
- b) The world record for the hundred meter dash is 9.77 seconds. What is the corresponding average speed in units of m/sec, km/hr, ft/sec, and miles/hr?

**Learning Target 5 – I can explain density and use the density equation to find an unknown.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. Pg 24-25

Wikipedia: Density

- 6) A rectangular block has dimensions of 2.9 cm x 3.5 cm x 10.0 cm. The mass of the block is 615.0 grams. What are the volume and the density of the block?
- 7) The density of pure silver is 10.5 g/mL at 20°C. If 5.25 grams of pure silver pellets are added to a graduated cylinder containing 11.2 mL of water, to what volume will the water in the cylinder rise?

**Learning Target 6 – I can define and explain terms that identify physical/chemical characteristics of matter.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. Pg 25-28  
of the terms below

Wikipedia: Matter or Wikipedia any

- 8) Define the following terms:

- a) Solid –
- b) Liquid –
- c) Gas –
- d) Pure substance –
- e) Homogeneous mixture –
- f) Heterogeneous mixture –
- g) Chemical change –
- h) Physical change –
- 9) Identify the following as a physical property, physical change, chemical property, or chemical change:
  - a) Ethanol has a density of 0.697 g/mL.
  - b) The solution turns blue upon mixing water and food coloring.
  - c) Wood burns in an oven.
  - d) Methyl alcohol is highly flammable.
  - e) Ice melts in a beaker.
  - f) Methyl ethanoate smells like apples.
  - g) A car crashes into a wall.
  - h) Sugar dissolves in water.

**Learning Target 7 – *I can identify the number of protons, neutrons, and electrons in atoms and isotopes.***

Review Reading: Zumdahl 7<sup>th</sup> Ed. Pg 49-50

Wikipedia: Isotope

10) What number of protons and neutrons are contained in the nucleus of each of the following atoms?

Assuming each atom is uncharged, what number of electrons are present?

- a)  ${}_{92}^{235}\text{U}$
- b)  ${}_{6}^{13}\text{C}$
- c)  ${}_{26}^{57}\text{Fe}$
- d)  ${}_{82}^{208}\text{Pb}$

11) Complete the following table:

**Learning Target 8 – I can define and use the Law of Definite Proportions and the Law of Multiple Proportions.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. Pg 31

Google: Law of Definite Proportions, Law of Multiple Proportions

Name	Mass #	Atomic #	of Protons	of Neutrons	of Electrons	Symbol
Gallium	70					
						${}_{15}^{31}\text{P}^{-3}$
Strontium-80						
						${}_{25}^{55}\text{Mn}^{+2}$

12) Explain:

a) Law of Definite Proportions:

b) Law of Multiple Proportions:

13) Solve the following problem:

in - Oxygen compound	Tin % by mass	Oxygen % by mass
Stannous oxide	88.10%	11.90%
Stannic oxide	78.70%	21.30%

in - Oxygen compound	Tin mass	Oxygen mass
Stannous oxide	100.0 grams	
Stannic oxide	100.0 grams	

a) Use the Law of Definite Proportions to determine the mass of oxygen needed to combine with the given masses of tin for stannous oxide and stannic oxide.

b) Does the Law of Multiple Proportions hold true in this case? Explain why or why not.

**Learning Target 9 – I can name and write formulas for ionic compounds.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. Pg 57-63  
inorganic compounds

Wikipedia: IUPAC nomenclature of

14) Name or give the formula for the following compounds:

<u>Name</u>	<u>Formula</u>
Sodium fluoride	_____
_____	K <sub>2</sub> O
Calcium phosphate	_____
_____	FeCl <sub>3</sub>
Iron (II) chloride	_____
_____	Hg <sub>2</sub> O
Sodium sulfate	_____
_____	CaCO <sub>3</sub>
Lithium phosphate	_____
_____	SO <sub>2</sub>
Calcium hydroxide	_____
_____	H <sub>2</sub> SO <sub>4</sub>
Cupric chloride	_____

**Learning Target 10 – I can write and balance equations.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. 98-102  
[www.chymist.com/Equations.pdf](http://www.chymist.com/Equations.pdf)

Write and balance the following equations:

- Iron metal reacts with oxygen to form rust, iron (III) oxide.
- Calcium metal reacts with water to produce aqueous calcium hydroxide and hydrogen gas.
- Aqueous barium hydroxide reacts with aqueous sulfuric acid to produce solid barium sulfate and water.

**Learning Target 11 – I can do conversions associated with moles.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. 82-88      Google: Mole Calculations

15) Solve the following problems:

- a) Calculate the mass of 500. Atoms of iron (Fe).
  
  
  
  
  
  
  
  
  
  
- b) How many formula units are present in 87.2 grams of lead (IV) carbonate?
  
  
  
  
  
  
  
  
  
  
- c) Aspartame is an artificial sweetener that is 160 times sweeter than sucrose (table sugar) when dissolved in water. It is marketed as Nutra-Sweet. The molecular formula of aspartame is  $C_{14}H_{18}N_2O_5$ .
  - i. Calculate the molar mass of aspartame.
  
  
  
  
  
  
  
  
  
  
  - ii. Calculate the mass, in grams, of 1.56 mol of aspartame.
  
  
  
  
  
  
  
  
  
  
  - iii. How many molecules are in 5.0 mg of aspartame?
  
  
  
  
  
  
  
  
  
  
  - iv. How many atoms of nitrogen are in 1.2 g aspartame?
  
  
  
  
  
  
  
  
  
  
  - v. What is the mass of one molecule of aspartame?

**Learning Target 12 – I can calculate percent by mass for an element in a compound.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. 89-90      Google: percent mass

16) Calculate the percent by mass for each element in aspartame from the previous problem.

**Learning Target 13 – I can calculate the average atomic mass of an isotope using percent abundance.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. 78-81

Google: average atomic mass

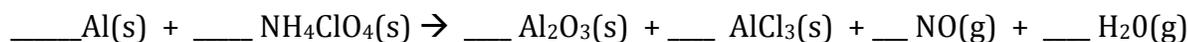
- 17) An element consists of 1.40% of an isotope with a mass of 203.973 amu, 24.10% of an isotope with mass 205.9745 amu, 22.10% of an isotope with mass 206.9759 amu, and 52.40% of an isotope with mass 207.9766 amu. Calculate the average atomic mass and identify the element.

**Learning Target 14 – I can solve stoichiometry problems, include those that use limiting and excess.**

Review Reading: Zumdahl 7<sup>th</sup> Ed. 102-113

Google: stoichiometry problems

- 18) The reusable booster rockets of the U.S. space shuttle employ a mixture of aluminum and ammonium perchlorate for fuel. A possible reaction for this is:



- a) Balance the following reaction:
- b) If 4.0 g of aluminum reacted with 15.0 g of ammonium perchlorate, what would be the limiting reactant? How much excess of the other reactant would you have?
- c) Using the above information, how much aluminum chloride would be produced in grams?
- d) If you actually collected 4.18 g of aluminum chloride what would be your percent yield?

19) You add aluminum to a solution of copper (II) chloride and it reacts exothermically. Write and balance the equation below.

a) If you react 1.25 g of Al, how much copper (II) chloride do you need to add for the Al to fully react?

b) How much of each product would you collect?

20) When 125.0 g of ethylene ( $C_2H_4$ ) burns in 60.0 grams of oxygen to give carbon dioxide and water, how many grams of  $CO_2$  are formed? (Hint: balance the equation and determine limiting reactant first)

**Learning Target 15 – I can determine the empirical and molecular formula by calculation.**

Review Reading:

Zumdahl 7<sup>th</sup> Ed. 91-96

Google: empirical formula

21) Phenol is a compound that contains 76.57% carbon, 6.43% hydrogen, and 17.0% oxygen.

a) Calculate the empirical formula.

b) If its molecular weight is 188 g/mol, what would be its molecular formula?

**Learning Target 16 - *I can calculate the empirical formula of an unknown hydrocarbon through a combustion reaction and calculation.***

**Review Reading:** Zumdahl 7<sup>th</sup> Ed. 91-92      **Google:** combustion analysis

22) One killer of a problem – a GOLD STAR if you can get this one:

Menthol, the substance we can smell in mentholated cough drops, is composed of carbon, hydrogen, and oxygen. A 0.1005 gram sample of menthol is combusted producing 0.2829 g of CO<sub>2</sub> and 0.1159 g of H<sub>2</sub>O. What is the empirical formula for menthol? Show work.