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Centre Number	Candidate Number	Name
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MINISTRY OF EDUCATION, BOTSWANA  
in collaboration with  
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE  
**Botswana General Certificate of Secondary Education**

**CHEMISTRY**

**0570/03**

Paper 3

October/November 2003

**1 hour 15 minutes**

Candidates answer on the Question Paper  
No additional materials are required

**Read the following carefully before you start.**

Write your centre number, candidate number and name in the spaces provided at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

Show your working for any calculations.

Do not use staples, paper clips, highlighters, glue or correction fluid.

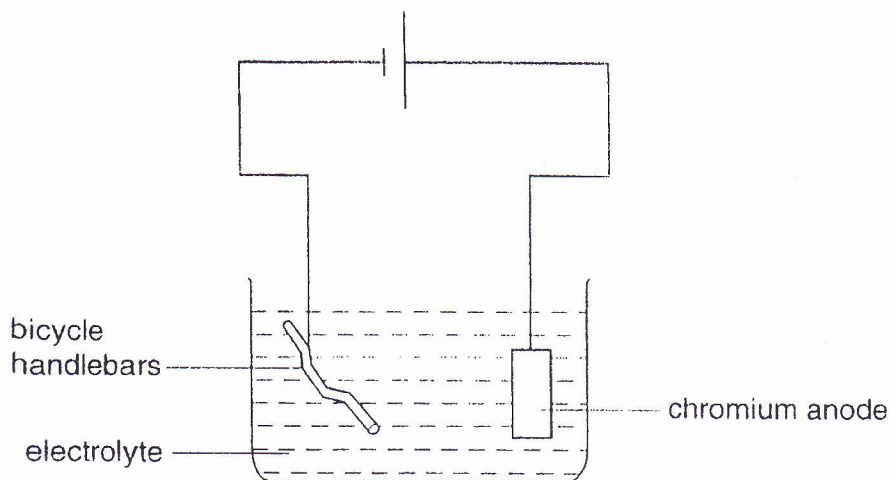
The number of marks is given in brackets [ ] at the end of each question or part question.

A copy of the Periodic Table is printed on page 12.

**For Examiner's Use**

This question paper consists of 12 printed pages.

- 1 The diagram shows how bicycle handlebars made of steel can be electroplated with chromium.



- (a) Complete the following sentence by choosing words from the list.

**anode      cathode      negative      positive**

The steel handlebars form the ..... and are connected to the ..... terminal of the battery. [2]

- (b) Suggest the name of a chromium salt that can be used as the electrolyte.

..... [1]

- (c) Explain why a chromium rod is used in the electrolysis cell.

..... [1]

- (d) The chromium ion has the symbol  $\text{Cr}^{3+}$ .

Write an equation to show the anode reaction.

..... [1]

(e) (i) How many moles of electrons are needed to liberate one mole of chromium atoms?  
..... [1]

(ii) Calculate the number of moles of electrons required to electroplate the handlebars with 13 g of chromium.  
(Ar; Cr; 52)

[1]

(iii) How many coulombs are needed to give 13 g of chromium?  
(One Faraday = 96 000 C)

[1]

(iv) Calculate the time taken to deposit 13 g of chromium if a steady current of 10 amps flows.

[1]

(f) Suggest **two** reasons for chromium-plating the handlebars of a bicycle.

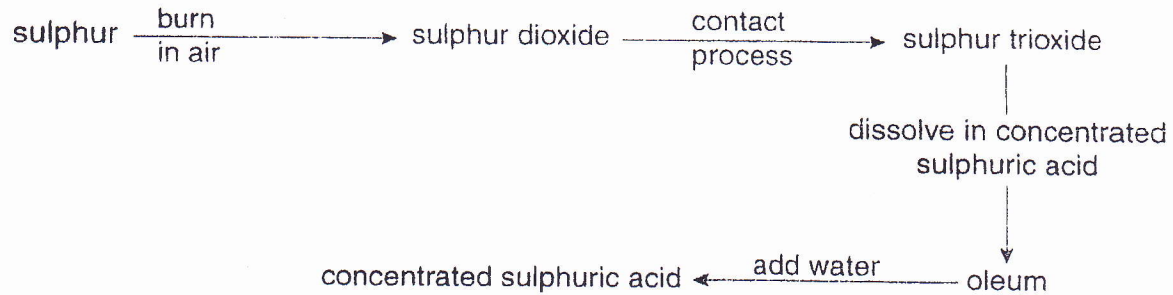
1. ....

2. .... [2]

(g) In which part of the Periodic Table is chromium found?

..... [1]

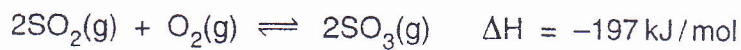
- 2 Study the flow chart which shows the manufacture of concentrated sulphuric acid.



- (a) Write an equation for the formation of sulphur dioxide from sulphur.

..... [1]

- (b) The Contact Process for the conversion of sulphur dioxide to sulphur trioxide is represented by the equation below.



- (i) What do the arrows  $\rightleftharpoons$  in the equation mean?

..... [1]

- (ii) State whether the reaction is exothermic or endothermic.

.....

Explain your answer.

..... [2]

- (iii) State **two** conditions necessary for the reaction to take place.

1. ....

2. .... [2]

- (c) (i) Explain why sulphur trioxide formed in this reaction is dissolved in concentrated sulphuric acid rather than reacted with water.

.....

..... [2]

- (ii) Write the formula of oleum.

..... [1]

- (d) Identify **two** reactions in the flow chart that can be described as oxidation reactions, and write their chemical equations.

1. ....

2. ....

Explain your answers.

.....

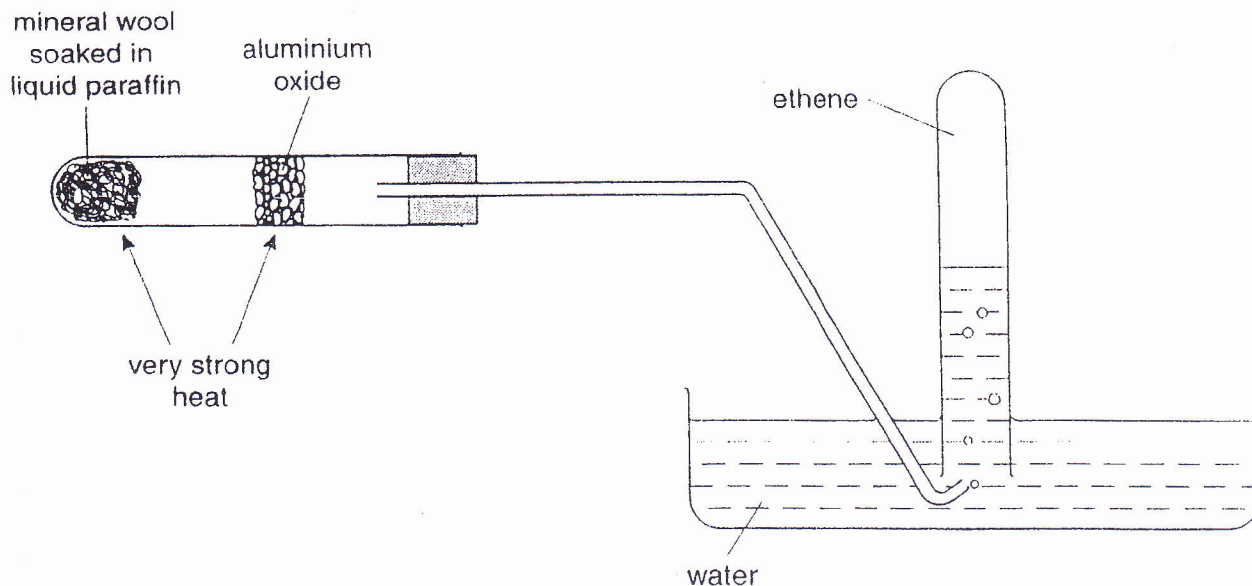
..... [3]

- (e) Give **two** large scale uses of sulphuric acid.

1. ....

2. .... [2]

3 The diagram shows the apparatus used for producing ethene by cracking liquid paraffin.



(a) (i) Explain the term *cracking*.

..... [1]

(ii) What is the use of the aluminium oxide in the diagram?

..... [1]

(iii) What property of ethene enables it to be collected by the method shown in the diagram?

..... [1]

(iv) Construct a dot and cross diagram of a molecule of ethene showing all the electrons.

[2]

(v) Suggest which gas, ethane or ethene, will diffuse faster.

.....

Explain your answer.

.....

..... [3]

- (b) By referring to their structures, explain why ethene is a gas but sodium chloride is solid.

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

- (c) The flow chart shows how ethene can be converted into other organic chemicals.



- (i) Name a substance that will react with ethene in stage 1 and give the conditions.

substance .....

conditions ..... [2]

- (ii) Name a substance that will convert ethanol to ethanoic acid.

..... [1]

- (iii) Draw the structural formula of ethanoic acid.

[1]

- (d) Ethene was burned in air to give carbon dioxide and water.

- (i) Complete the equation for the reaction.



- (ii) Calculate the volume occupied at room temperature and pressure by 7 g of ethene.

[3]

- (iii) Calculate the volume of carbon dioxide produced at room temperature and pressure when 7 g of ethane is burned in air.

[1]

4 Waste materials such as paper and glass can be recycled.

(a) What is meant by *recycling*?

.....  
..... [1]

(b) State **one** adverse effect of the waste materials.

..... [1]

(c) (i) Why are plastic materials more difficult to dispose of than waste papers?

..... [1]

(ii) Why is the burning of materials such as PVC hazardous?

..... [1]

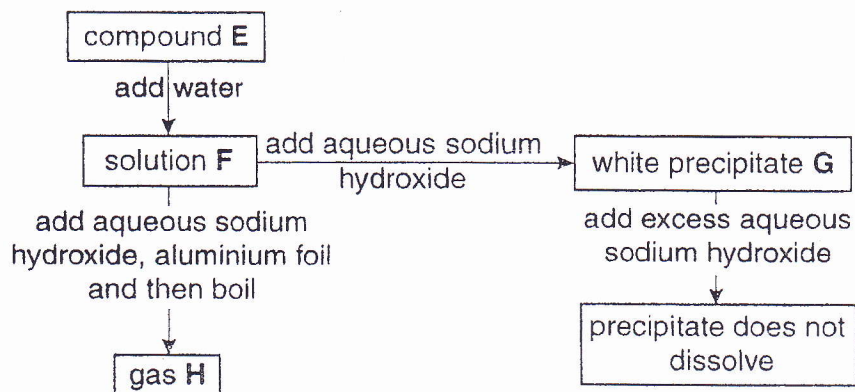
(d) Suggest **two** advantages of the recycling of metals, other than the avoidance of the effect you have stated in (b).

1. ....

2. .... [2]



- 6 A bottle containing white crystals lost its label. The flow chart shows how the unknown compound, **E**, was analysed.



- (a) Give the name and the formula of the white precipitate **G**.

name ..... formula ..... [2]

- (b) The gas **H** has a strong smell.

- (i) Name this gas.

..... [1]

- (ii) Name and give the formula of the ion found in solution **F** from which this gas was formed.

name ..... formula ..... [2]

- (iii) What type of reaction resulted in the formation of the gas **H** from the ions in **F**?

..... [1]