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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

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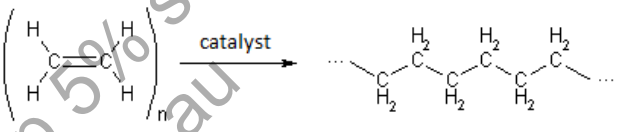
- **Safety precautions:**
  - Bromine (toxic, skin irritant, corrosive) – use in the fume cupboard, wear gloves and goggles
  - Hydrocarbons (flammable) – keep away from naked flames, do not dispose of down the drain
- **Variables:**
  - Controlled – volume of bromine water, volume of hydrocarbons
  - Independent variable – type of hydrocarbon
  - Dependent variable – colour of bromine water

Identify that ethylene serves as a monomer from which polymers are made.

- **Monomer:** small molecules that can chemically bind together to form a polymer, e.g. ethylene (CH_2=CH_2)
- Adding side chains and other functional groups allow the fine tuning of physical properties and chemical reactivity – often achieved through POLYMERISATION

Identify polyethylene as an addition polymer and explain the meaning of this term.

- **Polymerisation:** process of joining of small molecules (monomers) sequentially to form a chain
  - Examples: plastics, rubber, starch, cellulose, etc.
- **Addition polymerisation:** unsaturated monomers combine through addition reactions (double/triple bond breaks)
  - E.g. **n(CH_2=CH_2) → ~~(~~CH_2CH_2~~)~~$_n$**

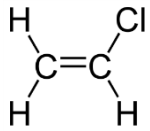


Outline the steps in the production of polyethylene as an example of an important polymer.

- **Steps in production:**
  1. **Initiation** – chemical (initiator like a peroxide) begins the reaction → covalent bonds break → activated free radical monomers forms
  2. **Propagation** – monomers join → chain grows
  3. **Termination** – chain growth eventually stops (by hydrogen atoms attaching to the free radical, or by the joining of 2 free radicals)
- **Commercial importance of polyethylene:**
  - Used for milk bottles, detergent containers, food containers and garbage bins because it is:
    - *Insoluble in water, inert* – don't dissolve or react with their contents
    - *Tough and strong* – don't break easily
    - Lightweight (*low density*) – easily transported

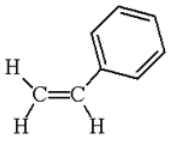
Describe the uses of the polymers made from the vinyl chloride and styrene in terms of their properties.

- **Vinyl chloride** (systematic name: chloroethene) – CH_2CHCl
- Polymerisation produces **polyvinylchloride** (PVC): **n(CH_2=$CHCl$) → ~~(~~CH_2CHCl~~)~~$_n$**



  - Properties:
    - Thermoplastic (can be heated, remelted and reshaped)
    - Additives are often added to improve its flexibility, thermal stability or UV stability (otherwise is hard and brittle)
    - Fire and water resistant
    - Does not conduct electricity
  - Uses: Rigid PVC: guttering, credit cards, waste water pipes
    Flexible PVC: soft furnishings, garden hoses, electrical insulation

- **Styrene** (systematic name: ethenylbenzene) – CH_2=$CH(C_6H_5)$
- Polymerisation produces **polystyrene: n[CH_2=$CH(C_6H_5)$] → ~~[~~$CH_2CH(C_6H_5)$~~]~~$_n$**



  - Properties:
    - Hard/stiff (large functional group restricts branching)
    - Good insulator
    - Transparent

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- **Evaluation:**
  - Crude oil's current availability/convenience has slowed research into alternative sources of fuels
  - Large corporations have already invested a lot in petroleum, and are thus often resistant to change
  - However, vehicle makers are starting to produce vehicles running on 0% to 100% ethanol
  - Large scale production may be seen as uneconomical, but with rising petrol costs, blends will become increasingly popular

Summarise the processes involved in the industrial production of ethanol from sugar cane.

- Converting sugar cane to ethanol:
  1. Sugar cane crop is grown, cut, crushed and grinded
  2. Hydrolise with dilute acid
  3. Crushed sugar cane is fermented
  4. Impure ethanol is distilled to produce pure liquid ethanol
- Processes in the **industrial production of ethanol**:

<table>
<tr><th>Raw Material</th><th colspan="3">Manufacturing Process</th><th>Finished Product</th></tr>
<tr><td>Sugar Cane</td><td colspan="2">→</td><td rowspan="3">Fermentation</td><td rowspan="3">Distillation</td><td rowspan="3">ETHANOL</td></tr>
<tr><td>Corn (starch)</td><td>→</td><td rowspan="2">Conversion to sugar</td></tr>
<tr><td>Grass/Wood (cellulose)</td><td>Pre-processing</td></tr>
</table>

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