Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY (US) 0439/13
Paper 1 Multiple Choice
May/June 2014
45 Minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Center number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO NOT WRITE IN ANY BARCODES.

There are forty questions on 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.

Read the instructions on the Answer Sheet very carefully.

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 booklet.
A copy of the Periodic Table is printed on page 16.
Electronic calculators may be used.

This document consists of 15 printed pages and 1 blank page.
1 The diagram shows the result of dropping a purple crystal into water.

![Diagram of purple crystal dissolving in water.](image)

Which processes take place in this experiment?

<table>
<thead>
<tr>
<th></th>
<th>chemical reaction</th>
<th>diffusing</th>
<th>dissolving</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>B</td>
<td>√</td>
<td>x</td>
<td>√</td>
</tr>
<tr>
<td>C</td>
<td>x</td>
<td>x</td>
<td>√</td>
</tr>
<tr>
<td>D</td>
<td>x</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>

2 Alcohol and water are completely miscible. This means when mixed together they form only one liquid layer.

Which method is used to separate alcohol from water?

A crystallization
B filtration
C fractional distillation
D precipitation
3 The four pieces of apparatus shown below are used in chemical experiments.

![buret](image1)
![graduated cylinder](image2)
![dropper](image3)
![thermometer](image4)

Which statement about the apparatus is correct?

A The buret measures the volume of liquid added in a titration.
B The graduated cylinder measures the mass of a substance used in an experiment.
C The dropper measures the volume of gas given off in a reaction.
D The thermometer measures the density of a solution.

4 The diagram shows the structure of an atom of element X.

![Atom Diagram](image5)

What is X?

A boron
B carbon
C sodium
D sulfur
5 The ‘lead’ in a pencil is made of a mixture of graphite and clay.

When the percentage of graphite is increased, the pencil slides across the paper more easily.

Which statement explains this observation?
A Graphite has a high melting point.
B Graphite is a form of carbon.
C Graphite is a lubricant.
D Graphite is a nonmetal.

6 The diagrams show four particles.

Which two diagrams show atoms that are isotopes of each other?
A 1 and 2  B 1 and 3  C 2 and 3  D 2 and 4
7 Solid F is an element.
Solid G is a compound.
Neither solid conducts electricity but G conducts electricity when dissolved in water.

These properties suggest that F is ……1…… and that G is ……2…… with ……3…… bonds.

Which words correctly complete gaps 1, 2 and 3?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>diamond</td>
<td>AgCl</td>
<td>covalent</td>
</tr>
<tr>
<td>B</td>
<td>diamond</td>
<td>NaCl</td>
<td>ionic</td>
</tr>
<tr>
<td>C</td>
<td>graphite</td>
<td>AgCl</td>
<td>ionic</td>
</tr>
<tr>
<td>D</td>
<td>graphite</td>
<td>NaCl</td>
<td>covalent</td>
</tr>
</tbody>
</table>

8 In athletics, banned drugs such as nandrolone have been taken illegally to improve performance.
Nandrolone has the molecular formula C_{18}H_{26}O_{2}.

What is the relative molecular mass, \( M_r \), of nandrolone?

(Relative atomic mass: H = 1; C = 12; O = 16)

A 46       B 150       C 274       D 306

9 A compound contains one atom of calcium, two atoms of hydrogen and two atoms of oxygen.

What is the correct chemical formula of the compound?

A CaO_{2}H_{2}  B HOCaOH  C H_{2}CaO_{2}  D Ca(OH)_{2}

10 Element X is in Group I of the Periodic Table. X reacts with element Y to form an ionic compound.

Which equation shows the process that takes place when X forms ions?

A \( X + e^- \rightarrow X^+ \)
B \( X - e^- \rightarrow X^- \)
C \( X + e^- \rightarrow X^- \)
D \( X - e^- \rightarrow X^+ \)

11 Which substance will not conduct electricity?

A aluminum
B copper
C plastic
D steel
12 Two chemical processes are described below.

- In the combustion of methane, energy is ......1...... .
- In the electrolysis of molten lead(II) bromide, energy is ......2...... .

Which words correctly complete gaps 1 and 2?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>given out</td>
<td>given out</td>
</tr>
<tr>
<td>B</td>
<td>given out</td>
<td>taken in</td>
</tr>
<tr>
<td>C</td>
<td>taken in</td>
<td>given out</td>
</tr>
<tr>
<td>D</td>
<td>taken in</td>
<td>taken in</td>
</tr>
</tbody>
</table>

13 Which equation shows an oxidation reaction?

A  \[ C + O_2 \rightarrow CO_2 \]
B  \[ CaCO_3 \rightarrow CaO + CO_2 \]
C  \[ CaO + 2HCl \rightarrow CaCl_2 + H_2O \]
D  \[ N_2O_4 \rightarrow 2NO_2 \]

14 Some reactions are endothermic.

How does the temperature and energy change in an endothermic reaction?

<table>
<thead>
<tr>
<th>temperature change</th>
<th>energy change</th>
</tr>
</thead>
<tbody>
<tr>
<td>A decreases</td>
<td>energy taken in</td>
</tr>
<tr>
<td>B decreases</td>
<td>energy given out</td>
</tr>
<tr>
<td>C increases</td>
<td>energy taken in</td>
</tr>
<tr>
<td>D increases</td>
<td>energy given out</td>
</tr>
</tbody>
</table>

15 Which products are formed at the anode and cathode when electricity is passed through molten lead(II) bromide?

<table>
<thead>
<tr>
<th></th>
<th>anode (+)</th>
<th>cathode (–)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>bromide ions</td>
<td>lead ions</td>
</tr>
<tr>
<td>B</td>
<td>bromine molecules</td>
<td>lead atoms</td>
</tr>
<tr>
<td>C</td>
<td>lead atoms</td>
<td>bromine molecules</td>
</tr>
<tr>
<td>D</td>
<td>lead ions</td>
<td>bromide ions</td>
</tr>
</tbody>
</table>
16 An experiment is carried out to investigate the rate of reaction when calcium carbonate is reacted with hydrochloric acid.

The volume of carbon dioxide gas given off is measured at different intervals of time.

The diagram shows pieces of apparatus used to collect gases.

![Diagram of apparatus]

Which apparatus is suitable to collect and measure the volume of the carbon dioxide?

A 1, 2 and 3  
B 2 and 3 only  
C 1 only  
D 3 only

17 In separate experiments, a catalyst is added to a reaction mixture and the temperature of the mixture is decreased.

What are the effects of these changes on the rate of the reaction?

<table>
<thead>
<tr>
<th></th>
<th>catalyst added</th>
<th>temperature decreased</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>faster</td>
<td>faster</td>
</tr>
<tr>
<td>B</td>
<td>faster</td>
<td>slower</td>
</tr>
<tr>
<td>C</td>
<td>slower</td>
<td>faster</td>
</tr>
<tr>
<td>D</td>
<td>slower</td>
<td>slower</td>
</tr>
</tbody>
</table>

18 Which statements about alkalis are correct?

1 When reacted with an acid, the pH of the alkali increases.
2 When tested with litmus, the litmus turns blue.
3 When warmed with an ammonium salt, ammonia gas is given off.

A 1, 2 and 3  
B 1 and 2 only  
C 1 and 3 only  
D 2 and 3 only
19 Which acid reacts with ammonia to produce the salt ammonium sulfate?
   A hydrochloric
   B nitric
   C phosphoric
   D sulfuric

20 The equation shows a reaction that is reversed by changing the conditions.
   \[
   \text{forward reaction} \quad \text{CuSO}_4 \cdot 5\text{H}_2\text{O} \xrightarrow{\text{CuSO}_4 + 5\text{H}_2\text{O}}
   \]

   How can the forward reaction be reversed?

<table>
<thead>
<tr>
<th></th>
<th>by adding water</th>
<th>by heating</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>B</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>C</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>D</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

21 Only two elements are liquid at 20 °C. One of these elements is shiny and conducts electricity.

   This suggests that this element is a ......1...... and therefore its oxide is ......2...... .

   Which words correctly complete gaps 1 and 2?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>metal</td>
<td>acidic</td>
</tr>
<tr>
<td>B</td>
<td>metal</td>
<td>basic</td>
</tr>
<tr>
<td>C</td>
<td>nonmetal</td>
<td>acidic</td>
</tr>
<tr>
<td>D</td>
<td>nonmetal</td>
<td>basic</td>
</tr>
</tbody>
</table>
22 An element melts at 1455 °C, has a density of 8.90 g/cm³ and forms a green chloride. Where in the Periodic Table is this element found?

23 Why is argon gas used to fill electric lamps?
   A It conducts electricity.
   B It glows when heated.
   C It is less dense than air.
   D It is not reactive.

24 Which statement about the Periodic Table is correct?
   A Elements in the same period have the same number of outer electrons.
   B The elements on the left are usually gases.
   C The most metallic elements are on the left.
   D The relative atomic mass of the elements increases from right to left.

25 Aqueous sodium hydroxide is added to solid X and the mixture is heated.
   A green precipitate is formed and an alkaline gas is given off.
   Which ions are present in X?
   A \( \text{NH}_4^+ \) and \( \text{Fe}^{2+} \)
   B \( \text{NH}_4^+ \) and \( \text{Fe}^{3+} \)
   C \( \text{OH}^- \) and \( \text{Fe}^{2+} \)
   D \( \text{OH}^- \) and \( \text{Fe}^{3+} \)
In an experiment, three test-tubes labeled X, Y and Z were half-filled with dilute hydrochloric acid. A different metal was added to each test-tube. After a few minutes the following observations were made.

In tube X, bubbles slowly rose to the surface.
In tube Y, there was a rapid release of bubbles.
In tube Z, no bubbles were produced.

Which three metals match the observations?

<table>
<thead>
<tr>
<th></th>
<th>tube X</th>
<th>tube Y</th>
<th>tube Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>copper</td>
<td>zinc</td>
<td>iron</td>
</tr>
<tr>
<td>B</td>
<td>magnesium</td>
<td>iron</td>
<td>copper</td>
</tr>
<tr>
<td>C</td>
<td>zinc</td>
<td>magnesium</td>
<td>copper</td>
</tr>
<tr>
<td>D</td>
<td>zinc</td>
<td>magnesium</td>
<td>iron</td>
</tr>
</tbody>
</table>

The diagrams show two items that may be found in the home. Each item contains zinc.

Zinc plated bucket  
Brass door-knocker

In which is zinc used as an alloy?

<table>
<thead>
<tr>
<th></th>
<th>bucket</th>
<th>door-knocker</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>B</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>C</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>D</td>
<td>✗</td>
<td>✗</td>
</tr>
</tbody>
</table>
28  The diagram shows some uses of water in the home.

For which uses is it important for the water to have been treated?

A  1 only   B  2 only   C  3 only   D  1, 2 and 3

29  The table shows properties of four metals.

Which metal is the most suitable for aircraft construction?

<table>
<thead>
<tr>
<th></th>
<th>density</th>
<th>strength</th>
<th>resistance to corrosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>high</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>B</td>
<td>high</td>
<td>low</td>
<td>low</td>
</tr>
<tr>
<td>C</td>
<td>low</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>D</td>
<td>low</td>
<td>low</td>
<td>high</td>
</tr>
</tbody>
</table>

30  The diagram shows a blast furnace.

In which part is iron ore changed to iron?
31 Acid rain is formed when sulfur dioxide and oxides of nitrogen dissolve in rain water.

Which problem is not caused by acid rain?

A breathing difficulties  
B dying trees  
C erosion of statues  
D lowered pH of lakes

32 Which compound contains two of the three essential elements needed for a complete fertiliser?

A ammonium chloride  
B ammonium nitrate  
C ammonium phosphate  
D ammonium sulfate

33 Four steel paper clips are treated as described before being placed in a beaker of water.

Which paper clip rusts most quickly?

A coated with grease  
B dipped in paint and allowed to dry  
C electroplated with zinc  
D washed with soap and rinsed

34 When compound X is heated, it changes colour from green to black. Compound Y is formed and a gas is given off which turns limewater milky.

What are X and Y?

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>calcium carbonate</td>
<td>calcium oxide</td>
</tr>
<tr>
<td>B</td>
<td>copper carbonate</td>
<td>carbon</td>
</tr>
<tr>
<td>C</td>
<td>copper carbonate</td>
<td>copper oxide</td>
</tr>
<tr>
<td>D</td>
<td>copper sulfate</td>
<td>copper oxide</td>
</tr>
</tbody>
</table>
35 Which type of compound is shown?

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

A alcohol  
B alkane  
C alkene  
D carboxylic acid

36 The table shows the composition of four different types of petroleum (crude oil).

<table>
<thead>
<tr>
<th>fraction</th>
<th>Arabian Heavy /%</th>
<th>Arabian Light /%</th>
<th>Iranian Heavy /%</th>
<th>North Sea /%</th>
</tr>
</thead>
<tbody>
<tr>
<td>gasoline</td>
<td>18</td>
<td>21</td>
<td>21</td>
<td>23</td>
</tr>
<tr>
<td>kerosene</td>
<td>11.5</td>
<td>13</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>diesel oil</td>
<td>18</td>
<td>20</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>fuel oil</td>
<td>52.5</td>
<td>46</td>
<td>46</td>
<td>38</td>
</tr>
</tbody>
</table>

Which type of petroleum is best for the motor vehicle industry?

A Arabian Heavy  
B Arabian Light  
C Iranian Heavy  
D North Sea

37 Which pollutant gas is produced by the decomposition of vegetation?

A carbon monoxide  
B methane  
C nitrogen oxide  
D sulfur dioxide
38 X, Y and Z are three hydrocarbons.

\[ X \text{ CH}_2=\text{CH}_2 \quad Y \text{ CH}_3-\text{CH}=\text{CH}_2 \quad Z \text{ CH}_3-\text{CH}_2-\text{CH}=\text{CH}_2 \]

What do compounds X, Y and Z have in common?

1. They are all alkenes.
2. They are all part of the same homologous series.
3. They all have the same boiling point.

A 1, 2 and 3  B 1 and 2 only  C 1 and 3 only  D 2 and 3 only

39 Alkenes are manufactured by cracking hydrocarbons obtained from petroleum.

Which row describes the process of cracking?

<table>
<thead>
<tr>
<th></th>
<th>size of X molecules</th>
<th>size of Y molecules</th>
<th>catalyst required</th>
<th>temperature required</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>large</td>
<td>small</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>B</td>
<td>large</td>
<td>small</td>
<td>yes</td>
<td>high</td>
</tr>
<tr>
<td>C</td>
<td>small</td>
<td>large</td>
<td>no</td>
<td>low</td>
</tr>
<tr>
<td>D</td>
<td>small</td>
<td>large</td>
<td>yes</td>
<td>high</td>
</tr>
</tbody>
</table>

40 Which statements about ethanol are correct?

1. It can be made by fermentation.
2. It is an unsaturated compound.
3. It burns in air and can be used as a fuel.

A 1, 2 and 3  B 1 and 2 only  C 1 and 3 only  D 2 and 3 only
The periodic table of the elements is shown with atomic numbers, names, and symbols for each element. The table is divided into groups and periods, and includes key for atomic mass, atomic number, and relative atomic mass. The volume of one mole of any gas is 24 dm³ at room temperature and pressure (t.r.p.).