Paper Reference(s)

6242/P.01

Edexcel GCS

Chemistry

Advanced Subsidiary

Unit Test 2

Wednesday 29 May 2002 - Morning

Time: 1 hour 15 minutes

Materials required for examination	Item included with question paper
Nil	Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, surname and initials, the paper reference and your signature.

Answer ALL the questions in the spaces provided in this question paper.

Calculators may be used.

Show all the steps in any calculations and state the units.

Information for Candidates

The total mark for this paper is 50. The marks for the various parts of questions are shown in round brackets: e.g. (2).

All blank pages are indicated.

A Periodic Table is printed on the back cover of this question paper.

Advice to Candidates

You are reminded of the importance of clear and orderly presentation in your answers.

Edexcel

Success through qualifications

1. The reaction of an acid with a base to give a salt is an exothermic reaction. In an experiment to determine the enthalpy of neutralisation of hydrochloric acid with sodium hydroxide, 50.0 cm^3 of 1.00 mol dm^{-3} HCl was mixed with 50.0 cm^3 of 1.10 mol dm^{-3} NaOH. The temperature rise obtained was 6.90°C.

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(a) Define the term enthalpy of neutralisation.

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(1)

(b) Assuming that the density of the final solution is 1.00 g cm^{-3} and that its heat capacity is 4.18 J K^{-1} g^{-1}, calculate the heat evolved during the reaction.

(3)

(c) 0.0500 mol of acid was neutralised in this reaction; calculate $\Delta H_{neutralisation}$ in kJ mol^{-1}.

(2)

(d) Suggest why sodium hydroxide is used in slight excess in the experiment.

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(1)

(Total 10 marks)

2. (a) (i) State two factors other than a change in temperature or the use of a catalyst that influence the rate of a chemical reaction. *Leave blank*

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(2)

(ii) For one of the factor you have chosen explain the effect on the rate.

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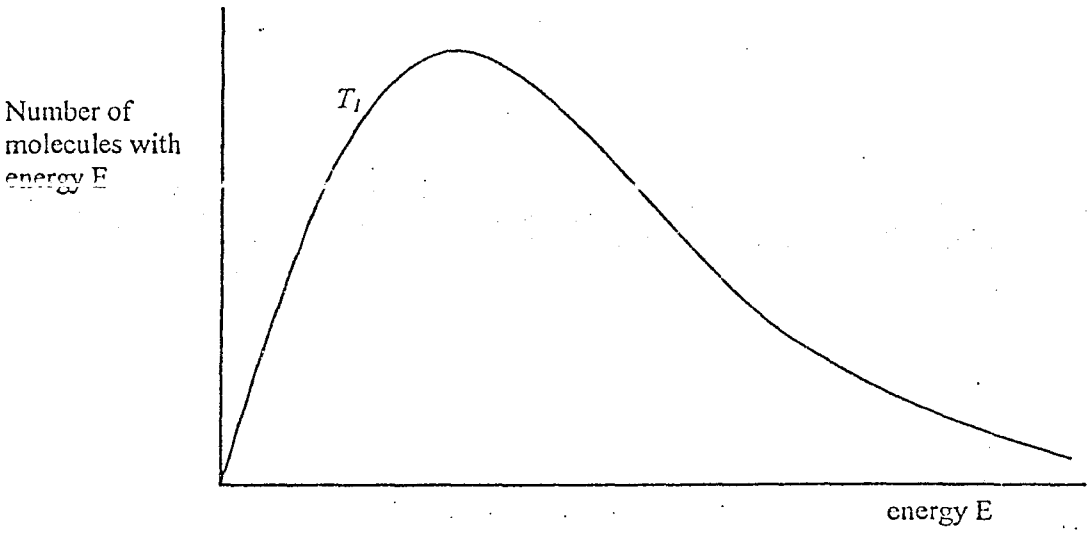
(2)

(b) The Maxwell-Boltzmarnn distribution of molecular energies at a given temperature T_1 is shown below.



(i) On the same axes draw a similar curve for a reaction mixture at a higher temperature T_2.

(2)

(ii) Place a vertical line E_a at a plausible value on the energy axis to represent the activation energy for a reaction.

(2)

(iii) Use your answers to parts (i) and (ii) to explain why an increase in temperature causes an increase in the reaction rate.

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(3)

(Total 10 marks)

3. The reaction in the Haber Process that is used to produce ammonia is a homogeneous dynamic equilibrium:

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$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92 \text{ kJ mol}^{-1}$$

(a) State the meaning of the terms:

(i) dynamic equilibrium;

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(2)

(ii) homogeneous.

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(1)

(b) Give, with a reason in each case, the effect of the following on the **position** of the equilibrium above:

(i) an increase in pressure;

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(2)

(ii) an increase in temperature.

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(2)

(c) (i) What temperature is used in the Haber Process?

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(1)

(ii) Justify the use of this temperature.

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(3)

(d) (i) Name the catalyst used in the Haber Process.

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(1)

(ii) How does a catalyst enable a reaction to occur more quickly?

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(2)

(Total 14 marks)

4. Consider the following reaction scheme:

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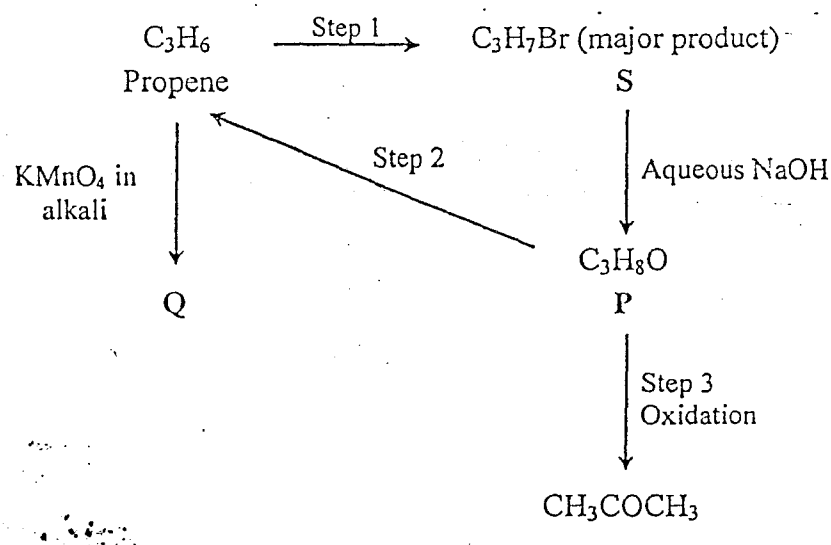

(a) (i) Give the reagent and condition needed for step 1.

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(2)

(ii) Give the structural formula of S.

(1)

(b) (i) Give the structural formula of **P**.

(1)

(ii) State the **type** of reaction in:

step 1 .....

(2)

the conversion of S to P .....

(2)

(c) (i) Give the reagent and the conditions needed for step 2.

Leave blank

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(2)

(ii) Give the reagent and the conditions needed for step 3.

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(3)

(d) Give the structural formula for compound Q.

(1)

(e) If S is reacted with a solution of hydroxide ions in ethanol, P is not the product. Draw the structure of the compound that is produced in this reaction.

(1)

(Total 15 marks)

5. (a) Ethene and propene are in the same homologous series. Explain the term **homologous series.**

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(3)

(b) (i) Draw a representative length of the polymer chain of poly(propene).

(2)

(ii) State, with a reason, the empirical formula of poly(propene).

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(3)

(c) Poly(propene) does not have a sharp melting temperature, but softens over a range of temperature Suggest why this is so.

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(1)

(d) (i) Tetrafluoroethene, C_2F_4, also forms a polymer. Suggest why this polymer is very inert.

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(1)

(ii) Give one use for poly (tetrafluoroethene).

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(1)

(e) Ethane and ethene both react with bromine. Ethane does not react at room temperature in the dark, whereas. ethene does so extremely quickly. Explain in terms of the bonding in each molecule why this is so.

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(3)

(Total 14 marks)

6. (a) (i) Define the term **standard enthalpy of combustion.**

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(3)

(ii) The values for the standard enthalpy of combustion of graphite and carbon monoxide are given below.

	ΔH_c^{θ} / kJ mol^{-1}
C (graphite)	-349
CO(g)	-283

Use these data to find the standard enthalpy change of formation of carbon monoxide using a Hess's law cycle.

$$C(\text{graphite}) + \tfrac{1}{2} O_2(g) \longrightarrow CO(g)$$

(3)

(iii) Suggest why it is not possible to find the enthalpy of formation of carbon monoxide directly.

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(1)

(iv) Draw an enthalpy level diagram below for the formation of carbon monoxide from graphite.

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(1)

(b) Natural gas consists of methane, CH_4. When methane burns completely in oxygen the reaction occurs as shown in the equation:

$$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l) \quad \Delta H = -890 \text{ kJ mol}^{-1}$$

Methane does not burn unless lit.

Use this information to explain the difference between thermodynamic and kinetic stability.

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(4)

(c) Suggest why methane is not used as a fuel for motor vehicles whereas octane is.

The following data may be useful:

$CH_4(g)$ $\quad \Delta H_c = -890 \text{ kJ mol}^{-1}$

$C_8H_{18}(g)$ $\quad \Delta H_c = -3530 \text{ kJ mol}^{-1}$

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(3)

(Total 15 marks)

TOTAL FOR PAPER: 75 MARKS

END