EXAMINATIONS COUNCIL OF ZAMBIA
Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level

SCIENCE

5124/3

PAPER 3 (CHEMISTRY)

Friday 9 NOVEMBER 2012

Additional materials:
Answer Booklet
Mathematical tables

Time: 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number at the top of this page and all separate answer paper used.

There are 11 questions in this question paper.

Section A
Answer all the questions.

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

Section B
Answer any two questions.
Write your answers on the separate Answer Booklet provided.

1 Fasten the separate Answer Booklet securely to the question paper.

2 Enter the numbers of the Section B questions you have answered in the grid.

INFORMATION FOR CANDIDATES
The number of marks is given in brackets [ ] at the end of each question or part question.
The Periodic Table is on page 11.
Cell phones are not allowed in the Examination room.

Section A

This question paper consists of 11 printed pages.
Matter is classified as solid, liquid or gas. State two physical properties of each of the following:

(a) Solid

_______________________________________________________________________________
_______________________________________________________________________________ [2]

(b) Liquid

_______________________________________________________________________________
_______________________________________________________________________________ [2]

(c) Gas

_______________________________________________________________________________
_______________________________________________________________________________ [2]
2 Two miscible liquids with boiling points of 78°C and 100°C were accidentally mixed.

(a) Name the process which can be used to separate the mixture.

(b) Draw a labelled diagram showing the arrangement of the apparatus used to separate the mixture.

(c) Explain how you can obtain hydrated sodium sulphate crystals from an aqueous solution of sodium sulphate.

[1] [3] [2]
3 Paper chromatography was used to catch a forger. A sample of ink, X from a forged signature was compared with inks from the pens of five suspects. The diagram below shows the chromatogram obtained:

(a) Draw the apparatus you would use to produce this chromatogram.

(b) Which of the inks A, B, C, D or E could have been used to write the forged signature?

[1]

(c) Which of the inks is insoluble in water?

[1]
4 The diagram below represents electronic arrangement of a particular atom. Study this diagram and answer the questions that follow.

(a) The relative atomic mass of the atom represented is 23.

(i) What is its proton number?

(ii) What is its neutron number?

(b) (i) In which group of the Periodic Table is the element found?

(ii) Explain your answer in (b) (i).

5 The diagram below shows the action of hydrogen on copper (II) oxide.

During this reaction copper (II) oxide is changed to copper and steam is produced.

(a) Construct a balanced chemical equation including state symbols for the reaction.

(b) In this reaction, state the oxidizing agent.

(c) Describe the colour change that occurs on the copper (II) oxide as the reaction progresses.

(d) What type of reaction is taking place in the diagram above?
6 (a) Organic compounds form homologous series. Give two characteristics of members of any homologous series.

(b) (i) Draw the structure of an alkane with two carbon atoms in the molecule. [2]

(ii) Calculate the percentage by mass of hydrogen in this alkane. [2]

7 Oxygen and nitrogen are the major gases present in the clean air. Other gases which are present in the clean air in small quantities include carbon dioxide and argon.

(a) State the percentage of oxygen and nitrogen in the air. [2]

(b) Briefly describe how you would show that carbon dioxide is present in the air. [2]

(c) Argon is a noble gas. What chemically makes it unreactive? [1]
8 The list below shows metals arranged in ascending order of reactivity:

   Silver
   Zinc
   Aluminium
   Sodium

Using metals from this list only, name:

(a) a metal which can be displaced by copper.

(b) a metal which reacts with cold water to produce an alkaline solution.

(c) a metal which forms an amphoteric oxide when burnt.

(d) a metal whose carbonate does not decompose when heated.

(e) a metal which forms a stable oxide layer.

(f) Write a balanced chemical equation for the reaction between sodium and water.
Section B

[20 MARKS]

Answer any two questions

9. Iron is extracted from iron (III) oxide in a blast furnace. One of the main reactions in the furnace is

\[ \text{Fe}_2\text{O}_3 + 3\text{CO} \rightleftharpoons 2\text{Fe} + 3\text{CO}_2 \]

(a) Name two ores of iron. [2]
(b) Calculate the relative molecular mass of iron (III) oxide, \( \text{Fe}_2\text{O}_3 \). [1]
(c) What is the mass of iron that can be obtained from 80 tonnes of iron (III) oxide. [3]
(d) Iron often rusts. State three ways of preventing the rusting of iron. [3]
(e) Give one use of iron. [1]

[Total: 10]

10. (a) Nuclides of magnesium and calcium are shown below.

What do the following numbers tell you about these atoms:

(i) 24 in the nuclide for magnesium? [1]
(ii) 20 in the nuclide for calcium? [1]

(b) Draw the electronic structure of the atom of magnesium. [1]

(c) Describe how the electronic structures of magnesium and calcium indicate that they are both in the same group of the periodic table. [1]

(d) An atom A (atomic number 11) burns in chlorine to produce a white solid chloride B. What is the charge on the atom

(i) before the reaction? [1]
(ii) after the reaction? [1]

(e) Write a balanced chemical equation for the reaction in (d) above. [2]

(f) State the type of bonding found in chloride B and discuss one of its properties. [2]

[Total: 10]
11 Organic acids are a homologous series of compounds having the carboxylic group – COOH joined to an alkyl radical.

(a) What is the general formula for organic acids? [1]
(b) Draw the structure of butanoic acid. [1]
(c) A reaction between an alcohol and an organic acid is described as esterification and this is similar to neutralisation. [3]
   (i) Ethylethanoate is an ester. Name two reagents used to prepare it. [2]
   (ii) State two ways in which esterification is different from neutralisation. [2]
   (iii) Write a balanced chemical equation for the esterification of ethylethanoate. [2]
(d) Calculate the mass of ethylethanoate formed from 15g of the organic acid. [2]

[Total: 10]
The volume of one mole of any gas is 24.4 L at room temperature and pressure (T=0 K).

| Key | X = atomic number | p = position (periodic) number | 90-103 Alkali metals | 18-37 Lanthanides | 56-71 Actinides
|-----|-------------------|-----------------------------|----------------------|-------------------|---------------------|
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