CHEMISTRY

Paper 1 Multiple Choice

October/November 2013

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, highlighters, glue or correction fluid.
Write your name, Centre 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 20.
Electronic calculators may be used.

This document consists of 18 printed pages and 2 blank pages.
1. An attempt was made to compress a gas and a solid using the apparatus shown.

Which substance would be compressed and what is the reason for this?

<table>
<thead>
<tr>
<th>substance</th>
<th>reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>A gas</td>
<td>the gas particles are close together</td>
</tr>
<tr>
<td>B gas</td>
<td>the gas particles are far apart</td>
</tr>
<tr>
<td>C solid</td>
<td>the solid particles are close together</td>
</tr>
<tr>
<td>D solid</td>
<td>the solid particles are far apart</td>
</tr>
</tbody>
</table>

2. A student measures the rate of two reactions.

In one reaction, there is a change in mass of the reactants during the reaction.

In the second reaction, there is a change in temperature during the reaction.

Which piece of apparatus would be essential in both experiments?

A balance
B clock
C pipette
D thermometer
Diagram 1 shows the paper chromatogram of substance X.

Diagram 2 shows the cooling curve for substance Y.

Which statement about X and Y is correct?

A X is a mixture and Y is a pure substance.
B X is a pure substance and Y is a mixture.
C X and Y are mixtures.
D X and Y are pure substances.

4 Which statements about a sodium atom, $^{23}_{11}\text{Na}$, are correct?

1 The number of protons and neutrons is the same.
2 The number of protons and electrons is the same.
3 The number of outer electrons is one.
A 1, 2 and 3  B 1 and 2 only  C 1 and 3 only  D 2 and 3 only
The diagrams show the electron arrangements in the atoms of four elements.

Which element does **not** form a covalent bond?

![Diagrams of electron arrangements](image)

Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

<table>
<thead>
<tr>
<th></th>
<th>electron change</th>
<th>formula of ion formed</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>electron gained</td>
<td>Rb⁺</td>
</tr>
<tr>
<td>B</td>
<td>electron gained</td>
<td>Rb⁻</td>
</tr>
<tr>
<td>C</td>
<td>electron lost</td>
<td>Rb⁺</td>
</tr>
<tr>
<td>D</td>
<td>electron lost</td>
<td>Rb⁻</td>
</tr>
</tbody>
</table>

Element X has 7 protons.

Element Y has 8 more protons than X.

Which statement about element Y is correct?

A  Y has more electron shells than X.
B  Y has more electrons in its outer shell than X.
C  Y is in a different group of the Periodic Table from X.
D  Y is in the same period of the Periodic Table as X.
8 The formulae of compounds W, X and Y are shown.

\[ W \quad CuSO_4 \cdot 5H_2O \]
\[ X \quad MgSO_4 \cdot 7H_2O \]
\[ Y \quad Cu(NO_3)_2 \cdot 6H_2O \]

Which statement is correct?

A W contains twice as many hydrogen atoms as oxygen atoms.
B X contains the most oxygen atoms.
C Y contains the most hydrogen atoms.
D Y contains the same number of hydrogen and oxygen atoms.

9 A solid mixture contains an ionic salt, X, and a covalent organic compound, Y.

Two students suggest methods of separating the mixture as shown.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</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>
The diagram shows the circuit for electrolysing lead(II) bromide and sodium chloride to liberate the metal.

In what form are these salts electrolysed for liberating the metal?

<table>
<thead>
<tr>
<th></th>
<th>lead(II) bromide</th>
<th>sodium chloride</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>concentrated solution</td>
<td>concentrated solution</td>
</tr>
<tr>
<td>B</td>
<td>concentrated solution</td>
<td>molten</td>
</tr>
<tr>
<td>C</td>
<td>molten</td>
<td>concentrated solution</td>
</tr>
<tr>
<td>D</td>
<td>molten</td>
<td>molten</td>
</tr>
</tbody>
</table>

Which relative molecular mass, $M_r$, is not correct for the molecule given?

<table>
<thead>
<tr>
<th></th>
<th>molecule</th>
<th>$M_r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ammonia, NH$_3$</td>
<td>17</td>
</tr>
<tr>
<td>B</td>
<td>carbon dioxide, CO$_2$</td>
<td>44</td>
</tr>
<tr>
<td>C</td>
<td>methane, CH$_4$</td>
<td>16</td>
</tr>
<tr>
<td>D</td>
<td>oxygen, O$_2$</td>
<td>16</td>
</tr>
</tbody>
</table>
12. When anhydrous copper(II) sulfate is added to water a solution is formed and heat is given out.

Which row correctly shows the temperature change and the type of reaction taking place?

<table>
<thead>
<tr>
<th>temperature change</th>
<th>type of reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>decreases</td>
</tr>
<tr>
<td></td>
<td>endothermic</td>
</tr>
<tr>
<td>B</td>
<td>decreases</td>
</tr>
<tr>
<td></td>
<td>exothermic</td>
</tr>
<tr>
<td>C</td>
<td>increases</td>
</tr>
<tr>
<td></td>
<td>endothermic</td>
</tr>
<tr>
<td>D</td>
<td>increases</td>
</tr>
<tr>
<td></td>
<td>exothermic</td>
</tr>
</tbody>
</table>

13. The diagram shows the electrolysis of concentrated aqueous sodium chloride.

What is the colour of the litmus at each electrode after five minutes?

<table>
<thead>
<tr>
<th></th>
<th>colour at anode</th>
<th>colour at cathode</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>blue</td>
<td>red</td>
</tr>
<tr>
<td>B</td>
<td>red</td>
<td>blue</td>
</tr>
<tr>
<td>C</td>
<td>red</td>
<td>colourless</td>
</tr>
<tr>
<td>D</td>
<td>colourless</td>
<td>blue</td>
</tr>
</tbody>
</table>
14 Anhydrous copper(II) sulfate can be made by heating hydrated copper(II) sulfate.

\[ \text{CuSO}_4 \cdot 5\text{H}_2\text{O} \rightarrow \text{CuSO}_4 + 5\text{H}_2\text{O} \]

What can be added to anhydrous copper(II) sulfate to turn it into hydrated copper(II) sulfate?

A concentrated sulfuric acid  
B sodium hydroxide powder  
C sulfur dioxide  
D water

15 Which fuel does not produce carbon dioxide when it burns?

A coal  
B hydrogen  
C methane  
D petrol

16 A student investigates the rate of reaction between zinc and an excess of sulfuric acid.

The graph shows the results of two experiments, X and Y.

Which change explains the difference between X and Y?

A A catalyst is added in Y.  
B A lower temperature is used in Y.  
C Larger pieces of zinc are used in Y.  
D Less concentrated acid is used in Y.
17 Which are properties of an acid?

1 reacts with ammonium sulfate to form ammonia
2 turns red litmus blue

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</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>

18 Which of the following are properties of the oxides of non-metals?

<table>
<thead>
<tr>
<th></th>
<th>property 1</th>
<th>property 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>acidic</td>
<td>covalent</td>
</tr>
<tr>
<td>B</td>
<td>acidic</td>
<td>ionic</td>
</tr>
<tr>
<td>C</td>
<td>basic</td>
<td>covalent</td>
</tr>
<tr>
<td>D</td>
<td>basic</td>
<td>ionic</td>
</tr>
</tbody>
</table>

19 The reactions shown may occur in the air during a thunder storm.

\[
\begin{align*}
N_2 + O_2 & \rightarrow 2NO \\
2NO + O_2 & \rightarrow 2NO_2 \\
NO + O_3 & \rightarrow NO_2 + O_2
\end{align*}
\]

Which row shows what happens to the reactant molecules in each of these reactions?

<table>
<thead>
<tr>
<th></th>
<th>N₂</th>
<th>NO</th>
<th>O₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>oxidised</td>
<td>oxidised</td>
<td>oxidised</td>
</tr>
<tr>
<td>B</td>
<td>oxidised</td>
<td>oxidised</td>
<td>reduced</td>
</tr>
<tr>
<td>C</td>
<td>reduced</td>
<td>reduced</td>
<td>oxidised</td>
</tr>
<tr>
<td>D</td>
<td>reduced</td>
<td>reduced</td>
<td>reduced</td>
</tr>
</tbody>
</table>
20 Calcium, on the left of Period 4 of the Periodic Table, is more metallic than bromine on the right of this period.

Why is this?

Calcium has

A fewer electrons.
B fewer protons.
C fewer full shells of electrons.
D fewer outer shell electrons.

21 Compound X is tested and the results are shown in the table.

<table>
<thead>
<tr>
<th>test</th>
<th>result</th>
</tr>
</thead>
<tbody>
<tr>
<td>aqueous sodium hydroxide is added, then heated gently</td>
<td>gas given off which turns damp red litmus paper blue</td>
</tr>
<tr>
<td>dilute hydrochloric acid is added</td>
<td>effervescence, gas given off which turns limewater milky</td>
</tr>
</tbody>
</table>

Which ions are present in compound X?

A ammonium ions and carbonate ions
B ammonium ions and chloride ions
C calcium ions and carbonate ions
D calcium ions and chloride ions

22 Some properties of four elements W, X, Y and Z are listed.

1 W melts at 1410 °C and forms an acidic oxide.
2 X has a high density and is easily drawn into wires.
3 Y acts as a catalyst and its oxide reacts with acids.
4 Z is a red-brown solid used to make alloys.

Which of the elements are metals?

A 1 and 3
B 2, 3 and 4
C 2 and 3 only
D 2 and 4 only
23 The diagram shows a light bulb.

Why is argon used instead of air in the light bulb?

A  Argon is a good conductor of electricity.
B  Argon is more reactive than air.
C  The filament glows more brightly.
D  The filament does not react with the argon.

24 An element has a melting point of 1084 °C and a density of 8.93 g/cm³. Its oxide can be used as a catalyst.

In which position in the Periodic Table is the element found?

25 The diagrams show the labels of four bottles.

Which label is not correct?
26 Equations P and Q represent two reactions which occur inside a blast furnace.

\[
P: \text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2
\]
\[
Q: \text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2
\]

Which type of reactions are P and Q?

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>redox</td>
<td>redox</td>
</tr>
<tr>
<td>B</td>
<td>redox</td>
<td>thermal decomposition</td>
</tr>
<tr>
<td>C</td>
<td>thermal decomposition</td>
<td>redox</td>
</tr>
<tr>
<td>D</td>
<td>thermal decomposition</td>
<td>thermal decomposition</td>
</tr>
</tbody>
</table>

27 Farmers add calcium oxide (lime) and ammonium salts to their fields.

The compounds are not added at the same time because they react with each other.

Which gas is produced in this reaction?

A ammonia

B carbon dioxide

C hydrogen

D nitrogen

28 Which row describes the uses of mild steel and stainless steel?

<table>
<thead>
<tr>
<th></th>
<th>mild steel</th>
<th>stainless steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>car bodies, cutlery</td>
<td>chemical plant, machinery</td>
</tr>
<tr>
<td>B</td>
<td>car bodies, machinery</td>
<td>chemical plant, cutlery</td>
</tr>
<tr>
<td>C</td>
<td>chemical plant, cutlery</td>
<td>car bodies, machinery</td>
</tr>
<tr>
<td>D</td>
<td>chemical plant, machinery</td>
<td>car bodies, cutlery</td>
</tr>
</tbody>
</table>
29 Reactions of three metals and their oxides are listed in the table.

<table>
<thead>
<tr>
<th>metal</th>
<th>reacts with cold water</th>
<th>metal oxide reacts with carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>X</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Y</td>
<td>yes</td>
<td>no</td>
</tr>
</tbody>
</table>

What is the order of reactivity of the metals?

<table>
<thead>
<tr>
<th></th>
<th>least reactive</th>
<th></th>
<th>most reactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>W</td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>B</td>
<td>X</td>
<td>W</td>
<td>Y</td>
</tr>
<tr>
<td>C</td>
<td>X</td>
<td>Y</td>
<td>W</td>
</tr>
<tr>
<td>D</td>
<td>Y</td>
<td>W</td>
<td>X</td>
</tr>
</tbody>
</table>

30 The diagrams show four uses of iron.

In which of these uses is the iron most likely to rust?

A iron bucket
B electroplated with zinc
C iron cored aluminium electricity cables
D painted iron fence

31 In which process is carbon dioxide **not** formed?

A burning of natural gas
B fermentation
C heating lime
D respiration
32 M is a shiny silver metal. It has a melting point of 1455 °C. Many of its compounds are green.

What is metal M?

A aluminium
B copper
C mercury
D nickel

33 In many countries river water is used for the washing of clothes. The same water is not considered to be safe for drinking.

Why is it not safe for drinking?

A because river water contains dissolved salts
B because river water may contain harmful bacteria
C because river water may contain small particles of sand
D because river water may contain soap from washing clothes
34 The diagram shows a kiln used to heat limestone.

What is the product and what waste gas is formed?

<table>
<thead>
<tr>
<th></th>
<th>product</th>
<th>waste gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>lime, CaO</td>
<td>carbon monoxide</td>
</tr>
<tr>
<td>B</td>
<td>lime, CaO</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>C</td>
<td>slaked lime, Ca(OH)₂</td>
<td>carbon monoxide</td>
</tr>
<tr>
<td>D</td>
<td>slaked lime, Ca(OH)₂</td>
<td>carbon dioxide</td>
</tr>
</tbody>
</table>

35 Which air pollutant is **not** made when coal burns in a power station?

A  carbon monoxide
B  lead compounds
C  nitrogen oxides
D  sulfur dioxide
36 The diagram shows some properties of two organic compounds X and Y.

![Diagram of organic compounds X and Y with arrows indicating reactions and uses.]

What are X and Y?

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ethane</td>
<td>ethanoic acid</td>
</tr>
<tr>
<td>B</td>
<td>ethane</td>
<td>ethanol</td>
</tr>
<tr>
<td>C</td>
<td>ethene</td>
<td>ethanoic acid</td>
</tr>
<tr>
<td>D</td>
<td>ethene</td>
<td>ethanol</td>
</tr>
</tbody>
</table>

37 Three types of organic compound are alkanes, alkenes and alcohols.

Which structure does not belong to any of these three types of compound?

- A
- B
- C
- D
38 The diagram represents ethene.

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

Which compound has chemical properties similar to those of ethene?

A

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

B

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

C

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

D

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

39 Petroleum is a mixture of hydrocarbons which can be separated into fractions using fractional distillation.

Which fraction is used as fuel in jet engines?

A  bitumen
B  gasoline
C  kerosene
D  naphtha

40 A chemist carried out a cracking reaction on a hydrocarbon, X, and obtained two products, Y and Z.

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

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

Y

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

Z

The chemist then wrote the following statements in his notebook.

1  A molecule of X has 7 carbon atoms.
2  Y is unsaturated.
3  Z will decolourise bromine water.

Which statements are correct?

A  3 only  B  1 and 2  C  1 and 3  D  1, 2 and 3
**DATA SHEET**
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>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>9</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Li</td>
<td>Be</td>
<td>B</td>
<td>C</td>
<td>N</td>
<td>O</td>
<td>F</td>
<td>Ne</td>
<td>He</td>
</tr>
<tr>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>K</td>
<td>Ca</td>
<td>Sc</td>
<td>Ti</td>
<td>V</td>
<td>Cr</td>
<td>Mn</td>
<td>Fe</td>
<td>Co</td>
</tr>
<tr>
<td>39</td>
<td>40</td>
<td>41</td>
<td>42</td>
<td>43</td>
<td>44</td>
<td>45</td>
<td>46</td>
<td>47</td>
</tr>
<tr>
<td>Na</td>
<td>Mg</td>
<td>Al</td>
<td>Si</td>
<td>P</td>
<td>S</td>
<td>Cl</td>
<td>Ar</td>
<td>K</td>
</tr>
<tr>
<td>78</td>
<td>79</td>
<td>80</td>
<td>81</td>
<td>82</td>
<td>83</td>
<td>84</td>
<td>85</td>
<td>86</td>
</tr>
<tr>
<td>Rb</td>
<td>Sr</td>
<td>Y</td>
<td>Zr</td>
<td>Nb</td>
<td>Mo</td>
<td>Tc</td>
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Key

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

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

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*58-71 Lanthanoid series
†90-103 Actinoid series

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