

# Quarter 3 Exam Review

# KEY

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For the following reactions 1) circle the type, 2) predict the products, 3) ~~write the states of matter~~ and 4) balance the equation.

1. Calcium metal reacts with nitrogen gas (write out the reactants and products)



Circle one: Synthesis Decomposition Single Replacement Double Replacement Combustion

2. The combustion of methane (CH<sub>4</sub>) (write out the reactants and products)



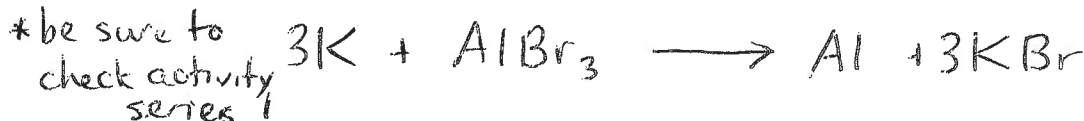
Circle one: Synthesis Decomposition Single Replacement Double Replacement Combustion

3. Aqueous beryllium fluoride reacts with aqueous copper (II) nitrate (write out the reactants and products)



Circle one: Synthesis Decomposition Single Replacement Double Replacement Combustion

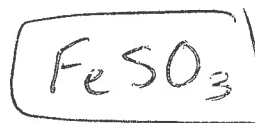
4. Potassium metal reacts with aqueous aluminum bromide (write out the reactants and products)



Circle one: Synthesis Decomposition Single Replacement Double Replacement Combustion

5. A 3.26 g sample is found to contain 1.34 g of iron, 0.769 g of sulfur and 1.15 g of oxygen. Using dimensional analysis, determine the empirical formula for this compound.

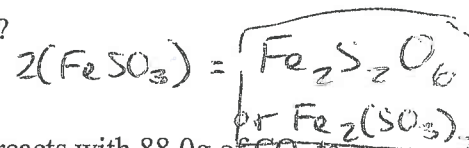
1.34g Fe	$\frac{1\text{mol}}{55.85\text{g Fe}}$	$= \frac{.024}{.024} = 1$
0.769g S	$\frac{1\text{mol}}{32.07\text{g S}}$	$= \frac{.024}{.024} = 1$
1.15g O	$\frac{1\text{mol}}{16.00\text{g O}}$	$= \frac{.0719}{.024} = 3$



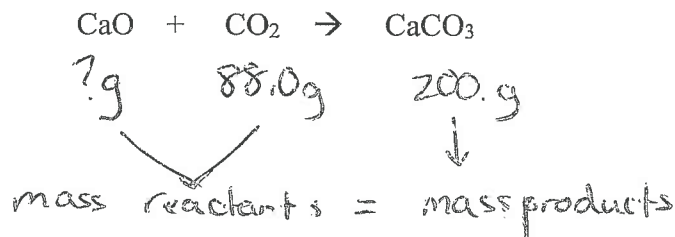
6. What is the molecular formula of the compound above if its molecular mass is 272g?

$$\begin{matrix} \text{Fe} = 55.85 \\ \text{S} = 32.07 \\ \text{O} = 3(16.00) \end{matrix} > 136.55$$

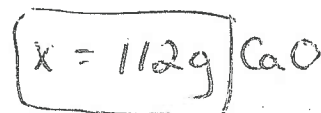
$$\frac{272}{136.55} = 2$$



7. Using the law of conservation of mass, determine the total mass of CaO that reacts with 88.0g of CO<sub>2</sub> to produce 200. g of CaCO<sub>3</sub>

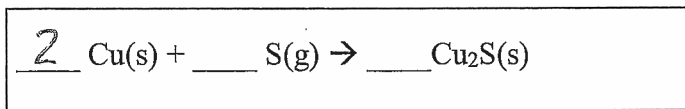


$$x + 88 = 200$$



8. If you are given 7.00 g of copper metal and 3.00 g of sulfur powder, determine the theoretical yield of copper (I) sulfide produced **in grams**.

(You MUST show the mathematical determination of limiting reactant!)



$$\frac{7.00 \text{ g Cu}}{63.55 \text{ g Cu}} \times \frac{1 \text{ mol Cu}}{2 \text{ mol Cu}} \times \frac{1 \text{ mol Cu}_2\text{S}}{1 \text{ mol Cu}} \times 159.17 \text{ g Cu}_2\text{S} = 8.77 \text{ g Cu}_2\text{S}$$

$$\frac{3.00 \text{ g S}}{32.07 \text{ g S}} \times \frac{1 \text{ mol S}}{1 \text{ mol S}} \times \frac{1 \text{ mol Cu}_2\text{S}}{1 \text{ mol S}} \times 159.17 \text{ g Cu}_2\text{S} = 14.9 \text{ g Cu}_2\text{S}$$

9. If 7.43 g of product is actually produced experimentally from the reaction described in the previous question, what is the % yield of product?

$$\frac{7.43}{8.77} \times 100 = 84.7\%$$

10. How does the law of conservation of mass allow for stoichiometric calculations of theoretical yield to be valid? (Start by defining the law and work from there! Remember that stoichiometry is a mathematical determination of products or reactants).

The law of <sup>cons of</sup> mass states that matter (mass) cannot be created or destroyed. Therefore, we know that the mass we start with in a reaction, must be the same as the mass we end with (mass reactants = mass products). For this reason we can trust that our mathematical calcs. during stoichiometry will be correct since no mass is lost or gained in the reaction.

11. Why are mole ratios important in stoichiometry? What do they help us to do when trying to solve for unknown values of products or reactants?

The mole is the common "currency" in chemistry. It is the only unit that allows for us to switch between different elements or compounds in a chemical reaction so we must use it to get from a known amount of one compound to an unknown amount of a different compound.

12. List the 5 reaction types? Write an example chemical equation for each type.



13. Where must you look before writing the products of a single replacement reaction to see if the reaction will actually occur? What must be true for the reaction to actually take place?

Activity Series; The single element must be above the ion it will replace in the compound

14. Where must you look to determine the solubility of the products of a double replacement reaction?

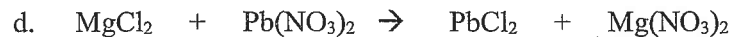
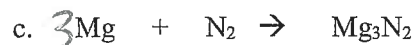
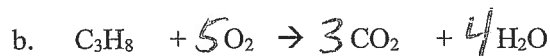
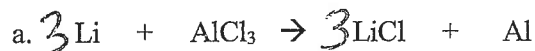
Solubility Rules (back of periodic table)

15. Determine if the following are soluble (aq) or insoluble (s) in water:

- a.  $Mg(NO_3)_2$  (aq)
- b.  $AgBr$  (s)
- c.  $LiCl$  (aq)
- d.  $PbCl_2$  (s)

16. What is a spectator ion? (think about the beaker diagrams we drew).

17. Balance the following chemical equations:



18. Write the formula for Molarity.

$$M = \frac{\text{mol (solute)}}{\text{L (of solution)}}$$

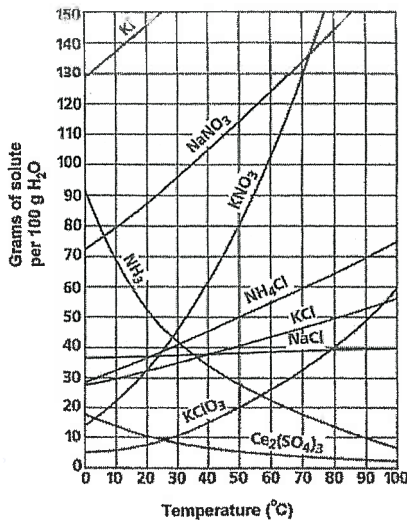
19. What is the molarity of 2.4 L of an aqueous solution that contains 77.4 grams of NaCl?

$$M = \frac{x \text{ mol}}{2.4 \text{ L}}$$

$$77.4 \text{ g NaCl} \left| \frac{1 \text{ mol NaCl}}{58.44 \text{ NaCl}} \right. = 1.32 \text{ mol NaCl}$$

$$M = \frac{1.32 \text{ mol}}{2.4 \text{ L}} = \boxed{0.55 \text{ M NaCl}}$$

20. Use the solubility curve below to answer questions 21-23.



21. How many grams of  $\text{NH}_4\text{Cl}$  can be dissolved in 100g of  $\text{H}_2\text{O}$  at  $50^\circ\text{C}$ ?

50g  $\text{NH}_4\text{Cl}$

22. How many grams of  $\text{NH}_4\text{Cl}$  can be dissolved in 300g of  $\text{H}_2\text{O}$  at  $50^\circ\text{C}$ ?

$$\frac{50 \text{ g NH}_4\text{Cl}}{100 \text{ g H}_2\text{O}} = \frac{x \text{ g}}{300 \text{ g H}_2\text{O}} \quad x = \boxed{150 \text{ g NH}_4\text{Cl}}$$

23. How many grams of water are needed to dissolve 180 g of  $\text{NH}_4\text{Cl}$  at  $70^\circ\text{C}$ ?

$$\frac{60 \text{ g NH}_4\text{Cl}}{100 \text{ g H}_2\text{O}} = \frac{180 \text{ g NH}_4\text{Cl}}{x} \quad x = \boxed{300 \text{ g H}_2\text{O}}$$

from graph

24. What is the formula for density?

$$D = \frac{\text{mass}}{\text{Volume}}$$



25. Calculate the density of liquid if the mass is 14.4 grams and the volume is 7.2 mL. How many sig figs should be in the answer? Why?

$$D = \frac{14.4 \text{ g}}{7.2 \text{ mL}} = \boxed{2.0 \text{ g/mL}}$$

26. What is the definition of accuracy? How can we mathematically determine if something is accurate?

Accuracy is how close the experimental value is to the actual value. We use % error calculation to determine accuracy ( $< 5\%$  = accurate)

27. What is the definition of precise?

28.

Trial #	Volume (ml)
1	16.4
2	16.0
3	15.8
4	16.3

$\rangle$  avg = 16.1 mL

a. Given the data set above, determine if the data is accurate if the actual volume of the data set would be 18.00 mL.

$$\left| \frac{18.00 \text{ mL} - 16.1 \text{ mL}}{18.00 \text{ mL}} \right| \times 100 = 10.6\% , \text{ not accurate because } 10.6\% > 5\%$$

b. Given the data set above, determine if the data is precise.

Yes, it is precise. All of the data points are close to each other (small range).

29. How is the average atomic mass for an element determined on the periodic table?

The masses of all of the isotopes of an element are added up and averaged based on their percent abundance  
 (Ex) Carbon has isotopes with masses of 12, 13, + 14

30. What are the rules for significant figures for the following:

- Non zero digits - always significant
- Sandwich/captive zeros - always significant
- Leading zeros - never significant
- Trailing zeros without a decimal in the number - never significant
- Trailing zeros with a decimal in the number - always significant

highest % abundance so avg = 12.0

Label the digits in the following number with the corresponding letter above

c c c a b b a e  
 0.0030040

31. Describe the titration process. An acid of unknown concentration (M) is titrated with a base of known concentration (M). An indicator (like phenolphthalein) is used to show when the endpoint is reached

- What can we calculate from the data collected during a titration?  
 (when  $[H^+] = [OH^-]$ )  
 the concentration of an unknown solution (acid or base)
- What purpose does phenolphthalein serve in a titration?  
 It changes color to pink when the endpoint has been reached

32. What does the term neutralization mean in Chemistry as it relates to acids and bases?  
 A reaction between an acid + base that results in a solution that is not as acidic or basic as the starting solutions

- What is the resulting pH of a "perfect" neutralization reaction (without any excess acid or base)?

pH = 7

33. Circle the acid in the group below. How do you know it is an acid?

NaOH

NaCl

HCl

NaHCO<sub>3</sub>

H<sup>+</sup> Cl<sup>-</sup>

it has H<sup>+</sup> ion

34. Circle the base in the group below. How do you know it is a base?

NaOH

NaCl

HCl

NaHCO<sub>3</sub>

Na<sup>+</sup> OH<sup>-</sup>

it has OH<sup>-</sup> ion

35. Write the names for the following acids:

- HCl Hydrochloric acid
- H<sub>2</sub>SO<sub>4</sub> Sulfuric acid
- H<sub>3</sub>PO<sub>4</sub> Phosphoric acid
- HNO<sub>3</sub> Nitric Acid
- ~~HI~~



36. Calculate the  $[H^+]$  in a solution that has the following pH values: (write to 3 sig figs)

a. 3.45  $3.55 \times 10^{-4} M$

b. 4.20  $6.31 \times 10^{-5} M$

c. 8.95  $1.12 \times 10^{-9} M$

37. Calculate the pOH when given the following values for  $[OH^-]$ : (to 3 sig figs)

a.  $1.2 \times 10^{-5} M$  4.92

b.  $6.2 \times 10^{-3} M$  2.21

c.  $5.4 \times 10^{-8} M$  7.27

38. Calculate the  $[OH^-]$  when given the following values for  $[H^+]$ : (to 3 sig figs)

a.  $3.5 \times 10^{-5} M$   $2.86 \times 10^{-10} M$

b.  $4.2 \times 10^{-3} M$   $2.38 \times 10^{-12} M$

c.  $8.4 \times 10^{-8} M$   $1.19 \times 10^{-7} M$

39. Calculate the pH of a solution with a pOH of 7.2.

$$pH + pOH = 14$$

$$pH + 7.2 = 14$$

$$pH = 6.80$$

40. What are the 3 factors that speed up the rate of dissolving a solid in a liquid (i.e. salt in water)?

- 1) increasing temperature
- 2) stirring / shaking
- 3) decreasing particle size