first titration day

H

Name _____
Period _____

1. Which of the following is the most acidic?

a. pH =10 b. pH =11 c. pH=12 d. pH =2 e. pH=4

2. Which of the following solutions is the most basic?

STRATEGY, DON'T COMPARE APPLES TO ORANGES, MAKE them all [H+]

a. $[H^+] = 1 \times 10^{-4}$ c. $[H^+] = 1 \times 10^{-9}$

b. $[OH^-] = 1 \times 10^{-4}$ d. $[OH^-] = 1 \times 10^{-9}$

↳ $H^+ = 1 \times 10^{-10}$ ↳ $[H^+] = 1 \times 10^{-5}$

ANSWER: B is the most basic b/c it has the least H+

3. When tested, a solution turns red litmus to blue. This indicates that the solution contains more SO, IT'S BASIC
   a. more H+ ions than OH- ions
   b. more H_3O^+ ions than OH- ions
   c. more OH- ions than H_3O^+ ions
   d. more H+ and OH- ions than H_2O molecules

4. If an aqueous solution turns blue litmus red, which relationship exists between the hydronium ion and hydroxide ion? SO IT'S ACIDIC
   a. $[H_3O^+] < [OH^-]$
   b. $[H_3O^+] = [OH^-]$
   c. $[H_3O^+] > [OH^-]$
   d. Neither ion is present

2.
3.

FROM HERE DOWN IS SORT OF A REVIEW OF UNIT 8 (MARCH 9 TO MARCH 27)

5. For this balanced reaction, calculate the following

$$CaH_2 + 2\,H_2O \rightarrow Ca(OH)_2 + 2\,H_2$$

If 3.03×10^{-5} grams of CaH_2 react, how many grams of water react?

$$\frac{3.03\times10^{-5}\ \text{g } CaH_2}{} \left| \frac{1\ \text{mol } CaH_2}{} \right| \frac{2\ \text{mol } H_2O}{} \left| \frac{18.02\ \text{grams } H_2O}{} \right| = 2.55\times10^{-5}\ \text{grams}$$

$$\left| \frac{42.09\ \text{g } CaH_2}{} \right| \frac{1\ \text{mol } CaH_2}{} \left| \frac{1\ \text{mol } H_2O}{} \right|$$

If 0.746 moles of water react, how many moles of C_aH_2 will react?

$$0.746\ \text{mol } H_2O \times \left(\frac{1\ \text{mol } CaH_2}{2\ \text{mol } H_2O} \right) = 0.373\ \text{mol } CaH_2$$

- ✓ **theoretical yield** (also called calculated yield) this is how much product you *expected* to get, based on your calculations
- ✓ **actual yield** This is measured by you in a laboratory, usually by weighing the product
- ✓ **%yield** = $\frac{\frac{actual\ yield}{theoretical\ yield}}{} \times 100$

8. Suppose 4.61 g of zinc was allowed to react with excess hydrochloric acid to produce zinc chloride and hydrogen gas.
   a. How much zinc chloride should you get?

Balance the reaction first

$Zn + 2HCl \rightarrow ZnCl_2 + H_2$

$$4.61\text{g Zn} \times \left(\frac{1\ \text{mol Zn}}{65.38\ \text{g Zn}}\right)\left(\frac{1\ \text{mol } ZnCl_2}{1\ \text{mol Zn}}\right) \times \left(\frac{136.28\ \text{grams } ZnCl_2}{1\ \text{mol } ZnCl_2}\right) = 9.61\ \text{g } ZnCl_2$$

   b. Suppose that you actually recovered 8.56 g of zinc chloride. What is your percent yield?

$$\%\ \text{yield} = \frac{\text{your lab result}}{\text{your pen and paper calculation}} \times 100 \qquad \% = \frac{8.56\text{g}}{9.61\text{g}} \times 100 = 89.1\%$$

don't forget the 100

Reaction Terminology

Theoretical yield is _____

Actual yield is _____

Percent yield is _____ divided by _____ times one hundred

Lab Data Use this to answer the next four questions

A student placed a piece of nickel in silver nitrate solution. Silver metal precipitated and aqueous nickel(II) nitrate was produced. The student collected the following data:

Mass of beaker	102.05 g
Mass of beaker with silver	103.13 g
Mass of nickel before	5.00 g
Mass of nickel after	4.69 g

9. Write a balanced equation for the reaction.

$Ni_{(s)} + 2AgNO_{3(aq)} \longrightarrow 2Ag_{(s)} + Ni(NO_3)_2$

10. From the mass of Ni reacted, determine the theoretical yield of silver

$$0.31\text{g Ni Reacted} \times \left(\frac{1\ \text{mol Ni}}{58.71\ \text{grams Ni}}\right) \times \left(\frac{2\ \text{mol Ag}}{1\ \text{mol Ni}}\right) \times \left(\frac{107.87\ \text{grams Ag}}{1\ \text{mol Ag}}\right) = 1.14\ \text{g Ag}$$

11. Determine the actual yield of silver

Beaker with silver minus beaker empty = silver

~~103~~

$(103.13\text{g}) - (102.05\text{g}) = 1.08\ \text{grams silver}$

12. Determine the percent yield of silver.

$\%\ \text{yield} = \frac{\text{actual}}{\text{theory}} \times 100$

$\%\ \text{yield} = \frac{1.08\text{g}}{1.14\text{g}} \times 100$

$\%\ \text{yield} = 94.7\%$

13. Tin (II) chloride, $SnCl_2$, reacts with oxygen gas to produce tin (II) oxide and chlorine dioxide. If 0.750 moles of O_2 and 0.750 moles of $SnCl_2$ were put in a test tube for this chemical reaction, find the following:

a. ~~Which reactant is the limiting reactant?~~

FIRST WRITE A BALANCED REACTION

$$2\,SnCl_2 + 5\,O_2 \rightarrow 2\,SnO + 4\,ClO_2$$

Then convert both. The smaller result tells LIMITING REACTANT.

$$.750\ mol\ O_2 \times \left(\frac{2\ mol\ SnO}{5\ mol\ O_2}\right) = 0.300\ mol\ SnO$$

$$.750\ mol\ SnCl_2 \times \left(\frac{2\ mol\ SnO}{2\ mol\ SnCl_2}\right) = .750\ mol\ SnO$$

so, O_2 is limiting

b. what mass of tin (II) oxide would be produced?

You must use the limiting reactant.

$$.750\ mol\ SnCl_2 \times \left(\frac{2\ mol\ SnO}{2\ mol\ SnCl_2}\right) \times \left(\frac{118.693\ grams\ SnO}{1\ mol\ SnO}\right) = 89.0\ grams\ SnO$$

14. Magnesium sulfate, $MgSO_4$, decomposes when heated to produce magnesium sulfide and oxygen gas. If 6.32 grams of $MgSO_4$ were heated in a test tube, what volume, in liters, of oxygen gas at STP should be released? (recall that 22.4 liters of ANY gas is ~~1 mole of gas at 0 degrees C and 1.00 atm~~)

$$MgSO_4 \rightarrow MgS + 2\,O_2$$

$$6.32\ grams\ MgSO_4 \times \left(\frac{1\ mol\ MgSO_4}{120.37\ g\ MgSO_4}\right)\left(\frac{2\ mol\ O_2}{1\ mol\ MgSO_4}\right)\left(\frac{22.4\ L\ O_2}{1\ mol\ O_2}\right)$$

Answer: 2.35 liters O_2 at S.T.P.

15. What mass of CO was used up in the reaction with an excess of oxygen gas if 24.7 g of carbon dioxide is formed? $2\,CO + O_2 \rightarrow 2\,CO_2$

$$24.7\ g\ CO_2 \times \left(\frac{1\ mol\ CO_2}{44.01\ g\ CO_2}\right) \times \left(\frac{2\ mol\ CO}{2\ mol\ CO_2}\right) \times \left(\frac{28.01\ grams\ CO}{1\ mol\ CO}\right) = 15.7\ grams\ CO$$

Purpose: How do we do titration calculations?

If you got this data

$[HCl] = 0.109\ M$

$[NaOH] = ?$

the lonely number → HCl volume = 35.0 mL

NaOH volume = 19.5 mL

In a titration, the "lonely number" is the volume of the substance of known concentration.

$$0.0350\ L_{HCl} \times \left(\frac{0.109\ mol\ HCl}{1\ L\ HCl} \right) = 3.815 \times 10^{-3}\ mol\ HCl$$

$$.003815\ mol\ HCl \times \left(\frac{1\ mol\ NaOH}{1\ mol\ HCl} \right) = 0.003815\ mol\ NaOH$$

$NaOH + HCl \rightarrow HOH + NaCl$

$$[NaOH] = \frac{\text{moles NaOH}}{\text{liters NaOH}}$$

$$[NaOH] = \frac{.003815 \text{ NaOH}}{0.0195 \text{ L}}$$

$$[NaOH] = 0.196 M$$

Answer: the titration of unknown NaOH showed us that the concentration was $[NaOH] = 0.196 \frac{mol}{L}$