

Name:

Date:

SOLUTIONS REVIEW

Part A: Definitions

Aqueous
Homogeneous Solution
Molarity
pH

Solute
Unsaturated Solution
Acid

Solvent
Saturated Solution
Base

Part B: Concentration Calculations

1. Determine the molarities of the following solutions:

a. 2 mol of sodium chloride in 1.5 L of water.

$$n = 2 \text{ mol} \quad V = 1.5 \text{ L} \quad C = \frac{n}{V} = \frac{2}{1.5} = 1.33 \text{ M}$$

b. 15 g of sodium chloride in 0.75 L of water

$$m = 15 \text{ g} \quad M_m = 58.5 \quad n = 0.25 \text{ mol} \quad V = 0.75 \text{ L} \quad C = \frac{0.25}{0.75} = 0.34 \text{ M}$$

c. 3 g of magnesium fluoride in a 200 mL aqueous solution

$$m = 3 \text{ g} \quad M_m = 62 \quad n = \frac{m}{M_m} = \frac{3}{62} = 0.048 \text{ mol} \quad V = 0.2 \text{ L} \quad C = \frac{0.048}{0.2} = 0.24 \text{ M}$$

2. Determine the number of moles present in the following solutions:

a. 2 L of 0.5 M $\text{CaCl}_2(\text{aq})$

$$V = 2 \text{ L} \quad C = 0.5 \text{ M} \quad n = C \times V = 2 \times 0.5 = 1 \text{ mol}$$

b. 300 mL of 0.4 M Na_2SO_4

$$V = 0.3 \text{ L} \quad C = 0.4 \text{ M} \quad n = C \times V = (0.4)(0.3) = 0.12 \text{ mol}$$

Part C: Diluting Solutions

1. A stock solution of HCl has a molarity of 12 M. If one were to take 15 mL of stock solution and add 485 mL of water (to make a 500 mL solution), what would the concentration of the solution be?

$$C_1 = 12 \text{ M} \quad C_2 = ? \quad C_1 V_1 = C_2 V_2 \quad C_2 = 0.36 \text{ M}$$

$$V_1 = 15 \text{ mL} \quad V_2 = 500 \text{ mL} \quad (12)(15) = C_2(500)$$

2. A stock solution of H_2SO_4 has a molarity of 18 M. How many milliliters of stock solution does one need to make a 0.4 M solution?

$$C_1 = 18 \text{ M} \quad C_2 = 0.4 \text{ M} \quad C_1 V_1 = C_2 V_2$$

$$V_1 = ? \quad V_2 = 250 \text{ mL} \quad (18)V_1 = (0.4)(250)$$

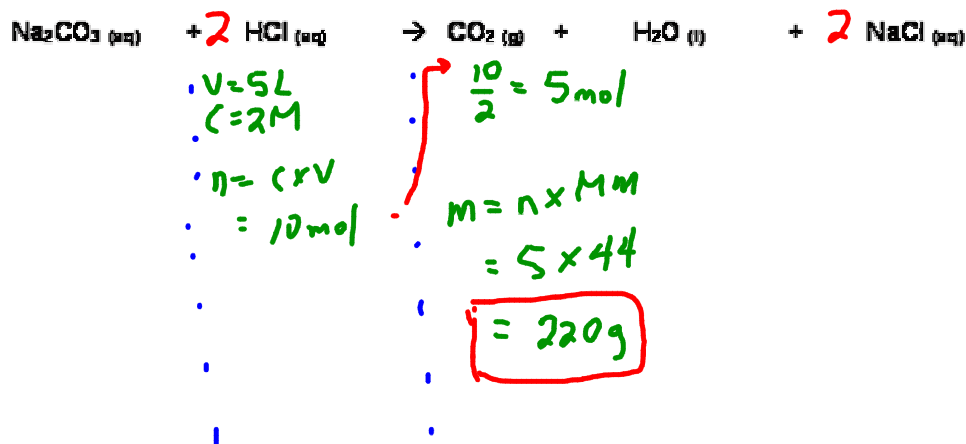
$$V_1 = 5.56 \text{ mL}$$

or

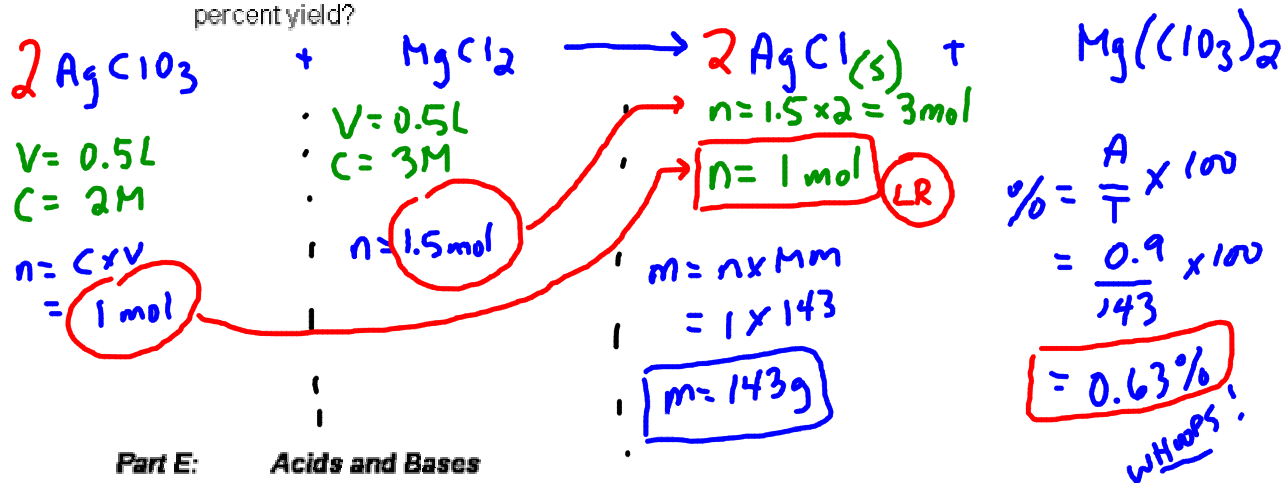
$$0.00556 \text{ L}$$

Part D: Solution Stoichiometry

1. Using the following equation, if 5L of a 2M solution of HCl reacts with excess Na₂CO₃, how many grams of CO₂ will be produced? (don't forget to balance)



2. Aqueous silver (I) chlorate reacts with aqueous magnesium chloride in a double displacement reaction. If 500 mL of a 2M solution of silver (I) chlorate is mixed with a 500 mL of a 3M solution of magnesium chloride, how many grams of precipitate are formed? This experiment creates an actual yield of 0.9 g of precipitate. What is the percent yield?



Part E: Acids and Bases

| Property | Acids | Bases |
|----------------------------------|----------------|-----------------|
| Ion that is present in solution | H ⁺ | OH ⁻ |
| Oxide (metal or non-metal) | Non-Metal | Metal |
| Reactivity? (metal or non-metal) | Metal | Non-Metal |
| Electrical conductivity | YEP | YEP |

| Property | Acids | Bases |
|---|----------------------|----------------------|
| Taste | SOUR | BITTER |
| Feel | TINGLE | SLIPPERY |
| pH range | 0-7 | 7-14 |
| Chemical indicators: Phenolphthalein will turn? Bromthymol Blue will turn? Litmus paper will turn? | N/R YELLOW RED | PINK BLUE BLUE |

1. Name the following acids:

- a. HI Hydroiodic Acid b. H_3P Hydrophosphoric Acid
c. HNO_3 Nitric Acid d. HNO_2 Nitrous Acid
e. H_3PO_5 Perphosphoric Acid f. H_2CO Hypocarbonous Acid

2. Write the Formula for the following acids:

- a. hydrochloric acid: HCl b. hydrosulfuric acid: H_2S
c. carbonic acid: H_2CO_3 d. percarbonic acid: H_2CO_4
e. phosphorous acid: H_3PO_3 f. hypochlorous acid: HClO

3. Calculate the pH of the following solutions:

- a. $[H^+] = 1 \times 10^{-4}$ b. $[H^+] = 3.64 \times 10^{-9}$
 $pH = -\log [1 \times 10^{-4}]$ $pH = -\log [3.64 \times 10^{-9}]$
 $= 4$ $= 8.4$

c. A solution that contains a 2.4×10^{-5} M of H_3PO_4

$$pH = -\log [3 \times 2.4 \times 10^{-5}] = 4.14$$

d. A 200 mL solution that contains 0.0014 mol of sulfurous acid

$$C = \frac{n}{V} = \frac{0.0014}{0.2} = 0.007$$

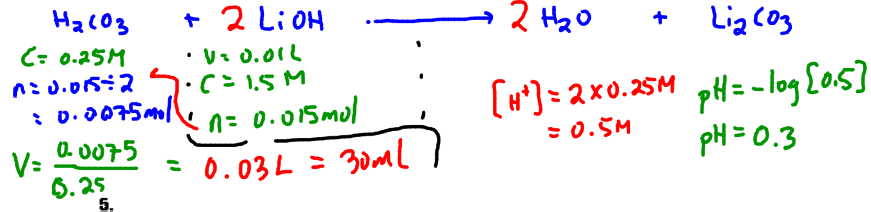
$$pH = -\log [2 \times 0.007]$$

$$= 1.85$$

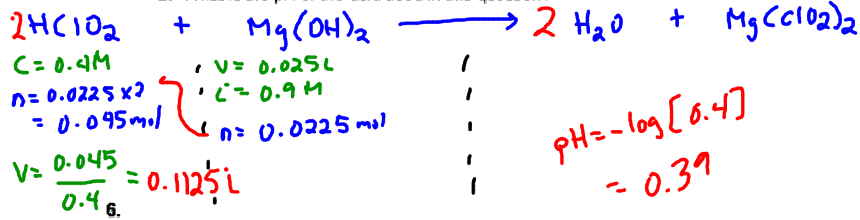
H_2SO_3

4.

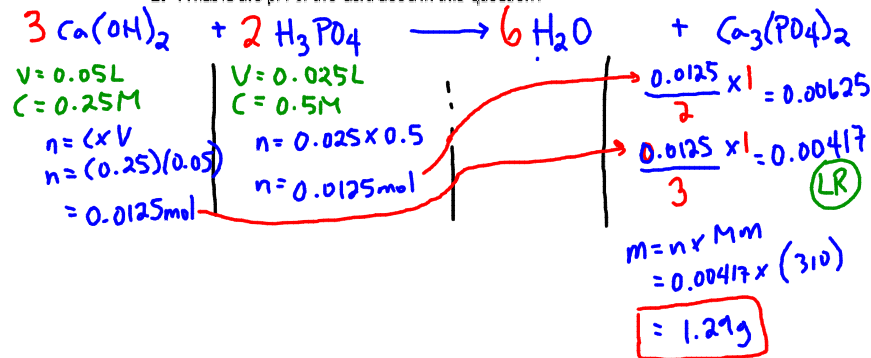
- a. Calculate the volume of 0.250 mol/L carbonic acid that is needed to react completely with 10.0 mL of 1.5 mol/L lithium hydroxide.
 b. What is the pH of the acid used in this question?



- a. Calculate the volume of 0.40 mol/L chlorous acid that is needed to react completely with 25.0 mL of 0.9 mol/L magnesium hydroxide.
 b. What is the pH of the acid used in this question?



- a. 50.0 mL of 0.25 mol/L calcium hydroxide is reacted with 25.0 mL of 0.50 mol/L phosphoric acid. Calculate the mass of the salt produced.
 b. What is the pH of the acid used in this question?



7. **BONUS.** The pH of acid rain is approximately 4.23 (carbonic acid). What volume of sodium hydroxide with a concentration of 0.01M would be needed to neutralize 50 mL of acid rain?

