Exam & State:	Year 12 Exam in NSW
Subject:	Chemistry
Type of Exam Preparation Material:	Mind Maps – four modules
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Past Performance:	ATAR score of 99.40 in 2011

Summary

This document contains four pages of mind maps designed for the Year 12 end of year Chemistry exam in NSW. It contains the following content:

Module 1: Production of Materials Topics	Module 2: The Acidic Environment Topics	Module 3: Chemical Monitoring & Management (Part 1 & Parts 2) Topics
Ethylene and polymers Glucose, cellulose, biopolymers Ethanol Oxidation reduction reactions Nuclear chemistry	Indicators Acidic oxides, equilibrium Acids and Bases Acid definitions, titration, buffers Esterification	Monitoring reations Ammonia, Haber process Analysis techniques Atmosphere, ozone, CFCs Water quality

In general this document may be useful for,

Year 12 students taking chemistry for the HSC would find this exam preparation material useful as a mind map/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.

Module 3 Chemical Monitoring and Management (Part 1)

Example chemist

Name: Burhan Gemikonakli
Type of chemist: plant chemist (analytical branch of chemistry)
Industry: Qenos (major Australian chemical manufacturing company making ethene from ethane and polymerising it to polyethylene)
Roles: monitor quality of substances used for impurities, monitor waste water before discharge, adjust conditions at the cracking furnace, ensure correct operation of equipment

Topic 1 – monitoring reactions

Examples of scientists

Polymer chemists: investigate polymers and manipulate their structures to alter properties
Environmental chemists: collect, analyse and assess environmental data, monitor water and air for pollutants
Metallurgical chemists: specialise in the properties, applications and development of metals
Biochemists: study the structure and functions of molecules in living things

Topic 2 – ammonia, Haber process

Ammonia (NH_3)

Uses of ammonia: fertilisers, household cleaners, refrigerants, vitamins, drugs, dyes, catalysts, fibres, plastics, synthetic polymers
Synthesis: Haber process: $N_2 + 3H_2 \leftrightarrow 2NH_3$ (exothermic reaction)

Haber process

Process: purified mixture of N_2 and H_2 is heated under pressure, passed into 'bombs' (catalytic towers) where 10% of mixture converts to ammonia, product is removed, N_2 and H_2 are recycled to repeat process
Equilibriums in the process: higher temperatures increase rate of reaction (greater kinetic energy and vibrations of molecules), higher pressures increase rate of reaction (but is very expensive and risky)
Necessary industrial conditions: temperatures around 500°C, high pressures ≈ 250atm, catalyst, constant removal of ammonia, appropriate ratio of N_2 and H_2
Use of catalyst: magnetic iron catalyst fused with small amounts of promoters (highly porous with large surface area, reduces activation energy of system)

Developments

Late 19th century: greater need for nitrogen compounds for fertilisers, dyes and explosives
Germany's war preparations around 1910: embargoes blocked raw materials, German scientist Fritz Haber first produced NH_3

Topic 3 – analysis techniques

Atomic Absorption Spectroscopy (AAS)

Sensitive technique measuring concentrations of metals down to parts per billion, developed by Alan Walsh
Process: cathode lamp emits light with particular frequencies → light is absorbed and re-emitted by sample (absorbs particular frequencies) → detector records intensity of light → produces absorption spectrum
Uses: testing purity of metallic samples, monitor pollution levels in waste water, monitor dangerous air-borne particles
Advantages: relatively simple and inexpensive, very sensitive, fast analysis, extremely accurate
Disadvantages: high initial expensive, only tests for one ion at a time

Testing for anions

Carbonate: bubbles of CO_2 gas formed with dilute inorganic acids, solutions have a pH of 8-11
Sulfate: adding Ba^{2+} or Pb^{2+} ions forms white precipitate
Chloride: adding Ag^+ forms white precipitate which slowly turns purple with light exposure
Phosphate: adding Ag^+ forms yellow precipitate

Testing for cations

Barium: flame test gives green colour, adding SO_4^{2-} ions forms white precipitate
Calcium: flame test gives red colour, adding SO_4^{2-}, F^-, or CO_3^{2-} ions forms white precipitate
Copper: flame test gives blue-green colour, adding OH^- ions forms blue precipitate
Lead: adding Cl^- forms white precipitate, adding I^- ions forms yellow precipitate
Iron (II): adding OH^- ions forms white precipitate and turns brown after oxidation
Iron (III): adding OH^- ions forms a reddish-brown precipitate