Centre No.						Paper Reference (complete below)							Surname	Initial(s)
Candidate No.										/			Signature	

Paper Reference(s)

6242.01

Edexcel GCE

Chemistry

Advanced Subsidiary

Unit Test C2

Friday 17th January 2003 – Morning

Time: 1 hour 15 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number and candidate number, your surname, initial(s), signature and the paper reference number.
The paper reference is shown at the top of this page.
Answer ALL the questions in the spaces provided in this question paper.
Show all the steps in any calculations and state the units.
Calculators may be used.

Information for Candidates

The total mark for this paper is 75. The marks for the various parts of questions are shown in round brackets, e.g. (2).
A Periodic Table is printed on the back of this booklet.

Advice to Candidates

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

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1. (a) Chlorine and sodium hydroxide are produced by electrolysis in a membrane cell.

Leave blank

(i) What electrolyte is used?

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(1)

(ii) State the gaseous product at the electrodes.

Anode .....

Cathode .....

(2)

(iii) Write the chemical equation for the overall reaction that occurs in the membrane cell. There is no need to give state symbols.

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(2)

(iv) Give one piece of everyday evidence that the reaction written in (iii) cannot occur without electrolysis.

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(1)

(v) State the purpose of the membrane in the electrolytic cell.

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(1)

(b) Sodium chlorate(I) is made by allowing chlorine to react with sodium hydroxide at room temperature.

(i) Write the **ionic** equation for the reaction between sodium hydroxide and chlorine, including state symbols.

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(3)

(ii) State why the reaction in (i) is a redox reaction.

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(1)

(iii) State one large-scale use of sodium chlorate(I).

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(1)

Leave blank

Q1

(Total 12 marks)

2. In the Ostwald process for the production of nitric acid, ammonia is oxidised at 900 °C over a platinum/rhodium alloy catalyst according to the equation:

Leave blank

$$4NH_3(g) + 5O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$$

The reaction is very exothermic.

(a) (i) Why do the concentrations of the substances in an equilibrium mixture remain constant?

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(1)

(ii) State with a reason the effect of an increase in pressure on this equilibrium system.

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(2)

(b) (i) The mixture obtained from the catalyst chamber contains excess oxygen. Write the equation for the further reaction that occurs on cooling this mixture.

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(1)

(ii) Show, by means of an equation, how the product in (b) (i) is used to make nitric acid.

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(2)

(c) (i) Sketch a Maxwell-Boltzmann distribution that could represent the energies of the molecules in the Ostwald reaction system at a given temperature.

Leave blank

(2)

(ii) Use your diagram and any necessary explanation to show how the presence of a catalyst leads to an increase in reaction rate at the same temperature.

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(4)

Q2

(Total 12 marks)

3. (a) A compound Z has the composition (by mass) of 68.2% C, 13.6% H and 18.2% O. It has a relative molecular mass of 88.

Leave blank

(i) Find the empirical formula of Z.

(3)

(ii) Deduce the molecular formula of Z.

(2)

(b) Compound Z is an alcohol, which can be tested for with phosphorus pentachloride, PCl_5.

(i) Using the symbol ROH to represent compound Z, write an equation to show how it reacts with PCl_5.

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(2)

(ii) What would you see as the test is performed?

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(1)

(c) (i) Draw a full structural formula for Z that is a branched-chain primary alcohol.

(2)

(ii) Draw the full structural formula of the compound that would be obtained if the primary alcohol in (c) (i) were to be oxidised so that the product distils over as it is formed.

(1)

(iii) Suggest a suitable oxidising mixture for the reaction in (c) (ii).

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(2)

(iv) State what type of organic compound would be formed if the reaction mixture in (c) (ii) were heated under reflux.

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(1)

(d) If the alcohol **Z** is heated with concentrated sulphuric acid, a gas **Y** is produced. Gas **Y** reacts with bromine solution decolourising it.

(i) Draw the functional group present in **Y**.

(1)

(ii) Suggest a structure for a compound that could be produced from the reaction of bromine with **Y**.

(2)

Q3

(Total 17 marks)

4. (a) The reactivity of organic compounds is related to their bonding. Ethane reacts very slowly with bromine in the dark but rapidly in ultraviolet light; ethene reacts rapidly with bromine even in the dark.

Leav blank

(i) What type of reaction is the reaction of bromine with ethane?

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(1)

(ii) Explain the difference in the reactivity of ethane and ethene with bromine in terms of the types of covalent bonding found in these two compounds.

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(4)

(b) Halogenoalkanes such as $CH_3CH_2CH_2Br$ react with potassium hydroxide solution in several ways depending on the conditions.

(i) Name the compound $CH_3CH_2CH_2Br$.

.....

(1)

(ii) Draw the structure of the compound obtained if $CH_3CH_2CH_2Br$ is reacted with KOH in ethanolic solution.

(1)

(iii) Draw the structure of the substance obtained if $CH_3CH_2CH_2Br$ is reacted with KOH in aqueous solution.

(1)

(iv) What is the role of the hydroxide ion in the reaction in (iii)?

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(1)

(v) $CH_3CH_2CH_2Cl$ reacts much more slowly with aqueous KOH than $CH_3CH_2CH_2Br$ does. Why is this?

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(2)

(Total 11 marks)

Lea
bla

5. (a) Define the term **standard enthalpy of combustion**, making clear the meaning of **standard** in this context.

Leav blank

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(3)

(b) Use the enthalpies of combustion given below to find the enthalpy change for the reaction:

$$2C(\text{graphite}) + 2H_2(g) + O_2(g) \rightarrow CH_3COOH(l)$$

	$\Delta H_{\text{combustion}}$/kJ mol^{-1}
C(graphite)	–394
$H_2(g)$	–286
$CH_3COOH(l)$	–874

(3)

(c) With reference to ethanoic acid, CH_3COOH, what is the enthalpy change obtained in (b) called?

.....

(1)

(d) Draw an enthalpy level diagram to represent the enthalpy change for the combustion of graphite. Show both the enthalpy levels of the reactants and products and an energy profile which represents the activation energy for the reaction.

Leave blank

(3)

(e) Use your diagram given in (d) to explain the terms **thermodynamic** and **kinetic stability** with reference to the combustion of graphite.

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(4)

Q5

(Total 14 marks)

6. (a) Poly(ethene) and poly(tetrafluoroethene), or PTFE, are widely-used polymers.

Leave blank

(i) Draw a representative length of the polymer chain for each of these polymers, making clear the repeating unit in each case.

(3)

(ii) State why a polymer such as poly(ethene) does not have a sharp melting temperature, but softens over a range of temperature.

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(1)

(b) Poly(tetrafluoroethene) is an expensive polymer, but is used in applications where extreme resistance to chemical attack is important. Suggest in terms of its bonding why PTFE is so inert.

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(2)

(c) Herbicides such as 2,4-D and 2,4,5-T contain carbon-chlorine bonds. Explain why the strength of this bond is both an advantage and a disadvantage in the use of herbicides.

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(3)

Q6

(Total 9 marks)

TOTAL FOR PAPER: 75 MARKS

END