Cambridge International General Certificate of Secondary Education

CHEMISTRY 0620/12
Paper 1 Multiple Choice
December 2015

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, 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 16.
Electronic calculators may be used.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of 15 printed pages and 1 blank page.
1. Which change of state takes place during evaporation?
   A. gas to liquid
   B. liquid to gas
   C. liquid to solid
   D. solid to gas

2. The diagram shows apparatus being used to demonstrate how the rate of a chemical reaction changes with temperature.

Which statement must be correct?
   A. The reaction is endothermic.
   B. The reaction is exothermic.
   C. The reaction produces a gas.
   D. The reaction produces an acid.
3  The table shows the nucleon number and the number of neutrons in one atom of isotopes W, X, Y and Z.

<table>
<thead>
<tr>
<th>isotope</th>
<th>nucleon number</th>
<th>number of neutrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>35</td>
<td>18</td>
</tr>
<tr>
<td>X</td>
<td>37</td>
<td>20</td>
</tr>
<tr>
<td>Y</td>
<td>39</td>
<td>20</td>
</tr>
<tr>
<td>Z</td>
<td>40</td>
<td>22</td>
</tr>
</tbody>
</table>

Which statement about W, X, Y and Z is correct?

A  W and X are isotopes of the same element.
B  X and Y are isotopes of elements in the same group of the Periodic Table.
C  Y and Z are isotopes of elements in the same period of the Periodic Table.
D  Z has a higher proton number than Y.

4  Compound X melts at 801 °C and is a good electrical conductor when dissolved in water.
Compound Y boils at 77 °C, is insoluble in water and is a non-conductor of electricity.

Which type of bonding is present in X and in Y?

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>covalent</td>
<td>covalent</td>
</tr>
<tr>
<td>B</td>
<td>covalent</td>
<td>ionic</td>
</tr>
<tr>
<td>C</td>
<td>ionic</td>
<td>covalent</td>
</tr>
<tr>
<td>D</td>
<td>ionic</td>
<td>ionic</td>
</tr>
</tbody>
</table>

5  What do the nuclei of \(^1\text{H}\) hydrogen atoms contain?

A  electrons and neutrons
B  electrons and protons
C  neutrons only
D  protons only
6 The electronic structures of atoms X and Y are shown.

![Diagram of X and Y atoms]

X and Y form a covalent compound.

What is its formula?

A. \(XY_5\)  
B. \(XY_3\)  
C. \(XY\)  
D. \(X_3Y\)

7 The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

A. a neutron  
B. a proton  
C. an atom of carbon-12  
D. an atom of hydrogen-1

8 The diagram shows the electrolysis of concentrated hydrochloric acid and concentrated aqueous sodium chloride using carbon electrodes.

![Diagram of electrolysis](image)

At which electrode(s) is hydrogen produced?

A. electrode 1 only  
B. electrodes 1 and 3  
C. electrode 2 only  
D. electrodes 2 and 4
9 The diagram shows a section of an overhead power cable.

Which statement explains why a particular substance is used?

A Aluminium has a low density and is a good conductor of electricity.
B Ceramic is a good conductor of electricity.
C Steel can rust in damp air.
D Steel is more dense than aluminium.

10 Hydrogen can be used as a fuel.

Which properties of hydrogen would be advantages and which would be disadvantages?

1 Hydrogen is expensive to produce.
2 Hydrogen reacts exothermically with oxygen.
3 When hydrogen burns, a greenhouse gas is not formed.

<table>
<thead>
<tr>
<th></th>
<th>advantages</th>
<th>disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>2 and 3</td>
</tr>
<tr>
<td>B</td>
<td>1 and 2</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>1 and 3</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>2 and 3</td>
<td>1</td>
</tr>
</tbody>
</table>

11 Which row correctly describes whether the reaction is exothermic or endothermic?

<table>
<thead>
<tr>
<th></th>
<th>reaction</th>
<th>exothermic</th>
<th>endothermic</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>calcium carbonate ( \rightarrow ) calcium oxide + carbon dioxide</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>B</td>
<td>carbon + oxygen ( \rightarrow ) carbon dioxide</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>C</td>
<td>methane + oxygen ( \rightarrow ) carbon dioxide + water</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>D</td>
<td>sodium + water ( \rightarrow ) sodium hydroxide + hydrogen</td>
<td>x</td>
<td>✓</td>
</tr>
</tbody>
</table>
12 The diagram shows four experiments in which equal volumes of aqueous acid (all in an excess) are added to equal masses of metal. Both acids have the same concentration.

In which experiment has the metal completely reacted in the shortest time?

![Experiments](image)

A. HCl - copper granules
B. HNO₃ - copper powder
C. HCl - zinc granules
D. HNO₃ - zinc powder

13 The element vanadium, V, forms several oxides.

In which change is oxidation taking place?

A. VO₂ → V₂O₃
B. V₂O₅ → VO₂
C. V₂O₃ → VO
D. V₂O₃ → V₂O₅

14 Which reaction is not a reversible reaction?

A. combustion of alkanes
B. hydration of anhydrous copper(II) sulfate
C. melting lead(II) bromide
D. thermal decomposition of hydrated cobalt(II) chloride

15 The reaction between magnesium and carbon dioxide is represented by the following equation.

$$2\text{Mg} + \text{CO}_2 \rightarrow 2\text{MgO} + \text{C}$$

Which statement describes what happens in this reaction?

A. Carbon is oxidised.
B. Magnesium is reduced.
C. Neither oxidation nor reduction happens.
D. The carbon in carbon dioxide is reduced.
16 Which element forms an acidic oxide?

A

B

C D

17 Which property is not characteristic of a base?

A It reacts with a carbonate to form carbon dioxide.
B It reacts with an acid to form a salt.
C It reacts with an ammonium salt to form ammonia.
D It turns universal indicator paper blue.

18 A sting from insect X has a pH of 6 and a sting from insect Y has a pH of 8.

The table shows the pH of four substances.

<table>
<thead>
<tr>
<th>substance</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>hydrochloric acid</td>
<td>1</td>
</tr>
<tr>
<td>sodium hydrogen carbonate</td>
<td>8</td>
</tr>
<tr>
<td>sodium hydroxide</td>
<td>14</td>
</tr>
<tr>
<td>vinegar</td>
<td>5</td>
</tr>
</tbody>
</table>

Which substances are used to treat the two stings?

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>hydrochloric acid</td>
<td>sodium hydroxide</td>
</tr>
<tr>
<td>B</td>
<td>sodium hydrogen carbonate</td>
<td>vinegar</td>
</tr>
<tr>
<td>C</td>
<td>sodium hydroxide</td>
<td>hydrochloric acid</td>
</tr>
<tr>
<td>D</td>
<td>vinegar</td>
<td>sodium hydrogen carbonate</td>
</tr>
</tbody>
</table>
19 A salt is produced in each of the following reactions.

\[
\begin{align*}
P & \quad \text{magnesium + dilute hydrochloric acid} \\
Q & \quad \text{zinc oxide + dilute sulfuric acid} \\
R & \quad \text{sodium hydroxide + dilute hydrochloric acid} \\
S & \quad \text{copper carbonate + dilute sulfuric acid}
\end{align*}
\]

Which statements about the products of the reactions are correct?

1. A flammable gas is produced in reaction P.
2. Water is formed in all reactions.
3. All the salts formed are soluble in water.

\[\text{A}\ 1, 2 \text{ and } 3 \quad \text{B}\ 1\text{ and } 2\text{ only} \quad \text{C}\ 1\text{ and } 3\text{ only} \quad \text{D}\ 2\text{ and } 3\text{ only}\]

20 The table shows the symbols of three metals with names that begin with the letter C.

Which row correctly shows the melting point of the metals?

<table>
<thead>
<tr>
<th></th>
<th>Co</th>
<th>Cr</th>
<th>Cs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>high</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>B</td>
<td>high</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>C</td>
<td>low</td>
<td>low</td>
<td>high</td>
</tr>
<tr>
<td>D</td>
<td>low</td>
<td>low</td>
<td>low</td>
</tr>
</tbody>
</table>

21 The table gives information about four elements.

Which element is a transition metal?

<table>
<thead>
<tr>
<th></th>
<th>electrical conductivity</th>
<th>density in g/cm³</th>
<th>melting point in °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>good</td>
<td>0.97</td>
<td>98</td>
</tr>
<tr>
<td>B</td>
<td>good</td>
<td>7.86</td>
<td>1535</td>
</tr>
<tr>
<td>C</td>
<td>poor</td>
<td>2.33</td>
<td>1410</td>
</tr>
<tr>
<td>D</td>
<td>poor</td>
<td>3.12</td>
<td>-7</td>
</tr>
</tbody>
</table>
22 The diagram shows elements W, X, Y and Z in a section of the Periodic Table.

Which statement about the reactivity of the elements is correct?

A X is more reactive than Y, and W is more reactive than Z.
B X is more reactive than Y, and Z is more reactive than W.
C Y is more reactive than X, and W is more reactive than Z.
D Y is more reactive than X, and Z is more reactive than W.

23 Which two elements make up mild steel?

A aluminium and magnesium
B copper and zinc
C iron and carbon
D tin and lead

24 The diagrams show what happens when three different metals are added to water.

What are X, Y and Z?

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>calcium</td>
<td>copper</td>
<td>potassium</td>
</tr>
<tr>
<td>B</td>
<td>copper</td>
<td>calcium</td>
<td>potassium</td>
</tr>
<tr>
<td>C</td>
<td>potassium</td>
<td>calcium</td>
<td>copper</td>
</tr>
<tr>
<td>D</td>
<td>potassium</td>
<td>copper</td>
<td>calcium</td>
</tr>
</tbody>
</table>
25 Which substances do not react together?
   A calcium + water
   B copper + dilute hydrochloric acid
   C sodium + water
   D zinc + dilute hydrochloric acid

26 Iron is extracted from hematite in a blast furnace.
   Which reaction increases the temperature in the blast furnace to over 1500 °C?
   A calcium carbonate → calcium oxide + carbon dioxide
   B calcium oxide + silicon dioxide → calcium silicate
   C carbon + oxygen → carbon dioxide
   D carbon dioxide + carbon → carbon monoxide

27 Which statements about water are correct?
   1 Household water may contain salts in solution.
   2 Water for household use is filtered to remove soluble impurities.
   3 Water is treated with chlorine to kill bacteria.
   4 Water is used in industry for cooling.
   A 1, 2, 3 and 4
   B 1, 2 and 3 only
   C 1, 3 and 4 only
   D 2, 3 and 4 only

28 Which gas is a pollutant of the air?
   A argon
   B carbon dioxide
   C nitrogen
   D sulfur dioxide
29 Carbon monoxide is an air pollutant produced when petrol is burned in a car engine. Why is carbon monoxide considered to be an air pollutant?

A It causes climate change.
B It causes the corrosion of buildings.
C It is a significant greenhouse gas.
D It is poisonous.

30 Metals are welded by using the heat produced by burning a gas in oxygen.

Which gas could not be used for this purpose?

A ethene
B hydrogen
C helium
D methane

31 Which elements are present in NPK fertilisers?

A nitrogen, phosphorus, potassium
B nitrogen, potassium, calcium
C sodium, phosphorus, potassium
D sodium, potassium, calcium
32 The apparatus shown is set up and left for a week.

Which diagram shows the level of the water at the end of the week?

A  

B  

C  

D  

33 A farmer moves his cows into a concrete shelter for protection.

There is little access for fresh air once the door is closed.

Which gases would increase in amount in the shelter?

A  carbon dioxide and carbon monoxide

B  carbon dioxide and methane

C  carbon monoxide and oxygen

D  methane and oxygen
34 A student is asked to draw a diagram showing the uses of limestone.

Which numbered lines show a correct use of limestone?
A 1, 2 and 3
B 1 and 2 only
C 1 and 3 only
D 2 and 3 only

35 Which formula is that of an alkene?
A \( \text{C}_2\text{H}_6 \)  
B \( \text{C}_3\text{H}_6 \)  
C \( \text{C}_3\text{H}_8 \)  
D \( \text{C}_4\text{H}_{10} \)

36 Which row describes the formation of a polymer?

<table>
<thead>
<tr>
<th></th>
<th>monomer</th>
<th>polymer</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ethane</td>
<td>poly(ethane)</td>
</tr>
<tr>
<td>B</td>
<td>ethane</td>
<td>poly(ethene)</td>
</tr>
<tr>
<td>C</td>
<td>ethene</td>
<td>poly(ethane)</td>
</tr>
<tr>
<td>D</td>
<td>ethene</td>
<td>poly(ethene)</td>
</tr>
</tbody>
</table>

37 Hydrocarbons obtained by fractional distillation of petroleum can be cracked to make useful products.

Which substance could not be obtained by cracking propane, \( M, 44 \)?
A \( \text{C}_2\text{H}_4 \)  
B \( \text{C}_3\text{H}_6 \)  
C \( \text{C}_4\text{H}_8 \)  
D \( \text{H}_2 \)
38. Ethanol can be formed by

1. fermentation
2. reaction between steam and ethene

Which of these processes uses a catalyst?

<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>

39. The flow chart shows the preparation of ethanol and some important chemistry of ethanol.

```
substance X → fermentation → ethanol → process Y → carbon dioxide + substance Z
```

What are X, Y and Z?

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ethane</td>
<td>combustion</td>
<td>yeast</td>
</tr>
<tr>
<td>B</td>
<td>glucose</td>
<td>combustion</td>
<td>steam</td>
</tr>
<tr>
<td>C</td>
<td>water</td>
<td>polymerisation</td>
<td>water</td>
</tr>
<tr>
<td>D</td>
<td>yeast</td>
<td>fermentation</td>
<td>glucose</td>
</tr>
</tbody>
</table>

40. What are the properties of a dilute solution of ethanoic acid?

<table>
<thead>
<tr>
<th></th>
<th>smell</th>
<th>appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>odourless</td>
<td>colourless</td>
</tr>
<tr>
<td>B</td>
<td>odourless</td>
<td>red</td>
</tr>
<tr>
<td>C</td>
<td>pungent smell</td>
<td>colourless</td>
</tr>
<tr>
<td>D</td>
<td>pungent smell</td>
<td>red</td>
</tr>
</tbody>
</table>
### 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></td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>He</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Li</td>
<td>Be</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Na</td>
<td>Mg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>K</td>
<td>Ca</td>
<td>Sc</td>
<td>Ti</td>
<td>V</td>
<td>Cr</td>
<td>Mn</td>
<td>Fe</td>
</tr>
<tr>
<td>6</td>
<td>Al</td>
<td>Si</td>
<td>P</td>
<td>S</td>
<td>Cl</td>
<td>Ar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Rb</td>
<td>Sr</td>
<td>Y</td>
<td>Zr</td>
<td>Nb</td>
<td>Mo</td>
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<td>Ru</td>
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<tr>
<td>9</td>
<td>Cs</td>
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<td>W</td>
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</tr>
<tr>
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<td></td>
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<tr>
<td>11</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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