2002 HIGHER SCHOOL CERTIFICATE EXAMINATION

Chemistry

Centre Number

Student Number

Section I (continued)

Part B – 60 marks
Attempt Questions 16–27
Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Marks

Question 16 (6 marks)

You have carried out a first-hand investigation to compare the reactivity of an alkene with its corresponding alkane.

(a) State the name of the alkene. **1**

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(b) Outline a procedure to compare the reactivity of this alkene with its corresponding alkane. **2**

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(c) Describe the results obtained from this first-hand investigation and include relevant chemical equations. **3**

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Question 17 (3 marks) **Marks**

Explain why alkanes and their corresponding alkenes have similar physical properties, but very different chemical properties. 3

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14. C The consequences of carrying out the reaction at 400°C compared to 200°C are:

- the reaction rate at 400°C will be faster than at 200°C. Steeper curves in (A), (C) and (D) show this. (B) is incorrect as it has a slower rate of NH_3 production.
- the yield of ammonia at 400°C will be less than at 200°C, because the forward reaction (formation of NH_3) is exothermic. Hence, lower temperatures favour the formation of NH_3 (Le Chatelier's Principle). Only the graph in (C) shows the lower yield, and so is the answer. Thus (A) and (D) are incorrect.

15. A

- Addition of HCl produces no change – so no Pb^{2+}. (B) and (C) are incorrect.
- Addition of KSCN produces no change – so no Fe^{3+}. (D) is incorrect.
- Addition of Na_2CO_3 produces a white precipitate – so Ca^{2+} or Ba^{2+} could be in solution. [Note: Pb^{2+} has been eliminated as a possibility above on the first bullet.]
- Addition of $AgNO_3$ produces a white precipitate – so Cl^- is in solution.

Thus (A), a solution containing $CaCl_2$ and $BaCl_2$, is consistent with the results.

PART B – 60 marks

16. (a) 1–hexene

(b) Place 1 mL of 1–hexene into a test tube, and 1 mL of hexane into another test tube. Add 2 drops of bromine dissolved in an organic solvent. Compare the time it takes for the colour of the bromine to change from red-brown to colourless.

[Note: (1) The colour of the bromine solution depends on the solvent used, e.g. it can be a red-yellow or a yellow-orange or a red-brown colour. (2) Both mixtures should be kept in the same place to ensure exposure to UV light is the same since alkanes will react slowly with Br_2 in UV light.]

(c) The red-brown colour of the Br_2 disappeared virtually straight away in the 1-hexene, and slowly (> 4 minutes) in the hexane.

Reaction of 1–hexene: $C_6H_{12}(l) + Br_2(solvent) \longrightarrow C_6H_{12}Br_2\,(l)$

Reaction of 1–hexane: $C_6H_{14}(l) + Br_2(solvent) \longrightarrow C_6H_{13}Br(l) + HBr(g)$

[Note: Times for the hexane/Br_2 reaction can vary depending on the UV present, but are always longer than the corresponding 1–hexene reaction.]

17. Their similar physical properties (e.g. density, melting point) depend on the intermolecular forces which are not very different. Both have non-polar molecules. An alkane has only two more H atoms than the corresponding alkene.

Their chemical properties differ because alkenes have a C=C double bond which can undergo addition reactions, whereas an alkane only has C–C bonds which are relatively unreactive. When an alkane reacts, atoms must break away from the parent molecule, and other atoms substitute for them.

18. (a) Condensation polymerisation.

(b) An early use of biopolymers made from wood pulp continues today, e.g. cellulose acetate used in celluloid film and 'acetate' sheeting, rayon used in fabrics. Today, shorter cellulose fibres from waste paper, straw, and wheat or corn husks, can also be used. These materials are cheaper and are often waste products anyway. Biopolymers are biodegradable by bacteria and fungi, and so their use is more environmentally sensitive. More recently, biopolymers known as polyhydroxy-alkanoates (PHAs) have been produced by bacteria, and even plants that have been genetically modified. PHAs have similar properties to synthetic plastics but are also biodegradable. Growth in this industry will result in less atmospheric emissions compared to that from the conventional plastics industry, and less discarded and useless plastics to be disposed of in increasingly expensive ways.