

Review of Ch. 7 Stoichiometry

* **Net ionic equations** can be written by following these steps:

i) write a balanced chemical equation

ii) dissociate or ionize substances with high solubility

iii) cancel out spectator ions on each side of the equation

1. *Write a net ionic equation for the reaction of sodium phosphate solution and calcium chloride solution.*

* **Gravimetric stoichiometry** uses the following steps to determine the exact mass of a solid reactant or product in a chemical reaction.

i) write a balanced chemical equation

ii) calculate moles of the given substance using $n= \frac{m}{M}$

iii) multiply the given amount by R/G to get the required amount

iv) calculate the mass of required substance using $m=nM$

 2. *Predict the mass of carbon dioxide produced when 1.00 kg of ethanol undergoes complete combustion in a car’s engine.*

* The **percent yield** of a reaction is the ratio of the actual or experimental quantity of product obtained to the theoretical quantity of product as predicted by stoichiometry.

$percent yield= \frac{actual yield}{predicted yield}$ x 100

3. *In a chemical analysis, 3.00 g of silver nitrate solution was reacted with excess sodium chromate to produce 2.84 g of filtered, dried precipitate. Calculate the percent yield of this reaction.*

* **Gas stoichiometry** uses the following steps to determine the exact mass or volume of a gaseous reactant or product in a chemical reaction.

i) write a balanced chemical equation

ii) calculate moles of the given substance using $n= \frac{m}{M}$ or $n= \frac{V}{V\_{m}}$ or $n= \frac{PV}{RT}$

iii) multiply the given amount by R/G to get the required amount

iv) calculate the mass of required substance using $m=nM$ or the volume of required substance using $V=nV\_{m}$ or $V=\frac{nRT}{P}$

 4. *Calculate the volume of hydrogen gas at SATP required to react with an excess of nitrogen gas and produce 2.00 ML of ammonia gas at 10°C and 120 kPa.*

* **Solution stoichiometry** uses the following steps to determine the exact concentraion or volume of a aqueous reactant or product in a chemical reaction.

i) write a balanced chemical equation

ii) calculate moles of the given substance using n = cv

iii) multiply the given amount by R/G to get the required amount

iv) calculate the concentration of the required solution using $c= \frac{n}{v}$ or calculate volume using $v= \frac{n}{c}$

5. *What volume of a 0.250 mol/L solution of sodium carbonate solution is required to completely*

 *react with 75.0 mL of a 0.200 mol/L solution of iron(III) chloride?*

Review of Ch. 8 Chemical Analysis

* **Qualitative analysis** to determine the identity of an unknown chemical substance can involve **colorimetry** – the color of an aqueous solution (P. 11 of Data Book) or the color a sample produces when placed in a flame (P. 6 Data Book).

6. *Identify the name and chemical formula of an ionic compound that appears yellow in aqueous solution and produces a yellow flame when burned.*

* **Quantitative analysis** to determine the quantity of a substance present can involve **gravimetric analysis** – the precipitation of a slightly soluble product in a single or double replacement reaction.

7. *Which of the following reagents can be used to precipitate acetate ions from a solution of sodium acetate?*

 *a) AgNO3(aq) b) BaCl2(aq) c) CaCl2(aq) d) Pb(NO3)2(aq)*

8. *What mass of precipitate is produced by the reaction of 25.0 mL of 0.275 mol/L sodium sufide solution with an excess of aluminium nitrate solution?*

* **Limiting reagents** (completely used up) and **excess reagents** (some left over after reaction) can be determined by calculating the amount in moles of each reactant present and comparing with the mole ratio from the balanced chemical equation.

9. *Identify the limiting and excess reagents when 20 g of aluminium chloride and 20 g of sodium hydroxide are allowed to react in a container AND determine the mass of excess reagent left over.*

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* Quantitative analysis can also involve **titration analysis** in which a titrant solution from a burette is gradually added to a sample solution in a flask until the endpoint is reached – a sudden change in color or pH of the sample solution.
* The volume of titrant needed to reach the endpoint can be used along with stoichiometry to determine the concentration of the titrant or the sample solution.

10. *A 100 mL standard solution of sodium carbonate was prepared in a volumetric flask using*

 *1.74 g of solid. Using methyl orange indicator to detect the second endpoint, 10.00 mL samples of this standard solution were titrated with hydrochloric acid and the results recorded in the following table.*

 Titration of 10.00 mL samples of Na2CO3(aq) with HCl(aq)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trial** | **1** | **2** | **3** | **4** |
| Final burette reading (mL) | 16.1 | 31.5 | 46.9 | 16.9 |
| Initial burette reading (mL) | 0.2 | 16.1 | 31.5 | 1.5 |
| Volume of titrant used (mL) |  |  |  |  |
| endpoint color | red | orange | orange | orange |

 *Determine the amount concentration of the hydrochloric acid solution.*

* **Titration curves** or pH curves are graphs of pH vs volume of titrant used to reach the endpoint.

The curves are useful because:

i) they can be used to identify the sample solution and titrant as an acid or a base.

ii) the volume of titrant needed to reach the equivalence point can be determined.

iii) an acid-base indicator can be chosen whose pH range includes the endpoint pH.

iv) each equivalence point shown on the curve represents one H+ reacting completely.

 11. *For each titration curve shown below:*

 *a) identify the sample solution and titrant as an acid or a base*

 *b) determine the volume of titrant used to reach the equivalence point*

 *c) determine the equivalence point pH*

 *d) suggest a suitable indicator that will change color at the equivalence point*



 a) sample \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ titrant \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b) equivalence point volume \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c) equivalence point pH \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 d) suitable indicator \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_



 a) sample \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ titrant \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b) equivalence point volume \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c) equivalence point pH \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 d) suitable indicator \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_