

Welcome to AP Chemistry!

I hope you will find next year's chemistry class to be interesting and enjoyable. I know that you will find it challenging. I have enclosed a packet of materials that I would like you to work on over the summer. This is the material I expect you to know when you walk into class. The first section consists of review material. The second part is the assessment for this review material. I would prefer that you would work in small groups and discuss any problems you have with each other.

You should work hard to make sure you are up to speed on this material. Understanding of this material will be expected but is by no means a prerequisite to be in the class. It will, however, make the start of the year much easier and relieve much of the stress and anxiety that can come at the beginning of an Advanced Placement class. The material in this packet will be briefly reviewed, but it is expected that you feel comfortable with most of it. All you'll need for this packet is a calculator and a periodic table.

If you need some help:

You can email me – my email is akraus@grantbulldogs.org.

I'm looking forward an exciting year in chemistry as well as successful scores on the Advanced Placement Test.

Enjoy the rest of the summer and have fun doing a little chemistry.

Ms. Amber Kraus

AP Chemistry Summer Review Packet

- How many significant figures are in each of the following:
 - 2.71 g
 - 0.00047 kg
 - 7.0×10^5 m
 - 1030 L
 - 150 pencils
 - 37500 g
 - 0.1010 cm
- Express each of the following in proper scientific notation (pay attention to sig figs and units)
 - 0.000125 m
 - 155.0 mL
 - 123,030,000 kg
 - 481.9×10^{-9} cm
- Calculate the correct answer with proper units and sig figs for each of the following:
 - $12 \text{ g} + 0.677 \text{ g} + 86.33 \text{ g} =$
 - $(355.78 \text{ g}) / (0.056 \text{ g}) =$
 - $97.34 \text{ mL} - 34.1 \text{ mL} =$
 - $14.68 \times 5 =$
- Dimensional Analysis Practice
 - 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 mi = 5280 ft, 1 in = 2.54 cm)
 - A student can eat 4.0 M&Ms every 1.00 seconds. If an M&M has a mass of 63 mg, determine how many kilograms of M&M's can be eaten by a class of 20 students in 3.75 hours.
- Name or formula for the following compounds:

a. Sodium fluoride	h. CaCO_3
b. K_2O	i. Lithium phosphate
c. Calcium phosphate	j. SO_2
d. FeCl_3	k. Calcium hydroxide
e. Iron(II)chloride	l. H_2SO_4
f. Hg_2O	m. Cupric chloride
g. Sodium sulfate	
- Write and balance the following equations:
 - Iron metal reacts with oxygen to form solid 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.

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7. Problems:

- a. Calculate the mass of 500. atoms of iron (Fe).

- b. 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. Find the % by mass of each element in this compound.

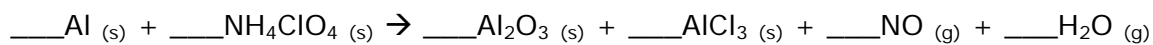
 - iii. Calculate the mass in grams of 1.56 moles of aspartame.

 - iv. How many molecules are in 5.0 mg of aspartame?

 - v. How many atoms of nitrogen are in 1.2 grams of aspartame?

 - vi. What is the mass of one molecule of aspartame?

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



- i. Balance the following reaction.
- ii. If 4.0 g of aluminum reacted with 15.0 g of ammonium perchlorate, what would be the limiting reactant? How much excess reactant would you have?

- iii. Using the above information, how much aluminum chloride would be produced in grams?

- iv. If you actually collected 4.18 g of aluminum chloride what would be your percent yield?

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- d. You add aluminum to a solution of copper(II)chloride and it reacts exothermically.
- Write and balance the equation.
 - What does the word exothermic mean. Come up with at least 4 facts about an exothermic reaction.
 - You reacted 1.25 g of Al, how much copper(II)chloride do you need to add for the Al to fully react?
 - How much of each product would you collect?
- e. Phenol is a compound that contains 76.57% carbon, 6.43% hydrogen, and 17.0% oxygen.
- Calculate the empirical formula.
 - If its molecular weight is 188 g/mol, what would be its molecular formula?
- f. When 125.0 g of ethylene (C₂H₄) burns in 60.0 g of oxygen to give carbon dioxide and water, how many grams of CO₂ are formed. (Hint: balance first!)

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Assessment of Review Material

Answer all questions completely. If work is needed show all work.

1. How many significant figures are in the following measurement? 2.40 cm _____
2. How many significant figures are in the following measurement? 0.1020 cm _____

Perform the following computations using the measurements in 1 and 2.

3. Multiply
4. Divide ($1 \div 2$)
5. Add
6. Subtract
7. Burning paper undergoes what kind of change. Explain.
8. Italian salad dressing is what kind of mixture, homogeneous or heterogeneous? Explain.

Identify the following as a compound, element, or mixture. Completely answer all questions asked in the problem.

9. MgCO_3
 - a. shows covalent or ionic bonding? _____
 - b. label and name the polyatomic ion. _____
 - c. write the name. _____
10. Ag-107
 - a. atomic number. _____
 - b. number of protons. _____
 - c. number of neutrons. _____
 - d. number of electrons. _____
 - e. what is the name of the group where it is found? _____
11. CuCl_2
 - a. what is one way we can write the name of this substance?

12. Aluminum has a density of 2.70 g/mL. If the mass of the block is 24.60 g, find the volume of the substance. Show all work and use sig figs.

13. This material has two isotopes 63 and 65. The relative abundance of each of 69.09% and 30.91% respectively. Calculate the atomic mass to 5 significant figures. Show all work.

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Multiple Choice Questions

- $[(2.30 \text{ g} - 0.055 \text{ g}) / 2.30 \text{ g}] \times 100$ (non-measurement value) =
 - 98%
 - 100%
 - 97.8%
 - 97.4%
 - 99.1%
- Silver has 2 naturally occurring isotopes, one with a mass of 107 and the other with a mass of 109. The percentage of Ag-107 is 51.82%. What is the atomic mass of all known silver atoms?
 - 107.9636 amu
 - 108 amu
 - 108.2342 amu
 - 107.5 amu
 - Can't determine
- Which one of the following is the molar mass of aluminum hydroxide?
 - 43.988
 - 78.004
 - 97.948
 - 35.226
 - 101.348
- Which of the following is NOT a correct way to interpret the following equation:
$$2 \text{H}_2\text{O}_{(l)} \rightarrow 2 \text{H}_{2(g)} + \text{O}_{2(g)}$$
 - Liquid water decomposes into hydrogen gas and oxygen gas
 - 2 molecules of water breaks down into 2 molecules of hydrogen and 1 molecule of oxygen
 - 2 moles of water decomposes into 2 moles of hydrogen and 1 mole of oxygen
 - 2 grams of water will give 2 grams of hydrogen and 1 gram of oxygen
 - All of them are correct
- 0.45 g of NaCl contain how many moles of chlorine ions?
 - 0.0038 moles
 - 0.0039 moles
 - 0.0077 moles
 - 130 moles
 - 0.004 moles
- Which of these alkaline earth metal oxides has the greatest percent by mass of oxygen?
 - Barium oxide
 - Calcium oxide
 - Beryllium oxide
 - Magnesium oxide
 - Strontium oxide
- Which oxides of manganese, Mn, have percent by mass of manganese that is greater than 50%?

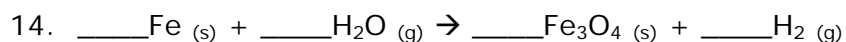
I. MnO	II. MnO ₂	III. Mn ₂ O ₃
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 - II only
 - III only
 - I and III only
 - II and III only
 - I, II, and III

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8. Which pair of samples contains the same number of oxygen atoms in each compound?
- 0.10 mol Al_2O_3 and 0.50 mol BaO
 - 0.20 mol Cl_2O and 0.10 mol HClO
 - 0.20 mol SnO and 0.20 mol SnO_2
 - 0.10 mol Na_2O and 0.10 mol Na_2SO_4
 - 0.20 mol $\text{Ca}(\text{OH})_2$ and 0.10 mol $\text{H}_2\text{C}_2\text{O}_4$
9. If 18 grams of X completely reacts with 14 grams of Y to produce 10 grams of M and 2.0 moles of Z, the molar mass of Z is:
- 11
 - 16
 - 22
 - 32
 - 42
10. $2 \text{Al}_{(s)} + 3 \text{S}_{(s)} \rightarrow \text{Al}_2\text{S}_3_{(s)}$
 What mass of Al_2S_3 is produced when 3.00 moles of aluminum reacts with excess sulfur according to the equation above?
- 81.0 g
 - 96.0 g
 - 123 g
 - 150 g
 - 225 g
11. $2 \text{KClO}_3_{(s)} \rightarrow 2 \text{KCl}_{(s)} + 3 \text{O}_2_{(g)}$
 Which expression gives the mass of O_2 produced when 15 g KClO_3 is heated, according to the equation above, in an open vessel until no further weight loss is observed?
- $15.0 \times \frac{122.5}{1} \times \frac{2}{3} \times \frac{32}{1}$
 - $15.0 \times \frac{1}{122.5} \times \frac{3}{2} \times \frac{32}{1}$
 - $15.0 \times \frac{1}{122.5} \times \frac{3}{2} \times \frac{1}{32}$
 - $15.0 \times \frac{1}{122.5} \times \frac{2}{3} \times \frac{1}{32}$
 - $15.0 \times \frac{122.5}{1} \times \frac{3}{2} \times \frac{32}{1}$
12. $\text{Cu}_{(s)} + 4 \text{HNO}_3_{(aq)} \rightarrow 2 \text{NO}_2_{(g)} + \text{Cu}(\text{NO}_3)_2_{(aq)} + 2 \text{H}_2\text{O}_{(l)}$
 What volume of $\text{NO}_2_{(g)}$ measured at 1 atm and 273 K can be produced by the reaction of 48 grams of copper with excess concentrated nitric acid according to the equation above?
- 11.2 liters
 - 22.4 liters
 - 33.8 liters
 - 44.8 liters
 - 67.2 liters
13. $2 \text{C}_2\text{H}_6_{(g)} + 7 \text{O}_2_{(g)} \rightarrow 4 \text{CO}_2_{(g)} + 6 \text{H}_2\text{O}_{(g)}$
 What quantity of reactant remains after ignition of a mixture that contains 0.40 moles of C_2H_6 mixed with 1.60 moles of O_2 ?
- 0.20 mol O_2
 - 0.80 mol O_2
 - 1.20 mol O_2
 - 0.20 mol C_2H_6
 - 0.30 mol C_2H_6

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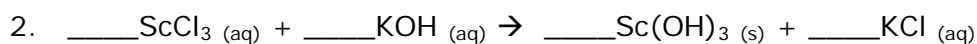
A mixture in a reaction vessel contains 12 moles of iron and 12 moles of steam. A reaction occurs according to the equation above. After the reaction, all gas escapes from the reaction vessel. Which describes the solid phase remaining after heating has occurred?

- 4.0 moles Fe_3O_4 and no excess Fe
- 12 moles of Fe_3O_4 and no excess Fe
- 2.0 moles of Fe_3O_4 and 6.0 moles excess Fe
- 3.0 moles of Fe_3O_4 and 3.0 moles excess Fe
- 4.0 moles of Fe_3O_4 and 4.0 moles excess Fe

Free Response

1. A compound is reported to contain 26.6% potassium, 35.3% chromium, and 38.1% oxygen by mass.

- Calculate the empirical formula.
- If the molecular weight is reported to be 294.2, calculate the molecular formula.
- If there is 3.40 moles of this compound, determine how many atoms would be found.



- Balance the following.
- If 0.60 grams of ScCl_3 and 0.15 grams of KOH are mixed together, identify the limiting reactant.
- Using the above information, how many grams of Sc(OH)_3 will be produced?
- Performing the experiment in lab, you collected 0.059 g of Sc(OH)_3 . Calculate the percent yield.
- How many grams of excess reactant will you have?

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One Killer of a Problem: Gold Star if you can get this!

3. Menthol, the substance we can smell in mentholated cough drops, is composed of C, H, and O. A 0.1005 g sample of menthol is combusted producing 0.2829 g of CO_2 and 0.1159 g H_2O . What is the empirical formula for menthol. Show work.