

**MULTIPLE CHOICE (2 pts each): Write the letter corresponding to the correct answer on the line next to each question. The LETTER ASSOCIATED WITH THE CORRECT ANSWER MUST BE WRITTEN ON THE LINE NEXT TO THE QUESTION in order to receive full credit.**

- 1) How many electrons are present in  $S^{2-}$ ? 1) A  
☒ a) 18                      b) 19                      c) 17                      d) 16  
 $16 + 2$
- 2) Butyllithium is a pyrophoric chemical, which means that it may burst into flames if exposed to air. This is an example of which type of property? 2) D  
a) biological                      b) physical                      c) ecological                      ☒ d) chemical
- 3) The fact that sodium chloride always exists as a 1:1 ratio of sodium to chloride ions is an example of which law? 3) B  
a) Multiple Proportions                      ☒ b) Definite Proportions  
c) Conservation of Mass                      d) Avogadro's
- 4) The formula for hydrochloric acid is 4) A  
☒ a) HCl                      b) HClO                      c) HClO<sub>2</sub>                      d) HClO<sub>3</sub>
- 5) How many protons are present in Zn? 5) C  
a) 95                      b) 35                      ☒ c) 30                      d) 65
- 6) In the formula  $Pb(CO_3)_2$ , lead is a 6) B  
a) cation with a charge of 2                      ☒ b) cation with a charge of 4  
c) anion with a charge of 2                      d) anion with a charge of 4
- 7) Elements are defined by their 7) D  
a) number of electrons                      b) number of neutrons  
c) mass number                      ☒ d) atomic number
- 8) How many neutrons are in mercury-196? (196 is the mass number) 8) B  
a) 80                      ☒ b) 16                      c) 201                      d) 104  
 $196 - 80 = 116$
- 9) A student ran 5 experiments to determine the molar mass of carbon tetrachloride, and obtained the following results: 153.8 g/mol, 153.6 g/mol, 154.1 g/mol, 153.9 g/mol, and 154.0 g/mol. The results were: 9) C  
a) precise but not accurate                      b) accurate but not precise  
☒ c) both accurate & precise                      d) neither precise nor accurate  
 $CCl_4 = 153.823 \text{ g/mol}$
- 10) How many electrons are present in an atom of arsenic? 10) D  
a) 75                      b) 18                      c) 40                      ☒ d) 33

*\*Note: This is simply an exam from Spring 2018. Your exam may or may not include similar questions & may include questions not included on this exam*

**SHORT ANSWER (10 pts each):** Completely answer all of the following questions. Read all questions carefully!!! Show all work. Make sure to include units and report all mathematical answers to the correct number of significant figures. Write final answers in designated locations when indicated.

1) State whether each of the following is a homogeneous mixture, heterogeneous mixture, or pure substance:

a.) calcium chloride

Answer a: pure substance

b.) fruit salad

Answer b: heterogeneous mixture

c.) iron

Answer c: pure substance

d.) coffee (brewed & filtered)

Answer d: homogeneous mixture

e.) pewter (an alloy)

Answer e: homogeneous mixture

2) How many atoms are present in 0.0247 L of mercury? (density of mercury = 13.69 g/cm<sup>3</sup>)

$$0.0247 \cancel{\text{L}} \left( \frac{1000 \cancel{\text{mL}}}{\cancel{\text{L}}} \right) = 24.7 \text{ mL} \left( \frac{1 \text{ cm}^3}{1 \cancel{\text{mL}}} \right) = 24.7 \text{ cm}^3 \quad \text{Answer: } 1.02 \times 10^{24} \text{ atoms}$$

$$24.7 \text{ cm}^3 \left( \frac{13.69 \text{ g}}{\text{cm}^3} \right) = 338.143 \text{ g Hg} \left( \frac{1 \text{ mol}}{200.59 \text{ g}} \right) = 1.6857 \text{ mol Hg}$$

$$1.6857 \text{ mol Hg} \left( \frac{6.022 \times 10^{23} \text{ atoms}}{\text{mol}} \right) = 1.01515 \times 10^{24} \text{ atoms}$$

3) a.) How many moles are present in 247.3 g of  $\text{MgCl}_2$ ?

Answer a: 2.597 mol

$$\text{Mg} = 24.305 \text{ g/mol} \times 1 = 24.305 \text{ g/mol}$$

$$\text{Cl} = 35.453 \text{ g/mol} \times 2 = \frac{70.906 \text{ g/mol}}{95.211 \text{ g/mol}}$$

$$247.3 \text{ g} \left( \frac{1 \text{ mol}}{95.211 \text{ g}} \right) = 2.5974 \text{ mol}$$

b.) What is the mass of 9.33 moles of  $\text{Mg(OH)}_2$ ?

Answer b: 544 g

$$\text{Mg} = 24.305 \text{ g/mol} \times 1 = 24.305 \text{ g/mol}$$

$$\text{O} = 15.9994 \text{ g/mol} \times 2 = 31.9988 \text{ g/mol}$$

$$\text{H} = 1.00794 \text{ g/mol} \times 2 = 2.01588 \text{ g/mol} \rightarrow 58.31968 \text{ g/mol}$$

$$9.33 \text{ mol} \times \left( \frac{58.31968 \text{ g}}{1 \text{ mol}} \right) = 544.12 \text{ g}$$

c.) How many atoms are present in 678.4  $\mu\text{g}$  of silver?

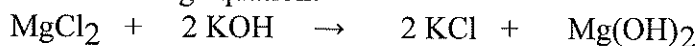
Answer c:  $3.787 \times 10^{18}$  atoms

$$678.4 \mu\text{g} \left( \frac{1 \text{ g}}{10^6 \mu\text{g}} \right) = 6.784 \times 10^{-4} \text{ g} \left( \frac{1 \text{ mol}}{107.868 \text{ g}} \right) = 6.289 \times 10^{-6} \text{ mol} \left( \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol}} \right) = 3.7873 \times 10^{18} \text{ atoms}$$

d.) How many atoms are present in 3.78 moles of methane ( $\text{CH}_4$ )? Answer d:  $1.14 \times 10^{25}$  atoms

$$3.78 \text{ mol} \left( \frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ mol}} \right) = 2.276 \times 10^{24} \text{ molecules } \text{CH}_4 \left( \frac{5 \text{ atoms}}{1 \text{ molecule}} \right) = 1.1382 \times 10^{25} \text{ atoms}$$

4) If you combined 5.36 g magnesium chloride and 6.15 g potassium hydroxide to form magnesium hydroxide according to the following equation:



(From Q3) 95.211 g/mol

K = 39.0983 g/mol

O = 15.9994 g/mol

H = 1.00794 g/mol

56.10564 g/mol

58.31968 g/mol (from Q3)

Answer a: KOH

a.) What is your limiting reagent?

b.) What is your theoretical yield of magnesium hydroxide?

Answer b: 3.20 g

c.) If you made 2.98 g, what is your percent yield?

Answer c: 93.1%

$$\text{a) } \text{MgCl}_2: 5.36 \text{ g} \left( \frac{1 \text{ mol}}{95.211 \text{ g}} \right) = 0.056296 \text{ mol } \text{MgCl}_2 \left( \frac{1 \text{ mol } \text{Mg(OH)}_2}{1 \text{ mol } \text{MgCl}_2} \right) = 0.056296 \text{ mol } \text{Mg(OH)}_2$$

$$\text{KOH}: 6.15 \text{ g} \left( \frac{1 \text{ mol}}{56.10564 \text{ g}} \right) = 0.109615 \text{ mol } \text{KOH} \left( \frac{1 \text{ mol } \text{Mg(OH)}_2}{2 \text{ mol } \text{KOH}} \right) = 0.054807 \text{ mol } \text{Mg(OH)}_2$$

↑ lower #

$$\text{b) } 0.054807 \text{ mol } \text{Mg(OH)}_2 \left( \frac{58.31968 \text{ g}}{1 \text{ mol}} \right) = 3.19635 \text{ g } \text{Mg(OH)}_2$$

↳ 3.20 g  $\text{Mg(OH)}_2$

$$\text{c) } \left( \frac{2.98 \text{ g}}{3.20 \text{ g}} \right) 100 = 93.125\%$$

↳ 93.1%

- 5) What is the empirical formula for a compound that is 59.96% carbon, 13.42 % hydrogen, and 26.62 % oxygen?

Assume 100g

Answer :  $C_3H_8O$

$$59.96 \text{ g C} \left( \frac{1 \text{ mol}}{12.011 \text{ g}} \right) = 4.992 \text{ mol C}$$

$$13.42 \text{ g H} \left( \frac{1 \text{ mol}}{1.00794 \text{ g}} \right) = 13.314 \text{ mol H}$$

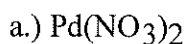
$$26.62 \text{ g O} \left( \frac{1 \text{ mol}}{15.9994 \text{ g}} \right) = 1.6638 \text{ mol O}$$

↑ lowest, use to normalize

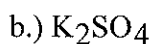
$$\text{C: } \frac{4.992 \text{ mol}}{1.6638 \text{ mol}} = 3.00 \quad \text{H: } \frac{13.314 \text{ mol}}{1.6638 \text{ mol}} = 8.00 \quad \text{O: } \frac{1.6638 \text{ mol}}{1.6638 \text{ mol}} = 1$$

$C_3H_8O$

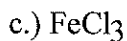
- 6) Name the following compounds:



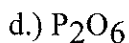
Lead (II) nitrate



Potassium sulfate



Iron (III) chloride

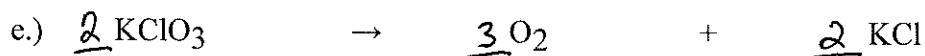
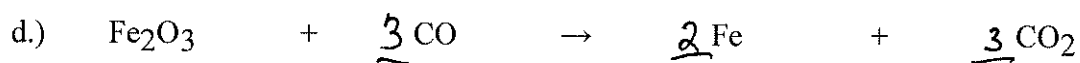
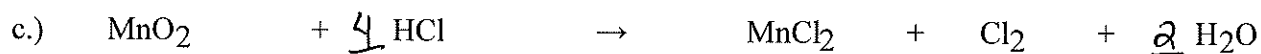
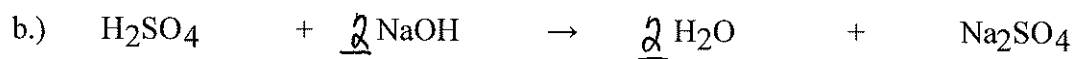


diphosphorus hexoxide



nitrogen trifluoride

7) Balance the following equations:



8) Write formulas for the following compounds:

