Exam & State:	HSC Exam in NSW
Subject:	Chemistry
Type of Exam Preparation Material:	Study Notes
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Date Document First Created:	21/06/2012
Past Performance:	ATAR of 99.4

Summary

In general, this document provides content, analysis and examples behind the course dot points as outlined in the Board of Studies chemistry syllabus. By breaking down the three core modules (production of materials, the acidic environment, chemical monitoring and management) into their subtopics and concepts, and structuring these notes accordingly, the relevant information is provided in a clear and concise form. With the inclusion of useful diagrams and important molecular formula presented in a visual manner, the notes should be easily accessible by all students of varying abilities.

Useful for

Year 12 students taking chemistry for the HSC would find this exam preparation material useful as a comprehensive summary of the fundamentals behind what should be known and learnt for the final exam. This document can be used as a learning aid, to clarify or even enhance the student's knowledge regarding the relevant course content. The notes can also serve as a quick and easy point of reference when revising for the exam or explaining a particular topic/concept.

CONTENTS

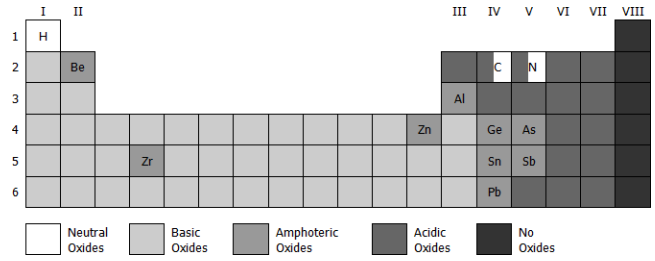
2. WHILE WE USUALLY THINK OF THE AIR AROUND US AS NEUTRAL, THE ATMOSPHERE NATURALLY CONTAINS ACIDIC OXIDES OF CARBON, NITROGEN AND SULPHUR. THE CONCENTRATIONS OF THESE ACIDIC OXIDES HAVE BEEN INCREASING SINCE THE INDUSTRIAL REVOLUTION.

Identify oxides of non-metals which act as acids and describe the conditions under which they act as acids.

- **Acidic oxides:**
  - Covalent oxides of non-metals
  - The more non-metallic, the more acidic
  - Formed by the combustion of the non-metal
    - E.g. $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$
  - Conditions to act as an acid:
    - Dissolve in water to form an acid:
      - $CO_{2(g)} + H_20_{(l)} \rightarrow H_2CO_{3(aq)}$ (carbonic acid)
    - React with a base to form a salt:
      - $CO_{2(g)} + 2NaOH_{(aq)} \rightarrow H_20_{(l)} + 2Na^{+}_{(aq)} + CO_3^{2-}{}_{(aq)}$
  - Common examples:
    - Carbon dioxide (CO_2)
    - Sulfur dioxide (SO_2)
    - Nitrogen dioxide (NO_2)
    - Silicon dioxide (SiO_2) – doesn't react with water, but does react with bases
- **Basic oxides:**
  - Oxides of metals
  - Conditions to act as a base:
    - Dissolve in water to form an alkaline solution
    - React with an acid to form a salt
      - $CuO_{(s)} + H_2SO_{4(aq)} \rightarrow CuSO_{4(aq)} + H_20_{(l)}$
  - Common examples:
    - Copper oxide (CuO)
- **Amphoteric oxides:**
  - Show both acidic and basic properties (react with both acids and alkalis)
  - E.g. ZnO, PbO, Al_2O_3
- **Neutral oxides:**
  - Don't react with either acids or bases
  - E.g. CO, NO, N_2O

Analyse the position of these non-metals in the Periodic Table.

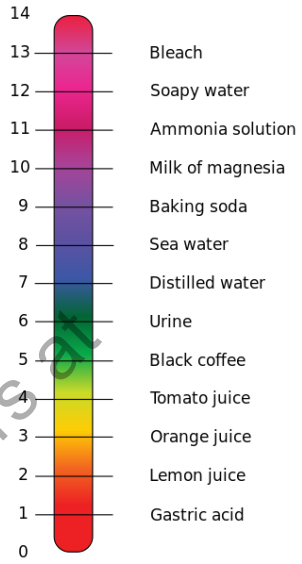
- **Metal oxides** – mostly basic (<u>left</u> side of table)
- **Non-metal oxides** – mostly acidic (<u>right</u> side of table)
- **Amphoteric oxides** – oxides of elements close to the borderline between metals and non-metals
- No oxides are formed with the noble gases



Define Le Chatelier's principle.

- **Le Chatelier's principle:** if a system in equilibrium is disturbed or changed in some way, then the system adjusts itself to minimise the change and return to equilibrium
- **Features of a system in equilibrium:**
  - Closed system
  - Macroscopic properties (colour, temp, pressure, state) do not alter
  - Concentrations remain the same
  - Rate of forward reaction = rate of reverse reaction

- **Dilute**: relatively small amount of solute dissolved in a given volume of solvent



Describe the use of the pH scale in comparing acids and bases.

- pH scale: numerical scale indicating the degree of acidity or alkalinity of a solution
- pH varies due to:
  - Concentrated vs dilute
  - Number of H^+ ions the acid could release
  - Temperature of solution
  - Strong vs weak

Identify pH as $-\log_{10}[H^+]$.

- $pH = -\log_{10}[H^+]$
- $[H^+] = 10^{-pH}$
- [ ] means the concentration
- $[H^+] \times [OH^-] = 10^{-14}$
- A change in pH of 1 means a ten-fold change in $[H^+]$

Compare the relative strengths of equal concentrations of acids.

Acid	Degree of Ionisation	pH
Hydrochloric	100%	1
Citric	7.9%	2.1
Acetic	1.3%	2.9

- In order of strength: hydrochloric > citric > acetic

Describe the difference between a strong and a weak acid.

- Strong acids – complete forward reaction
  - $HCl + H_2O \rightarrow H_3O^+ + Cl^-$
- Weak acids – equilibrium set up
  - $HCN + H_2O \leftrightarrow H_3O^+ + CN^-$

Explain the use of acids as food additives.

- **Uses** of acids in food: to improve the taste, for preservation
- Examples of **food additives:**

Acid	Foods	Role
Tartaric acid and citric acid	Jams	Provides a sharp taste
Citric acid	Canned/jarred food	Antioxidant, prevents bacterial growth
Acetic acid (vinegar)	Pickles	Preserving agent
Phosphoric acid	Soft drinks	Provides a sharp taste

- Acids for **food preservation**:
  - Prevent bacteria growth (many types can't survive in acidic conditions)
  - If the acid is weak enough, the food is still consumable
  - Examples of acidic food preservatives:
    - sulfur dioxide SO_2
    - lactic acid $CH_3CHOHCOOH$
    - acetic (ethanoic) acid CH_3COOH
    - propionic (propanoic) acid CH_3CH_2COOH