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# CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD
# ORDINARY LEVEL EXAMINATION

| SUBJECT TITLE | SUBJECT CODE | PAPER NUMBER |
|---|---|---|
| CHEMISTRY | 0515 | 2 |
| | EXAMINATION DATE: JUNE 2017 | |

**Two and a half hours**

Enter the information required in the boxes above.

This paper is arranged in three sections, A, B and C.

**Section A:** answer 4 questions out of 5;

**Section B:** answer 2 questions out of 3 and

**Section C:** answer both questions.

**In calculations, you are advised to show all the steps in your working, giving your answer at each stage Calculators are allowed.**

*You are reminded of the necessity for good English and orderly presentation in your answers.*

---------- *TURN OVER for USEFUL DATA* ----------

| *FOR EXAMINERS' USE ONLY* | |
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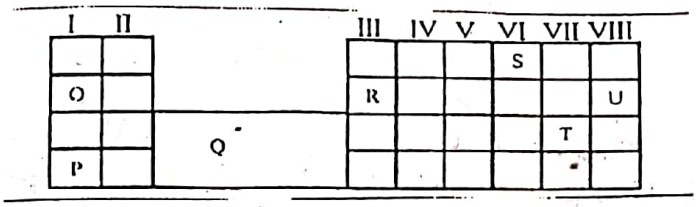
4-/0515/2/C/Q

**SECTION A: Answer 4 questions in this section.**

1. Below is an incomplete Periodic Table with the letters O, P, Q, R, S, T and U representing some elements.
(These letters are not the usual symbols of the elements)




(a) Give two elements found in the group of elements labelled Q
Fe, Zn Fe, Al, Cu
**(2 marks)**

Using the letters only, answer the questions that follow

(b) Which of these elements is a noble gas?
U
**(1 mark)**

(c) How many valence electrons does an atom of each of these elements have?
(i) R? 3
(ii) S? 6
**(2 marks)**

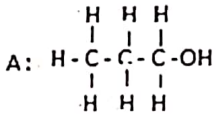
Write down the formula of the compound formed between
(i) O and T. OT
(ii) S and Hydrogen. $SH_2$
**(2 marks)**

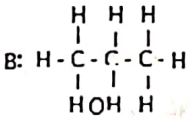
(d) Which type of bond exists in the compound formed in d(i) above?
Ionic bonding ionic bond
**(1 mark)**

(e) Which of these elements is the most reactive
(i) Metal? P
(ii) Non metal? S
**(2 marks)**

**(Total= 10 marks)**

2. The structural formulae of two organic compounds, A and B are shown below:

A:


B:


(a) What is the name of

A? Prop-1-ol

B? Prop-2-ol

(2 marks)

(b) To which homologous series do the two compounds belong?

Alcohols

(1 mark)

(c) (i) What would you observe when a piece of sodium is dropped in compound A?

Effervescence occurs as Hydrogen is been Libirated

(ii) Write an equation for the reaction taking place

$C_3H_7OH + Na \rightarrow C_3H_7ONa + H_2$

(3 marks)

(d) Compound A reacts with ethanoic acid.

(i) Identify the organic product formed and write an equation for the reaction.

Organic product:

Equation: $C_3H_7OH + C_2H_3COOH \rightarrow CH_3COOC_3H_7 + H_2O$

(ii) State the physical test for this product:

It has a sweety fruity smell

(iii) Give one large scale use of the organic product formed.

Use in the production of perfumes

(4 marks)

(Total = 10 marks)

3. The table below shows some methods used to prepare salts in the laboratory

| METHOD | STARTING MATERIAL | PRODUCTS |
|---|---|---|
| A | Solid X and dilute sulphuric acid $H_2SO_4 + CuO \rightarrow CuSO_4 + H_2O$ | Copper(II) sulphate and water |
| B | Granulated zinc and liquid L $Zn + HCl \rightarrow ZnCl + H_2$ | Zinc chloride an hydrogen |
| C | Solution O and solution P $BaSO_4 + NaCl \rightarrow BaCl + Na_2SO_4$ | Barium sulphate and sodium chloride |

(a) Identify the substances X, L, O, P

X Cupper (II) Oxide L Hydrochloric acid

O $BaCl_2$ P $Na_2SO_4$

(2 marks)

(b) Which of the methods A,B and C produces an insoluble salt? Write an equation for the reaction taking place

Method C

Equation $BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4 + NaCl$

(2 marks)

(c) Which of these methods is suitable for preparing magnesium sulphate? State the starting

Material Magnesium Ribbon and Hydrochloric acid

Method B

(2 marks)

(d) A student in an attempt to obtain crystals of copper (II) sulphate, evaporated the salt solution to dryness.

(i) What is wrong with this procedure?

The student was not to evaporated $CuSO_4$ to dryness

(ii) What is the correct procedure?

By heating the salt to crystallization

(2 marks)

(e) Give an example of

(i) An acid salt $NaHSO_4$

(ii) A deliquescent salt NaOH

(2 marks)

Total 10 marks)

4. The results of a soil analysis showed that the soil had a P $^H$ of 5 and was also lacking in nitrogen. The farm was advised to apply lime and a nitrogenous fertilizer.

(a) (i) What would applying lime do to the soil?

To neutralize the acid soil.

(ii) Should the farmer apply quicklime (CaO) or slaked lime ($Ca(OH)_2$)? Explain your answer.

Choice of lime: $Ca(OH)_2$

Reason for choice: bcs is an alkaline salt that will easily Neutralise the salt

(3marks)

(b) (i) What is a nitrogenous fertilizer?

Nitrogenous fertilizer are those fertilisers that contain Nitrogen as a component

(ii) Why do some plants not require nitrogenous fertilizers?

(2 marks)

(c) (i) What must happen to ammonium ions before the nitrogen in them can be absorbed by plants?

The $NH_4$ should be converted to Nitrate

(ii) What soil organism brings about the change in c(i)?

Nitrofixing bacterials

(2 marks)

(d) (i) Ammonium nitrate is manufactured from ammonia and nitric acid. State the process used to obtain each of these raw materials

Ammonia: Nitrogen and oxygen; Habers process

Nitric acid: Ammonia and Oxygen; ostwald process

(ii) Calculate the percentage of nitrogen in ammonium nitrate

$NH_4(NO_3) \Rightarrow 14+4+14+(48) \Rightarrow 80$

$N \Rightarrow 42 \quad \frac{28}{80} \times 100 \Rightarrow 35\%$

$NH_4(NO_3)$

$(14\times2)+(1\times4)+(3\times16)$

$28+4+48 = 80 \quad \frac{28}{80} \times 100 = \frac{35}{2} = 17.1\%$

(3 marks)

**Total 10 marks**

5. When 0.05 F of electricity was passed through an aqueous solution of copper(II) sulphate using inert electrodes, a gas was produced at the anode

$CuSO_4$ $H$ $OH$

(a) (i) What would you observe at the cathode?

The cathode gradually Increase in size with Time

(ii) Write an equation to show the reaction at the cathode (1 mark)

$Cu^{2+} + 2e \rightarrow Cu$

(b) (i) Identify the gas produced at the anode. (2 marks)

Oxygen

(ii) State one large scale use of the gas in b(i)

used in respiration.

(2 marks)

(c) Calculate the volume of the gas that would be evolved at r.t.p at the anode

$4OH \rightarrow O_2 + 2H_2O_{(l)} + 4es$

If $4F \longrightarrow 24000cm^3$

$0.05F \longrightarrow x\,cm^3$

$x\,cm^3 = 300cm^3$

**(3 marks)**

(d) In a similar experiment, the inert electrodes were replaced by copper electrodes?

(i) What would you observe at the anode?

It will decrease in size

(ii) Write an equation for the anode reaction

$Cu \rightarrow Cu^{2+} + 2es$

**(2 marks)**

(e) How is the observation in the electrolyte different when the inert electrodes are replaced by copper electrodes?

The electrolyte has acid due to the presence of $H^+$ and $SO_4^{2-}$ that was not discharged to form $H_2SO_4$ with copper Electrode no change is seen

**(1 mark)**

**Total 10 marks**

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## SECTION B

Answer **any two** questions. All questions carry equal marks. Where appropriate equations and diagrams should be used to illustrate your answer. Write your answer on the sheets that follow this section.

6. Briefly distinguish between the following pairs as used in Chemistry. Your answer should include suitable examples and/or equations.

(a) Addition polymerisation and condensation polymerisation.

(b) Etherification and hydrolysis

(c) Oxidation and reduction

(d) Substitution reaction and addition reaction.

**(20 marks)**

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7. Metals can be extracted by electrolysis or chemical reduction, depending on their reactivity. For each method, select a metal and describe how the metal is extracted from a named ore. Give two large scale uses of each metal in Cameroon.

(20 marks)

8. (a) Describe a simple experiment to determine the heat of neutralisation of nitric acid ($HNO_3$) by potassium hydroxide (KOH). Your description should show clearly the set up, precautions taken, data collected and any assumptions made.

(b) In one such experiment, 50cm³ of 1.0M$HNO_3$ solution were mixed with 50cm³ of 1.0M KOH solution. Both solutions were initially at 20°C. Calculate the heat of neutralisation if the final temperature of the mixture is 23.5°C

(20 marks)

## SECTION C

ANSWER ALL QUESTIONS IN THIS SECTION

9. You are provided with the following laboratory apparatus and chemicals: beaker, pipette, burette, conical flask, wash bottle and volumetric flask, 10.6g anhydrous sodium carbonate, dilute hydrochloric acid solution, distilled water and phenolphthalein indicator.

You are required to prepare 250cm³ of a standard solution of sodium carbonate and use the solution to determine the molarity of the solution of dilute hydrochloric acid.

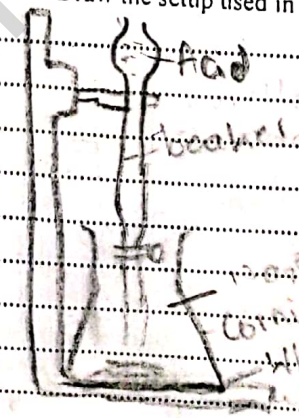
(a) State the three steps involved in the preparation of the standard solution

- Weigh the exact mass (10.6g) of $Na_2CO_3$
- Dissolve the salt in a beaker using distilled $H_2O$ and fill right up to the mark
- Turn it to a volumetric flask and filled up to the mark

(2 marks)

(b) 25cm³ of the standard solution is transferred into a conical flask and 3 drops of phenolphthalein indicator are added. The solution is then titrated with dilute hydrochloric acid till the end point is reached.

(i) Draw the setup used in the titration

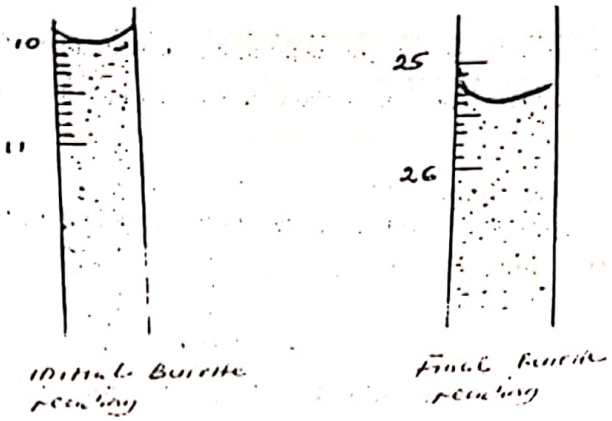



(2 marks)

(ii) The colour change that occurs in the solution in the conical flask is from Colouless (Initial colour) to Pink (Colour at end point)

**(2 marks)**

(c) The following diagram shows the initial and final burette readings for the titration




(i) Read and record the initial and final Burette readings.

| Burette | |
|---|---|
| Initial burette readings | 10.0cm³ |
| Final burette readings | 25.4cm³ |
| Volume of acid used/cm³ | 15.4cm³ |

(ii) What is the volume of the hydrochloric acid used? 15.4cm³

**(2 marks)**

(d) Calculate the molarity of the sodium carbonate solution

$M_{Na_2CO_3} = 23\times2 + 12.1\times3 = 106$

$Mole = \frac{10.6}{106} = 0.1M$

$Molarity = \frac{moles}{Vol(dm^3)} = \frac{0.1}{0.025} = 4M\ mol/dm^3$

**(2 marks)**

(e) Determine the concentration o the dilute hydrochloric acid solution.

$Na_2CO_{3(aq)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + CO_{2(g)} + H_2O_{(l)}$

$M_AV_A = n_A \Rightarrow M_A = \frac{M_BV_An_A}{n_BV_B} = \frac{2\times4\times25}{1\times10} = 13Mols/dm^3$

**(3marks)**

Con (Mol/dm³) = Molarity

Con (Grams/dm³) = Con

$Con = M \times RMM$

$= 13M \times 36.5$

$= 474.5 g/dm^3$

(f) You are given two salts: NaCl and $CuSO_4$. You are required to obtain crystals of each salt from the salt solution.
Briefly describe how you would obtain crystals of

NaCl by evaporation to dryness

$CuSO_4$ heat up to point of crystallisation

(4 marks)

(g) You are provided with the following techniques of separation: use of a separating funnel, winnowing, hand picking and fractional distillation.
Complete the following table by selecting the most convenient technique.

| Mixture | Separation technique |
|---|---|
| Rice and beans | hand picking |
| Kerosene and water | separating funnels |

(2 marks)
**Total = 20 marks**

10. (a) You are provided with the following reagents: aqueous NaOH, aqueous $NH_3$, aqueous $BaCl_2$, HCl, aqueous $AgNO_3$. You are required to carry out a series of tests on four salts A-D. Complete the following table showing observations and conclusions made by a student

| | Test | Observations | Conclusions |
|---|---|---|---|
| (a) | To 2cm³ of solution A add two drops of aqueous $AgNO_3$ | A pale yellow precipitate seen | bromide ion |
| (b)(i) | To 2cm³ of solution B add two drops of $BaCl_2$ followed by excess dilute HCl | White ppt | Presence of $SO_4^{2-}$ |
| (b)(ii) | Carry out a flame test on a small portion of B | Bluish green flame colour | Copper (II) ion |
| (c) | To 2cm³ of solution C add two drops of NaOH | A dirty green precipitate is observed | Iron (II) ion |
| (d) | To 2cm³ of solution D add dilute HCl. Test for any gas evolved with lime water | Colourless, odourless gas evolved; gas turns lime water milky | $CO_3^{2-}$ |

(6 marks)

(e) (i) Suggest what salt B could be

$CuSO_4$

(2 marks)

(ii) Identify the precipitate which is produced in test (a)

AgBr (silver bromide)

**(1 mark)**

(iii) Identify the gas evolved in test (d)

Carbondioxide ($CO_2$)

**(1 mark)**

(iv) Write an ionic equation for the reaction taking place in test (c)

$NaOH_{(aq)} + Fe^{2+}_{(aq)} \longrightarrow Na^{+}_{(aq)} + Fe(OH)_{2(aq)}$

**(3 marks)**

(f) Identify a substances that is used in the laboratory

(i) To dry Ammonia gas

CaCl

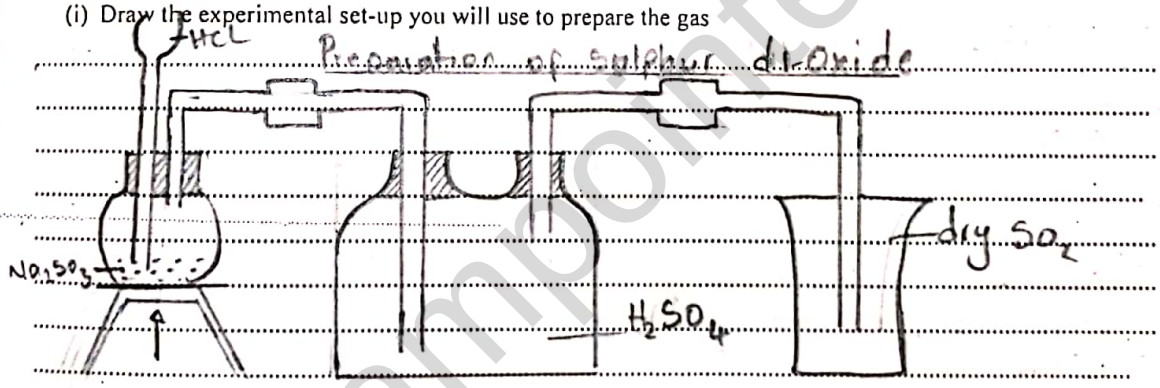
(ii) To test for the presence of water. Anhydrous $CuSO_4$ (white - blue)

(iii) For converting CuO to Cu. Hydrogen or Coke

**(3 marks)**

(g) You are expected to prepare a gas in the laboratory. You are provided with the following: solid sodium sulphite, dilute hydrochloric acid flat bottomed flask, Thistle funnel; delivery tubes, conc sulphuric acid, gas jar.

(i) Draw the experimental set-up you will use to prepare the gas




**(4 marks)**

(ii) Write a balanced chemical equation for the reaction producing the gas

$Na_2SO_3 + HCl \longrightarrow NaCl_{(aq)} + SO_{2(g)} + H_2O_{(l)}$

**(1 mark)**

**Total =20 marks**