



BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
NUMBER

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CHEMISTRY

0570/03

Paper 3

October/November 2014

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.
Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.

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

Show your working for any calculations.

You may use a calculator

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	
1	
2	
3	
4	
5	
6	
Total	

- 1 Each box below contains a definition of a term. Join each box to the correct term. One has been done for you.

definition	term
The breaking down of a substance by reaction with water.	deliquescent
The loss of electrons from a molecule or ion.	hygroscopic
A substance that absorbs water vapour from the air and dissolves in it.	exothermic
A substance that absorbs water vapour from the air but does not dissolve in it.	hydrolysis
The reprocessing of waste materials to form new substances.	oxidation
A chemical reaction that loses heat energy.	recycling

[Total: 5]

2 A substance used to clean false teeth contains potassium percarbonate, $K_2C_2O_6$.

(a) How many atoms are present in potassium percarbonate, $K_2C_2O_6$?

.....

[1]

(b) Potassium percarbonate is an ionic compound containing **two** ions.

(i) Write the formulae of the **two** ions.

..... and

[2]

(ii) Suggest **two** physical properties of potassium percarbonate.

.....

.....

.....

[2]

(c) Calculate the relative molecular mass of potassium percarbonate, $K_2C_2O_6$.

[1]

(d) Calculate the percentage by mass of carbon in potassium percarbonate.

[1]

(e) When potassium percarbonate, $K_2C_2O_6$, is strongly heated, it decomposes completely into potassium carbonate, carbon dioxide and oxygen.

Write a balanced chemical equation for the reaction.

.....

[2]

[Total: 9]

3 Sulphuric acid is manufactured industrially from sulphur by the Contact Process.

(a) Give **one** source of sulphur.

..... [1]

(b) Name the catalyst used in the Contact Process.

..... [1]

(c) Outline the steps involved in the manufacture of sulphuric acid from sulphur including the Contact Process. You may write equations.

.....
.....
.....
.....
.....
.....
.....
.....
.....
..... [4]

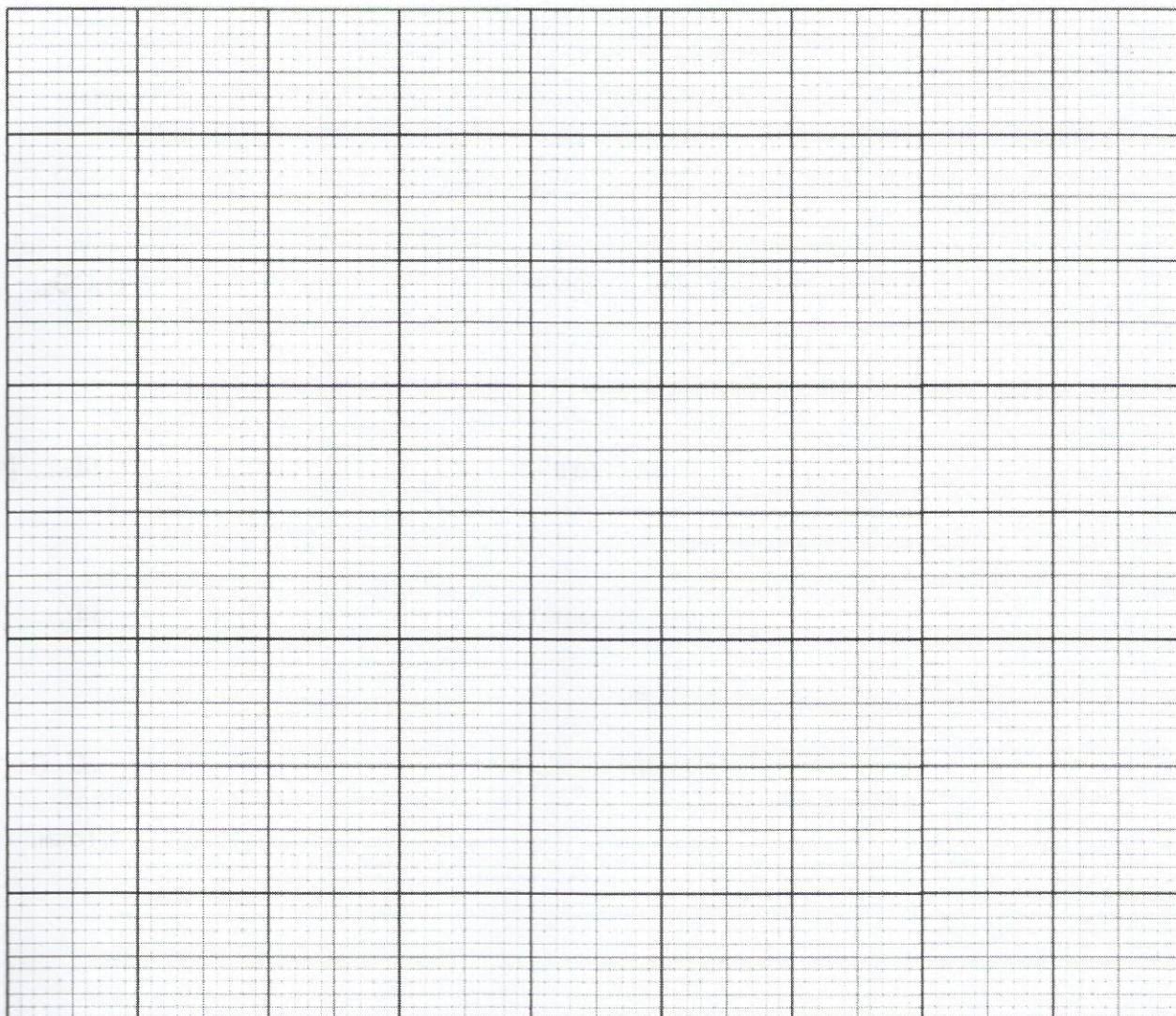
(d) Give **one** use of sulphuric acid.

..... [1]

- (e) Dilute sulphuric acid was reacted with powdered limestone, CaCO_3 , and the volume of carbon dioxide produced was collected and measured. The table shows the results.

time/s	0	10	20	30	40	50	60	70	80
volume of carbon dioxide / cm^3	0	60	90	105	112	118	120	120	120

- (i) Plot a graph of volume of carbon dioxide produced (vertical axis) against time.



[3]

(ii) Suggest a reason why the volume of carbon dioxide reached a maximum value.

.....

..... [1]

(iii) Describe a positive test for carbon dioxide.

test [1]

result [1]

(iv) Name the type of reaction that occurs between sulphuric acid and limestone.

..... [1]

(f) The carbon dioxide gas collected was dissolved in water to form carbonic acid, H_2CO_3 , which is a weak acid.

(i) What is meant by the term weak acid?

..... [1]

(ii) Suggest the pH of carbonic acid.

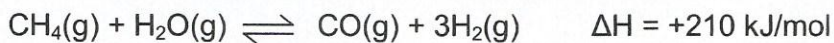
..... [1]

(iii) Give another example of a weak acid.

..... [1]

[Total: 17]

- 4 Methane and steam will react together at high temperatures and in the presence of a catalyst. The reaction is reversible. The equation for the reaction is as shown.



- (a) What is meant by a reversible reaction?

..... [1]

- (b) In a closed container, the reaction proceeds until it reaches a state of equilibrium.

What happens to the rate of the forward and backward reactions at equilibrium?

..... [1]

- (c) What will be the effect on the amount of hydrogen gas, H_2 , at equilibrium if;

- (i) the pressure in the container is increased,

..... [1]

- (ii) the temperature of the mixture is increased,

..... [1]

- (iii) some of the carbon monoxide is removed from the equilibrium mixture?

..... [1]

- (d) Draw a labelled energy level diagram, including activation energy, for the **backward** reaction.

[4]

[Total: 9]

5 A large tank of liquid industrial waste contains a mixture of sulphuric acid and ammonium nitrate.

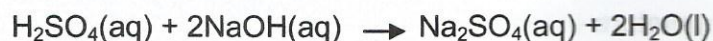
(a) Name **two** cations present in the mixture.

..... and [2]

(b) Describe a chemical test to confirm the presence of sulphate ions in the tank.

.....
.....
.....
..... [2]

(c) A 10.0 cm^3 sample of the mixture from the tank is diluted with water to prepare 250 cm^3 of solution. In a titration, 25.0 cm^3 of the diluted solution of the mixture reacts completely with 20.0 cm^3 of 0.2 mol/dm^3 sodium hydroxide. The equation for the reaction is as shown.



(i) Calculate the number of moles of sodium hydroxide contained in 20.0 cm^3 of 0.2 mol/dm^3 solution.

[2]

(ii) Use your answer to (c)(i) to calculate the number of moles of sulphuric acid contained in 25.0 cm^3 of the diluted solution.

[1]

(iii) Calculate the number of moles of sulphuric acid contained in 250 cm^3 of the diluted solution.

[2]

(iv) State the number of moles of sulphuric acid contained in the 10.0 cm^3 sample from the tank.

[1]

(v) Calculate the concentration measured in mol/dm^3 of sulphuric acid in the tank.

[2]

(vi) The tank contained 20 dm^3 of the liquid industrial waste.
Calculate the mass of sulphuric acid in the mixture in the tank.
($M_r[\text{H}_2\text{SO}_4] = 98$)

[2]

[Total: 14]

6 The table shows information about compounds of the same homologous series.

name	molecular formula	structural formula	melting point/°C	boiling point/°C
propane	C ₃ H ₈	<pre> H H H H - C - C - C - H H H H </pre>	- 190	- 42
butane	<pre> H H H H H - C - C - C - C - H H H H H </pre>	- 138	0
.....	C ₅ H ₁₂	<pre> H H H H H H - C - C - C - C - C - H H H H H H </pre>	-129
hexane	C ₆ H ₁₄		- 95	69

(a) Complete the table to show the **four** missing pieces of information. [4]

(b) Write the name and the general formula of the homologous series of the compounds in the table.

name

general formula

(c) Give **two** characteristics of the homologous series, other than the trend in melting point and boiling point.

1

2

(d) In what state is butane at room temperature and pressure?

..... [1]

(e) Draw the structural formulae of **two** isomers of C_5H_{12} other than that given in the table.

[2]

(f) Propane reacts with chlorine gas according to the equation shown.



(i) Name the type of chemical reaction that occurs between propane and chlorine.

..... [1]

(ii) Draw a 'dot' and 'cross' diagram to show the arrangement of outer electrons in a molecule of hydrogen chloride, HCl .

[2]

(g) Two types of polymerisation are addition and condensation. Explain the difference between them.

..... [2]

[Total: 16]

