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

CHEMISTRY 5070/1
PAPER 1 Multiple Choice

Thursday 16 OCTOBER 2014

Additional materials:
Electronic calculator (non programmable) and / or Mathematical tables
Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

Do not open this question paper until you are told to do so.
Look at the left hand side of your answer sheet. Ensure that your name, the school/centre name and subject paper are printed. Also ensure that the subject code, paper number, centre code, your examination number and the year are printed and shaded. Do not change the already printed information.

There are forty questions in this paper. Answer all questions. For each question there are four possible answers, A, B, C and D. Choose the one you consider correct and record your choice in soft pencil on the separate answer sheet provided.

Read very carefully the instructions on the Answer Sheet.

INFORMATION FOR CANDIDATES

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this question paper.

The Periodic Table is printed on page 15.

Cell phones are not allowed in the examination room.

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This question paper consists of 15 printed pages.
1 A 100cm³ sample of ethanol is mixed with 100cm³ of water as shown in the diagram below.

![Diagram of mixing ethanol and water](image)

The volume of the mixed alcohol and water is found to be 198cm³. Choose the best explanation for this.

A The alcohol molecules fit into the gaps between water molecules.
B There is a reaction between water and alcohol.
C Water and alcohol are immiscible liquids.
D Some alcohol molecules evaporate.

2 If equal volumes of different gases under same conditions of temperature and pressure are taken on the scale they would show ***

A equal masses.
B same number of atoms.
C same number of molecules but different masses.
D same masses but different number of molecules.

3 The table below shows some information about the solubilities of three solids, P, Q and R.

<table>
<thead>
<tr>
<th>Solid</th>
<th>Solubility in water</th>
<th>Solubility in ethanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Insoluble</td>
<td>Soluble</td>
</tr>
<tr>
<td>Q</td>
<td>Soluble</td>
<td>Insoluble</td>
</tr>
<tr>
<td>R</td>
<td>Insoluble</td>
<td>insoluble</td>
</tr>
</tbody>
</table>

The following operations could be carried out to obtain pure Q from a mixture of P, Q and R.

1 filter
2 evaporate filtrate to dryness
3 add ethanol
4 add water

In what order should the operations be carried out?

A 1, 2, 3, 4
B 3, 1, 2 (omit stage 4)
C 3, 4, 1, 2
D 4, 1, 2 (omit stage 3)
4 The diagram below shows the chromatogram obtained by analysis of a single dye.

Three measurements $X$, $Y$ and $Z$ are shown.

How is the $R_f$ value of the dye calculated?

A \[ \frac{x}{x+y} \]

B \[ \frac{y}{x+y} \]

C \[ \frac{x}{x+y+z} \]

D \[ \frac{y}{x+y+z} \]

5 Which of the following ions contains the smallest number of electrons?

A Ca$^{2+}$

B Cl$^-$

C K$^+$

D O$^{2-}$

6 An element $E$ forms a hydride $EH_3$, which contains 90% of $E$ by mass. What is the relative atomic mass of $E$?

A 27

B 30

C 87

D 90
7. Pupils are asked to draw a diagram of an atom with symbol $^4_2X$.

Which diagram above is correct?

**Key**
- ● proton
- ○ neutron
- × electron

8. What is the concentration of iodine molecules, $I_2$, in a solution containing 2.54g of iodine in 250cm$^3$ of solution?

- A 0.01 mol/dm$^3$
- B 0.02 mol/dm$^3$
- C 0.04 mol/dm$^3$
- D 0.08 mol/dm$^3$

9. Deduce the chemical formula of strontium chloride if 264g of strontium reacted with 213g of chlorine.

- A $\text{Sr}_2\text{Cl}_6$
- B $\text{SrCl}_2$
- C $\text{SrCl}_4$
- D $\text{SrCl}_2$

10. When calcium carbonate is heated the following reaction takes place.

$$\text{CaCO}_3(s) \rightarrow \text{CaO}(s) + \text{CO}_2(g)$$

Which volume of carbon dioxide at room temperature and pressure (r.t.p) would be produced if 150g of calcium carbonate is heated?

- A 36 dm$^3$
- B 66 dm$^3$
- C 72 dm$^3$
- D 122 dm$^3$

11. Lead (II) nitrate reacts with potassium iodide according to the equation

$$\text{Pb(NO}_3)_2(aq) + 2\text{KI}(aq) \rightarrow \text{PbI}_2(s) + 2\text{KNO}_3(aq)$$

The mass of lead (II) iodide that will be formed when 16.6g of potassium iodide reacts with excess lead (II) nitrate is...

- A 8.30g.
- B 22.05g.
- C 33.20g.
- D 46.10g.
12 All ammonium salts on heating with sodium hydroxide produce ammonia gas. From which ammonium salt can the greatest mass of ammonia be obtained?

A  0.5 mol \((\text{NH}_4)_3\) PO_4
B  0.5 mol \((\text{NH}_4)_2\) SO_4
C  1.0 mol NH_4Cl
D  1.0 mol NH_4NO_3

13 The diagram below shows the apparatus used in the purification of impure copper by electrolysis in an industry.

Which equation represents the electrode reaction on plate B?

A  \(\text{Cu}^{2+}_{(aq)} - 2e^- \rightarrow \text{Cu}_{(s)}\)
B  \(\text{Cu}^2+_{(aq)} - 2e^- \rightarrow \text{Cu}_{(s)}\)
C  \(2\text{H}^+_{(aq)} + 2e^- \rightarrow \text{H}_2(g)\)
D  \(4\text{OH}^-_{(aq)} + 4e^- \rightarrow 2\text{H}_2\text{O}(l)\)

14 The diagram below shows the electrolysis of dilute sulphuric acid.

What is gas \(x\)?

A  Chlorine
B  Hydrogen
C  Nitrogen
D  Oxygen
15 The diagram below shows the electrolysis of aqueous copper (II) sulphate using copper electrodes.

Which graph shows how the mass of the cathode changes during electrolysis?

A

\[ \begin{array}{c}
\text{mass} \\
\text{time}
\end{array} \]

B

\[ \begin{array}{c}
\text{mass} \\
\text{time}
\end{array} \]

C

\[ \begin{array}{c}
\text{mass} \\
\text{time}
\end{array} \]

D

\[ \begin{array}{c}
\text{mass} \\
\text{time}
\end{array} \]

16 An element X has a relative atomic mass of 88. When a current of 0.5 amps was passed through the fused chloride of X for 32 minutes 10 seconds, 0.44g of X was deposited at the cathode. What is the number of Faradays required to liberate 1 mole of X?

1 Faraday = 96500 coulombs = 1 mole of electrons.

A 0.2

B 0.4

C 2.0

D 4.0
The diagram below shows the energy profiles for a chemical reaction.

What is the correct description of the reaction?

<table>
<thead>
<tr>
<th>Sign of ΔH</th>
<th>Overall energy change</th>
<th>Sign of Ea</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-</td>
<td>Exothermic</td>
</tr>
<tr>
<td>B</td>
<td>+</td>
<td>Endothermic</td>
</tr>
<tr>
<td>C</td>
<td>+</td>
<td>Endothermic</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
<td>Exothermic</td>
</tr>
</tbody>
</table>

Consider the bond energies below.

<table>
<thead>
<tr>
<th>Bond</th>
<th>Bond energy KJ/mol</th>
</tr>
</thead>
<tbody>
<tr>
<td>H – H</td>
<td>436</td>
</tr>
<tr>
<td>Cl – H</td>
<td>431</td>
</tr>
<tr>
<td>Cl – Cl</td>
<td>242</td>
</tr>
</tbody>
</table>

Using the bond energies above, what is the enthalpy change, ΔH, of the reaction below?

H₂(g) + Cl₂(g) → 2HCl(g)

A  -678kJ
B  -431kJ
C  -242kJ
D  -184kJ

Which statement about energy change is false?

A  Electrical energy is absorbed during electrolysis.
B  Light energy is absorbed during photosynthesis.
C  Electrical energy is produced by the reaction in the battery.
D  Heat energy is absorbed when potassium reacts with water.
20 Aqueous hydrogen peroxide decomposes to form water and oxygen as shown in the equation below.

\[ 2\text{H}_2\text{O}_2(\text{l}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g}) \]

The following experiments were carried out to measure the rate of production of oxygen from aqueous hydrogen peroxide.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Solution used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 cm³ of 1.0 mol/dm³ H₂O₂</td>
</tr>
<tr>
<td>2</td>
<td>300 cm³ of 0.2 mol/dm³ H₂O₂</td>
</tr>
</tbody>
</table>

Which graph best shows the results indicated?

A

B

C

D

21 Magnesium reacts with hydrochloric acid. Which solution would give the fastest initial rate of reaction?

A 40 g of HCl in 1000 cm³ of water

B 20 g of HCl in 1000 cm³ of water

C 10 g of HCl in 100 cm³ of water

D 4 g of HCl in 50 cm³ of water

22 Nitrogen and hydrogen react in a closed vessel.

\[ \text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{Heat} \]

How do the speeds of the forward and reverse reaction change if pressure in the vessel is increased but temperature is kept constant?

**Forward reaction**  **Reverse reaction**
A increases                           increases
B does not change                    does not change
C decreases                           increases
D increases                           does not change
23 An acidic gaseous reducing agent is passed through an aqueous solution of X. The solution changes from purple to colourless. What could X be?
   A  Acidified potassium manganate (VII)
   B  Acidified potassium dichromate (VI)
   C  Potassium iodide
   D  Methylated spirit

24 Which equation represents the most suitable way to prepare lead (II) sulphate?
   A  \( \text{PbO} + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + \text{H}_2\text{O} \)
   B  \( \text{PbCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + \text{H}_2\text{O} + \text{CO}_2 \)
   C  \( \text{Pb(OH)}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + 2\text{H}_2\text{O} \)
   D  \( \text{Pb(NO}_3)_2 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + 2\text{HNO}_3 \)

25 Which of the following compounds can react with aqueous solution of both sodium hydroxide and hydrochloric acid.
   A  CaO
   B  ZnO
   C  MgO
   D  FeO

26 A man suffering from an excess of acid in stomach has no indigestion tablets. Which substance could he take to lower his acidity?
   A  Aspirin (pH₆)
   B  Bicarbonate of soda (pH₆)
   C  Lemon juice (pH₆)
   D  Salt water (pH₇)

27 Which of the following properties can be used to predict the chemical reactions of an element?
   A  Density
   B  Melting point
   C  Colour of its compound
   D  Position on the Periodic Table

28 Sulphur and selenium are in the same group of the Periodic Table. From this, we would expect selenium to form compounds having the formula:
   A  \( \text{Se}_2\text{O}, \text{Na}_2\text{Se} \) and \( \text{NaSeO}_4 \).
   B  \( \text{SeO}_2, \text{Na}_2\text{Se} \) and \( \text{NaSeO}_4 \).
   C  \( \text{SeO}_2, \text{Na}_2\text{Se} \) and \( \text{Na}_2\text{SeO}_3 \).
   D  \( \text{SeO}_3, \text{NaSe} \) and \( \text{NaSeO}_3 \).
29 The element A, B, C or D most likely to be a transition metal in the following table is ... 

<table>
<thead>
<tr>
<th>Element</th>
<th>Melting point in °C</th>
<th>Density in g/cm³</th>
<th>Number of chlorides known</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-259</td>
<td>0.07</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>-7</td>
<td>3.10</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>113</td>
<td>2.07</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>1083</td>
<td>8.92</td>
<td>2</td>
</tr>
</tbody>
</table>

30 The diagram below shows the connections of an iron pipe and magnesium metal to prevent rusting of the iron pipe.

Which statement is false concerning the diagram above?
A  Magnesium oxidises
B  Magnesium gains electrons
C  Magnesium corrodes
D  Magnesium is a reducing agent

31 The diagram shows the industrial extraction of zinc metal.

What is the name of the ore used in the manufacture of the metal?
A  Bauxite
B  Calamine
C  Fluospar
D  Magnetite
32 Dry ammonia was passed over heated copper II oxide as shown:

\[ 2\text{NH}_3 \xrightarrow{\text{dry ammonia}} \text{N}_2(g) + 3\text{H}_2\text{O}(g) \]

What type of change occurs?
A Ammonia is neutralised to water
B Ammonia reduces copper (II) oxide to copper
C Copper (II) oxide is oxidised by ammonia to form copper
D Copper (II) oxide is neutralised by ammonia

33 Gas \(X\) reacts with sulphur dioxide in a reaction chamber containing solid \(Y\) to form Sulphur trioxide as shown below.

What are Gas \(X\) and Solid \(Y\)?

**Gas \(X\)**
A Sulphur
B Carbon monoxide
C Oxygen
D Nitrogen

**Solid \(Y\)**
A Platinum
B Iron
C Vanadium (V) oxide
D Iron (III) oxide
34. The diagram shows apparatus used to measure the percentage composition of oxygen in the atmosphere.

Phosphorus reacts with oxygen in air to form phosphorus (V) oxide which dissolves in water. If the initial volume of air in the tube is 90 cm$^3$. What volume of gas remains in the tube?

A. 18 cm$^3$
B. 20 cm$^3$
C. 64 cm$^3$
D. 72 cm$^3$

35. Silicon is used to make polymers known as silicones. The structure of a silicone is shown below:

Which statement below best explains why silicones are fire resistant compared to carbon based plastics?

A. Silicone has a higher melting point compared to carbon.
B. Si-O bonds are much stronger than C-C bonds.
C. Si-O bonds are never broken while C-C bonds are broken.
D. Silicon is a poor conductor of heat while carbon is a good conductor.
36  Which of the following has not been prepared by reacting a carboxylic acid with an alcohol?

A  \[ \text{Structure A} \]

B  \[ \text{Structure B} \]

C  \[ \text{Structure C} \]

D  \[ \text{Structure D} \]

37  The equation shows a molecule of hexane being split into two smaller molecules by heating to a high temperature.

\[ \text{Hexane} \rightarrow \text{Molecule 1} + \text{Molecule 2} \]

What is the name of the process shown above?

A  Addition polymerisation

B  Condensation polymerisation

C  Hydrolysis reaction

D  Thermal cracking

38  The following structure is of a monomer of a condensation polymer.

\[ \text{Structure} \]

Name the polymer.

A  Glucose

B  Maltose

C  Starch

D  Protein
39 An aqueous solution of a compound of formula C₂H₄O₂ reacts with potassium carbonate, liberating carbon dioxide.

What is the structural formula of the compound?

A

\[
\begin{array}{c}
\text{H} \\
\text{C} \\
\text{O} \\
\text{H}
\end{array}
\]

B

\[
\begin{array}{c}
\text{H} \\
\text{C} \\
\text{O} \\
\text{H}
\end{array}
\]

C

\[
\begin{array}{c}
\text{H} \\
\text{C} \\
\text{C} \\
\text{O} \\
\text{H}
\end{array}
\]

D

\[
\begin{array}{c}
\text{H} \\
\text{C} \\
\text{=C} \\
\text{O} \\
\text{H}
\end{array}
\]

40 Diesel, petrol, refinery gases and kerosene are fractions obtained from the distillation of crude oil. The order of volatility of these fractions, starting with the most volatile is ...

A refinery gas, petrol, kerosene, diesel.

B refinery gas, kerosene, petrol, diesel.

C diesel, kerosene, petrol, refinery gas.

D refinery gas, petrol, diesel, kerosene.
### The Periodic Table of the Elements

<table>
<thead>
<tr>
<th>Group</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
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</thead>
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<td>32</td>
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</tr>
<tr>
<td>34</td>
<td>Se</td>
<td>Selenium</td>
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*58-71 Lanthanoid series +90-103 Actinoid series

**Key**
- **a** = relative atomic mass
- **X** = atomic symbol
- **b** = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

\[
NA = 6.0 \times 10^{23}/\text{mol}; \ 1\ F = 96503\text{C}.
\]

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