

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

CHEMISTRY (SALTERS)

2848

CHEMISTRY OF NATURAL RESOURCES

Friday

18 JANUARY 2002

Morning

1 1/2 hours

Candidates answer on the question paper.

Additional materials:

Scientific calculator

Data Sheet for Chemistry (Salters)

Candidate Name

Centre Number

Candidate
Number

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TIME *1 1/2* hours

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use a scientific calculator.
- You are advised to show all the steps in any calculations.
- You may use the *Data Sheet for Chemistry (Salters)*.

FOR EXAMINER'S USE		
Qu	Max.	Mark
1	13	
2	29	
3	26	
4	13	
5	16	
TOTAL	97	

This question paper consists of 16 printed pages.

- (iii) Bromide ions are hydrated in aqueous solution. Draw a diagram to show how a water molecule interacts with a bromide ion.

[2]

- (d) Great care has to be taken when storing or transporting liquid bromine. Give a reason for this.

.....

.....[1]

[Total: 13]

(ii) In Equation 2.1 water acts as an acid. When water acts as an acid a base is formed. This base is called the conjugate base.

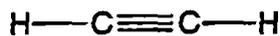
1. Describe how water acts as an acid.

.....
[2]

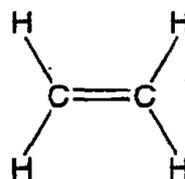
2. Give the formula of the conjugate base formed from water.

.....[1]

(iii) Ethyne is an unsaturated compound containing a carbon-carbon triple bond. The triple bond reacts in a similar way to the carbon-carbon double bond in ethene.



ethyne



ethene

Bromine can react with ethyne to form a completely saturated compound, $\text{C}_2\text{H}_2\text{Br}_4$.

1. Give the structural formula of this compound.

[1]

2. Give the systematic name for this compound.

.....[2]

(iv) Name the **type** of mechanism by which ethene reacts with bromine.

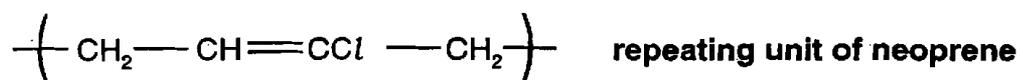
.....[2]

(v) Suggest why bromine molecules are attracted more strongly to ethyne than to ethene.

.....

[2]

- (ii) Chlororoprene polymerises to give the polymer, neoprene. The repeating unit of neoprene is shown below.

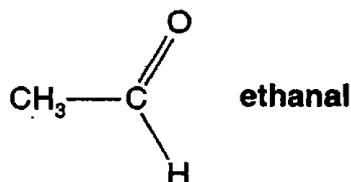


Draw two possible structures for the neoprene repeating unit and use them to explain why neoprene shows *cis-trans* (geometric) isomerism.

.....
.....[3]

[Total: 29]

An intermediate compound in the oxidation of ethanol is ethanal.



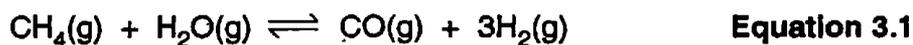
Some early manufacturing processes for ethanoic acid involved catalytic oxidation of hydrocarbons such as butane. A mixture of oxidation products, including ethanoic acid, was formed.

- (d) Suggest **two** reasons why the formation of a mixture of products made the early processes expensive.

.....
[2]

- (e) Recently, chemists have discovered ways of controlling such reactions using both heterogeneous and homogeneous catalysis.

In the first stage of the newer process, methane (natural gas) reacts with steam in the presence of a heterogeneous catalyst. The equation for the reaction is given below.



- (i) Suggest the **physical state** of the catalyst in this reaction.

.....[1]

- (ii) What effect, if any, will increasing the pressure have on the **rate** of reaction?

.....[1]

- (iii) What effect, if any, will increasing the pressure have on the **yield** of carbon monoxide?

.....[1]

- (g) One use of ethanoic acid is in lime descalers because it reacts with calcium carbonate (lime-scale). The equation is given below.



In an experiment it is found that 20.0 cm³ aqueous ethanoic acid are neutralised by 0.100 g of solid CaCO₃.

[A_r: C, 12.0; O, 16.0; Ca, 40.1]

- (i) Calculate the number of moles of CaCO₃ that will neutralise this ethanoic acid.

Answermol [2]

- (ii) Deduce the number of moles of ethanoic acid present in the 20.0 cm³ aqueous ethanoic acid.

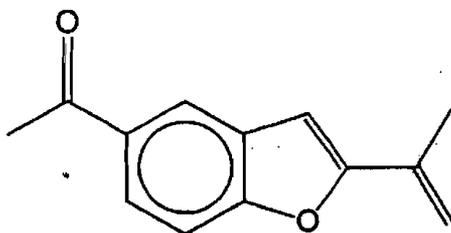
Answermol [1]

- (iii) Calculate the concentration in mol dm⁻³ of the ethanoic acid solution. Give your answer to an appropriate number of significant figures.

Answer mol dm⁻³ [3]

[Total: 32]

- (c) Tremetone slowly changes into the non-toxic compound **A**. The structure of **A** is shown below.



compound **A**

- (i) Underline the **type** of reaction in which compound **A** is formed from tremetone.

addition elimination hydrolysis substitution

[1]

- (ii) A chemist reacted compound **A** with hydrogen in an attempt to convert it back to tremetone. What conditions would be used in the laboratory to do this?

.....[2]

- (iii) The main product of the hydrogenation reaction in (ii) was **not** tremetone. Draw a possible skeletal formula for this product.

[2]

- 5 Deodorant sprays used to be powered by CFCs. The use of CFCs in aerosols was banned in Europe in the early 1990s. Most aerosol products now use butane or propane as the propellant. Since changing the propellant there have been many accidents including extensive burn damage and death from hydrocarbon poisoning. There were no such accidents whilst CFCs were used as propellants.

(a) Draw the structure of the CFC chlorotrifluoromethane to show the three-dimensional shape of the molecule.

[2]

(b) Alkanes and CFCs can be used as aerosol propellants because of their volatility.

Name the **type** of intermolecular force present in **butane**.

.....[1]

(c) Draw a digram to show whether **chlorotrifluoromethane** has any polar bonds.
[Electronegativity values: C, 2.6; F, 4.0; Cl, 3.2]

[2]