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

SCIENCE

PAPER 3 (CHEMISTRY)

Friday 4 NOVEMBER 2011 1 hour 15 minutes

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.

A copy of the Periodic Table is on page 9.

Cell phones are not allowed in the Examination room.

This question paper consists of 9 printed pages.
Section A

[45 MARKS]

Answer **all** the questions in this section.

Write your answers in the spaces provided.

1 Use the information in the table to answer the following questions.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Conducts electricity when solid</th>
<th>Melting point/°C</th>
<th>Dissolves in water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>No</td>
<td>808</td>
<td>Yes</td>
</tr>
<tr>
<td>Sulphur</td>
<td>No</td>
<td>113</td>
<td>No</td>
</tr>
<tr>
<td>Tungsten</td>
<td>Yes</td>
<td>3377</td>
<td>No</td>
</tr>
<tr>
<td>Wax</td>
<td>No</td>
<td>35 – 50</td>
<td>No</td>
</tr>
<tr>
<td>Aluminium</td>
<td>Yes</td>
<td>660</td>
<td>No</td>
</tr>
</tbody>
</table>

(a) (i) Name **one** metal from the table.

______________________________________________________________________ [1]

(ii) How can you tell from the table that the substance you have chosen in a(i) is a metal?

______________________________________________________________________ [1]

(b) How can you tell from the table that wax is a mixture?

______________________________________________________________________ [1]

(c) (i) Name a compound from the table.

______________________________________________________________________ [1]

(ii) Explain the meaning of the word compound.

______________________________________________________________________ [1]

Total [5]
2  Use the list of separation techniques below to answer the questions that follow.
Fractional distillation, Simple distillation, Use of separating funnel, Magnetism,
Chromatography, Evaporation and Filtration.
Choose one method from the list above which can be used to separate:-
(a) Sand from water                                           [1]
(b) Oil from water                                             [1]
(c) Water from ink                                             [1]
(d) Sulphur powder from iron filings                          [1]
(e) Salt from paraffin                                         [1]
Total [5]

3  Element E whose proton number is 7 combines with hydrogen to form a gas.
The diagram below shows the bonding in one molecule of this gas.

(a) Identify element E.                                        [1]
(b) What is the name of the gas?                                [1]
(c) Write the chemical formula of the gas.                     [1]
(d) What type of bonding holds the atoms together in this compound? [1]
(e) State one physical property of the gas that is due to the type of bonding it has. [1]
(f) Name another compound which has the same type of bonding.  [1]
Total [6]
4 Use the Periodic Table to answer this question.
   (a) Give the symbol of:
      (i) a non-metal used to sterilise water, \( \text{[1]} \)
      (ii) an element which forms diatomic molecules, \( \text{[1]} \)
      (iii) an element which reacts with water to give an alkaline solution. \( \text{[1]} \)
      (iv) an element which forms an ion of the type \( X^{2-} \), \( \text{[1]} \)
   (b) (i) Oxygen, sulphur and selenium are in Group VI of the Periodic Table. At room temperature oxygen is a gas and sulphur is a solid. Predict whether selenium is a liquid, a solid or a gas, at room temperature. \( \text{[1]} \)
   (ii) The trend in reactivity of Group VI is similar to that in Group VII. Suggest the most reactive element in Group VI. \( \text{[1]} \)
   Total [6]

5 Urea, \((\text{NH}_2)_2\text{CO}\) and water are formed when ammonia reacts with carbon dioxide. Urea is obtained as a solid from the reaction mixture.
   (a) (i) Write a balanced chemical equation including state symbols for this reaction. \( \text{[3]} \)
   (ii) How many atoms of hydrogen are present in one molecule of urea? \( \text{[1]} \)
   (b) What mass of urea in tonnes can be formed from 34 tonnes of ammonia? \( \text{[2]} \)
   Total [6]
6  (a) Name three of the components of clean, dry air.

(i) ________________________________________________________________________

(ii) ________________________________________________________________________

(iii) ________________________________________________________________________ [3]

(b) Air can be polluted by various chemicals.

(i) Give the chemical name for one of these air pollutants.

__________________________________________________________________________ [1]

(ii) Name the source of the pollutant mentioned in b(i) above.

__________________________________________________________________________ [1]

(iii) State the process by which it is produced.

__________________________________________________________________________ [1]

Total [6]
7 Study the diagram below on extraction of iron.

(a) (i) Apart from iron ore, name two other materials (C and D) that are fed into the reaction chamber.

(ii) Write the balanced chemical equation for the reduction reaction of iron ore to iron metal.

(b) Name substances A and B.
   A: 
   B: [2]

(c) State one physical characteristic of the brick lining in the furnace.

8 Plastics are organic polymers. The table below describes two types of plastics. Complete the table. Part of the table has been completed for you as an example.

<table>
<thead>
<tr>
<th>Name</th>
<th>Repeating Unit</th>
<th>Use</th>
<th>Type of polymerisation used in manufacture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poly(ethene)</td>
<td></td>
<td>Making plastic bags</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Condensation polymerisation</td>
</tr>
</tbody>
</table>

Total [7]
Section B

[20 MARKS]

Answer any two questions in this section.

Write your answers on the separate Answer Booklet provided.

9  Caesium, lithium, potassium and sodium are all in Group 1 of the Periodic Table.

(a) Place these metals in order of reactivity, starting with the most reactive. [1]

(b) All Group 1 elements react in a similar manner with water.

(i) Name the chemical products of the reaction between caesium and water. [2]

(ii) Write a chemical equation for the reaction of caesium with water. Include state symbols. [3]

(iii) What three things would you expect to see if small pieces of caesium were dropped in water in a glass trough? [3]

(c) What is the other name for Group 1 elements? [1]

Total [10]

10  Crude oil is an important raw material that we need in modern life. Engineers process and refine crude oil in a tower to produce a number of fractions as shown in the diagram below.

(a) Name the process used to separate the fractions of crude oil. [1]

(b) Name the two major elements that are found in crude oil. [2]

(c) State two differences in physical properties between fractions extracted at C and B. [2]
(d) A large proportion of fraction A has the molecular formula CH₄.
Write a balanced chemical equation for the complete combustion of the
compound with chemical formula CH₄. [2]
(e) Crude oil is a non-renewable energy source. Explain what is meant by a non-
renewable source. [1]
(f) Give two reasons why the sun is a better source of energy than crude oil. [2]

Total [10]

11 Barium sulphate (BaSO₄) is an insoluble salt which is prepared by precipitation.
(a) Using sodium sulphate as one of the reactants:
   (i) name the other reactant you would use to prepare barium sulphate. [1]
   (ii) write a balanced chemical equation for the reaction. Include state
        symbols [2]
   (iii) write an ionic equation for the reaction. [1]
(b) Briefly explain how you would obtain a fairly pure dry sample of the salt. [3]
(c) Name one salt that can be prepared by the reaction of a metal with a dilute
    acid. [1]
(d) Calcium chloride (CaCl₂) can be prepared by reacting calcium carbonate
    and dilute hydrochloric acid as shown in the equation below:

    \[
    \text{CaCO}_3(s) + 2\text{HCl}(aq) \rightarrow \text{CaCl}_2(aq) + \text{CO}_2(g) + \text{H}_2\text{O}(l)
    \]

    Calculate the mass of calcium chloride produced by 150g of calcium
    carbonate. [2]

Total [10]
The Periodic Table of the Elements

DATA SHEET
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