Chemistry 20	Unit 4
Lesson 4 - Solution Stoichiometry	84 mins

Solution Stoichiometry

- the application of stoichiometric calculation principles to substances in solution.	***Solutions of ammonia and phosphoric acid are used to produce ammonium hydrogen phosphate fertilizer.*** What volume of 14.8 mol/L $NH_{3(aq)}$ is needed for the ammonia to react completely with 1.00 kL of 12.9 mol/L $H_3PO_{4(aq)}$ to produce fertilizer? $2\ NH_{3(aq)} + H_3PO_{4(aq)} \rightarrow (NH_4)_2HPO_{4(aq)}$ V = ?? V = 1.00 kL $14.8\ M$ 1.00 x 10^3 L 12.9 M $n_{H3PO4} = 1.00 \times 10^3 L \times \frac{12.9\ mol}{L} = 1.29 \times 10^4\ mol$ $n_{NH3} = 1.29 \times 10^4\ mol \times \frac{2\ mol\ of\ NH3}{1\ mol\ of\ H3PO4} = 2.58 \times 10^4\ mol$ $V_{NH3} = 2.58 \times 10^4\ mol \times \frac{L}{14.8\ M} = 1.74 \times 10^3 L\ or\ 1.74\ kL$ ***Alternatively… you could keep the prefix unit kilo throughout the calculations… 12.9kL becomes 12.9 kmol becomes 25.8 kmol becomes 1.74 kL***

Gravimetric, Gas, and Solution Stoichiometry Overview

1. Write a balanced chemical equation, and list the quantities and conversion factors for the given substance and the one to be calculated. 2. Convert the given measurement to its chemical amount using the appropriate conversion factor. 3. Calculate the amount of the other substance using the mole ratio from the balanced equation. 4. Convert the calculated amount to the final quantity requested using the appropriate conversion factor.	A technician determines the amount concentration, C, of a sulfuric acid solution. In the experiment, a 10.00 mL sample of sulfuric acid reacts completely with 15.9 mL of 0.150 mol/L potassium hydroxide solution. Calculate the amount concentration of the sulfuric acid. $H_2SO_{4(aq)} + 2\ KOH_{(aq)} \rightarrow K_2SO_{4\ (aq)} + 2\ H_2O_{(aq)}$ 10.00 mL 15.9 mL $1.000 \times 10^{-2} L$ $1.59 \times 10^{-2} L$ C = ?? C = 0.150 M $n_{KOH} = 15.9\ mL \times \frac{0.150 mol}{L} = 2.39\ mmol$ $n_{H2SO4} = 2.39\ mmol \times \frac{1\ mol\ of\ H2SO4}{2\ mol\ of\ KOH} = 1.19\ mmol$ $C_{H2SO4} = 1.19\ mmol \times \frac{1}{10.00\ mL} = 0.119\ M$

Chemistry 20 - Unit 4 - Solution Stoichiometry

Name: _____

1) Some antacid products contain aluminium hydroxide to neutralize excess stomach acid. Determine the volume of 0.10 mol/L stomach acid (assumed to be $HCl_{(aq)}$) that can be neutralized by 912 mg of aluminium hydroxide in an antacid tablet.

2) Slaked lime can be added to an aluminium sulfate solution in a water treatment plant to clarify the water. Fine particles in the water stick to the precipitate produced. Calculate the volume of 0.0250 mol/L calcium hydroxide solution required to react completely with 25.0 mL of 0.125 mol/L aluminium sulfate solution.

3) Sulfuric acid is produced on a large scale from readily available raw materials. One step in the industrial production of sulfuric acid is the reaction of sulfur trioxide with water. Calculate the amount concentration of sulfuric acid produced by the reaction of 10.0 Mg of sulfur trioxide with an excess quantity of water to produce 7.00 kL of acid.

4) 5.844×10^4 milligrams of sodium chloride are dissolved in 2.50 L of water. This mixture then reacts with a 0.350 mol/L lithium sulfide solution. What is mass of lithium chloride produced in this reaction?

5) 35.50 mL of 15.0 mmol/L acetic acid reacts with 12.50 grams of solid baking soda (sodium hydrogen carbonate.). What is the volume of gas produced in this reaction?

(Assume SATP, and you may need to look up this chemical reaction)