10th Grade AP Chemistry

Ms. Fontilea

There are FOUR parts to the AP Chemistry Summer Assignment.

PART 1: COMMON IONS AND ACIDS

You need to master the formulas, charges, and names of the common polyatomic ions and acids. If you have learned this in 8th grade, it will be a review. On the first few days of the school year, you will be given a quiz on these ions and acids. You will be asked to:

- Write the names of the ions and acids when given the formula and charge.
- Write the formula and charge (if applicable) when given the names.

PART 2: SIGNIFICANT FIGURES IN CALCULATIONS

- I have attached a page with explanations of the rules and problems for practice. Due: first day of class

PART 3: DIMENSIONAL ANALYSIS

- Complete the attached assignment, using dimensional analysis. Due: first day of class

PART 4: AP CHEMISTRY STUDY GUIDE

- Please get an AP Chemistry study guide, and bring it to school on the first day of class. I recommend either the *2020* (or 2019 if that is what's available) *5 Steps To a 5*, or *2020 Sterling Test Prep* or *2020 The Princeton Review* but others will suffice as well. Begin reading the first section of the book.

PART 1: COMMON IONS AND ACIDS

This is a guide on how to memorize the ions and acids.

Polyatomic Ions

Most of the work on memorization occurs with these ions.

- "ate" anions have one more oxygen then the "ite" ion, but the same charge. If you memorize the "ate" ions, then you should be able to derive the formula for the "ite" ion and vice-versa.

- If you know that a sulfate ion is SO_4^{2-}, then to get the formula for hydrogen sulfate ion, you add a hydrogen ion to the front of the formula. Since a hydrogen ion has a 1+ charge, the net charge on the new ion is less negative by one.

- Learn the hypochlorite →chlorite →chlorate→perchlorate series, and you also know the series containing iodite/iodate as well as bromite/bromate.

  The relationship between the "ite" and "ate" ion is predictable, as always. Learn one and you know the other.

  The prefix "hypo" means "under" or "too little" (think "hypodermic", "hypothermic" or "hypoglycemia")

  Hypochlorite is "under" chlorite, meaning it has one less oxygen. The prefix "hyper" means "above" or "too much". The prefix "per" is derived from "hyper" so perchlorate (hyperchlorate) has one more oxygen.

Memorize the following polyatomic ions. Suggestion: Make flash cards with the 'name' on one side & the 'ion' on the other side (Do not forget the charge!). You should learn these to the extent at which they can be immediately recalled.

1) Acetate CH_3COO^- or $C_2H_3O_2^-$
2) Ammonium NH_4^+
3) Carbonate CO_3^{2-}
4) Chlorate ClO_3^-
5) Chlorite ClO_2^-
6) Chromate CrO_4^{2-}
7) Cyanide CN^-
8) Dichromate $Cr_2O_7^{2-}$
9) Dihydrogen phosphate $H_2PO_4^-$
10) Hydrogen carbonate or bicarbonate HCO_3^-
11) Hydrogen phosphate HPO_4^{2-}
12) Hydrogen sulfate or bisulfate HSO_4^-
13) Hydrogen sulfite or bisulfite HSO_3^-
14) Hydroxide OH^-
14) Hypochlorite ClO^-
15) Nitrate NO_3^-
16) Nitrite NO_2-
17) Oxalate $C_2O_4^{2-}$
18) Permanganate MnO_4^-
19) Perchlorate ClO_4^-
20) Peroxide O_2^{2-}
21) Phosphate PO_4^{3-}
22) Sulfate SO_4^{2-}
23) Sulfite SO_3^{2-}
24) Thiocyanate SCN^-

Memorize the following acid names

(Hydro---ic) ACIDS (has no oxygen)

1) HCl hydrochloric acid

2) HF hydrofluoric acid
3) HBr hydrobromic acid
4) HI hydroiodic acid
5) HCN hydrocyanic acid
6) H2S hydrosulfuric acid

(--ic) ACIDS

7) H_2CO_3 carbonic acid
8) HNO_3 nitric acid
9) H_2SO_4 sulfuric acid
10) $HClO_3$ chloric acid
11) H_3PO_4 phosphoric acid
12) HIO_3 iodic acid

(per---ic) ACIDS (add 1 oxygen to –ic acid)

13) $HClO_4$ perchloric acid
14) HNO_4 pernitric acid
15) HIO_4 periodic acid

(---ous) ACIDS (subtract 1 oxygen from –ic acid)

16) H_2CO_2 carbonous acid
17) HNO_2 nitrous acid
18) H_2SO_3 sulfurous acid
19) $HClO_2$ chlorous acid
20) H_3PO_3 phosphorous acid

(**hypo---ous) ACIDS** (subtract 2 oxygens from –ic acid)

21) H_2CO hypocarbonous acid
22) HNO hyponitrous acid
23) H_2SO_2 hyposulfurous acid
24) HClO hypochlorous acid

Memorize the following list of STRONG ACIDS

1) HCl hydrochloric acid
2) HBr hydrobromic acid
3) HI hydroiodic acid
4) HNO_3 nitric acid
5) $HClO_4$ perchloric acid
6) H_2SO_4 sulfuric acid

PART 2: SIGNIFICANT FIGURES IN CALCULATIONS

Study Guide: Learn these rules to predict proper significant figures.

Significant Figures in Measurement and Calculations

A successful chemistry student habitually labels all numbers, because the unit is important. Also of great importance is the number itself. Any number used in a calculation should contain only figures that are considered reliable. Figures that are considered reliable are called *significant figures*. Chemical calculations involve numbers representing actual measurements. In a measurement, significant figures in a number consist of: Figures (digits) definitely known + One estimated figure (digit)

Rules for Zeros

Zero Within a Number. In reading the measurement 9.04 cm, the zero represents a measured quantity, just as 9 and 4, and is, therefore, a significant number. A zero between any of the other digits in a number is a significant figure.

Zero at the Front of a Number. In reading the measurement 0.46 cm, the zero does not represent a measured quantity, but merely locates the decimal point. It is not a significant figure. Also, in the measurement 0.07 kg, the zeros are used merely to locate the decimal point and are, therefore, not significant. Zeros at the first (left) of a number are not significant figures.

Zero at the End of a Number. In reading the measurement 11.30 cm, the zero is an estimate and represents a measured quantity. It is therefore significant. Another way to look at this: The zero is not needed as a placeholder, and yet it was included by the person recording the measurement. It must have been recorded as a part of the measurement, making it significant. Zeros to the right of the decimal point, and at the end of the number, are significant figures.

Zeros at the End of a Whole Number. Zeros at the end of a whole number may or may not be significant. If a distance is reported as 1600 feet, one assumes two sig figs. Reporting measurements in scientific notation removes all doubt, since all numbers written in scientific notation are considered significant.

Rounding Off Numbers In reporting a numerical answer, one needs to know how to "round off" a number to include the correct number of significant figures. Even in a series of operations leading to the final answer, one must "round off" numbers. The rules :

- If the figure to be dropped is less than 5, simply eliminate it.

- If the figure to be dropped is 5 or greater, eliminate it and raise the preceding figure by 1.

Multiplication and Division

In multiplying or dividing two numbers, when you wish to determine the number of significant figures you should have in your answer, you should inspect the numbers multiplied or divided and find which has the least number of significant figures. This is the number of significant figures you should have in your answer. Thus the answer to 0.024 x 1244 would be rounded off to contain two significant figures since the factor with the lesser number of significant figures (0.024) has only *two* such figures.

Addition and Subtraction

In adding (or subtracting), set down the numbers, being sure to keep like decimal places under each other, and add (or subtract). Next, note which column contains the first estimated figure. This column determines the last decimal place of the answer. After the answer is obtained, it should be rounded off in this column. In other words, round to the least number of decimal places in you data.

Name_____

Give the number of significant figures in each of the following:

____ 402 m	____ 0.00420 g	____ 5.1×10^4 kg	____ 78 323.01 g
____ 34.20 lbs	____ 3 200 liters	____ 0.48 m	____ 1.10 torr
____ 0.03 sec	____ 0.0300 ft.	____ 1 400.0 m	____ 760 mm Hg

Multiply each of the following, observing significant figure rules:

17 m x 324 m = _____ 0.005 in x 8 888 in = _____

0.424 in x .090 in = _____ 1.7 mm x 4 294 mm = _____

0.050 m x 102 m = _____ 324 000 cm x 12.00 cm = _____

Divide each of the following, observing significant figure rules:

23.4 m ÷ 0.50 sec = _____ 12 miles ÷ 3.20 hours = _____

0.960 g ÷ 1.51 moles = _____ 1200 m ÷ 12.12 sec = _____

Add each of the following, observing significant figure rules:

3.40 m +0.022 m + 0.5 m = _____

102.45 g + 2.44 g + 1.9999g =_____

102. cm + 3.14 cm + 5.9 cm = _____

Subtract each of the following, observing signigicant figure rules:

42.306 m -1.22 m =_____ 14.33 g- 3.468 g =_____

PART 3: DIMENSIONAL ANALYSIS: Show all work with proper units and significant figures.

Name:_____

Cookie Stoichiometry

Oatmeal Raisin - Yields 36 Cookies

Use the ingredient list below to answer questions 1-10.

⅔ cup granulated sugar ⅔ cup packed brown sugar ½ cup butter or margarine, softened ½ cup shortening **1** teaspoon baking soda **1** teaspoon ground cinnamon **1** teaspoon vanilla	½ teaspoon baking powder ½ teaspoon salt **2** eggs **3** cups quick-cooking or old-fashioned oats **1** cup all-purpose flour **1** cup raisins, chopped nuts or semisweet chocolate chips, if desired

1. If you only had one egg, how much brown sugar should you use?

2. If 4 cups of butter were used, how many cups of shortening should be used?

3. If you wanted to make 54 cookies, how many cups of raisins should you use?

4. If three teaspoons of cinnamon were used, how many teaspoons of vanilla should be used?

5. If you had ⅓ of a teaspoon of vanilla, how many cookies could you make?

6. June wants to make her cookies with ⅓ of the flour being whole wheat flour. She uses 2 cups of whole wheat flour in her recipe. How many cups of oats does she need?

7. In order to accommodate your vegan friend, you substitute ¼ cup of applesauce per egg. If you have 2.5 cups of applesauce, how many cups of margarine (vegan, remember?) will you need?

8. A teaspoon of salt has a mass of 5.69 grams. An egg has a mass of 60 grams. If you had 14 grams of salt, how many grams of eggs would you want?

9. A teaspoon of granulated sugar has a mass of 4.2 grams. If 30 grams of sugar are used, how many cups of raisins will you need? (1 cup = 48 teaspoons)

10. The sugar used in baking tends to be sucrose ($C_{12}H_{22}O_{11}$). Find the molar mass of sucrose and then determine how many cookies will be made if you use a mole of sucrose in your recipe. Remember, one teaspoon of sugar = 4.2 grams of sugar.