CHEMISTRY 0620/13

Paper 1 Multiple Choice (Core) October/November 2016

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, 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.
1 ‘Particles moving very slowly from an area of higher concentration to an area of lower concentration.’

Which process is being described?

A a liquid being frozen  
B a solid melting  
C a substance diffusing through a liquid  
D a substance diffusing through the air

2 A student mixes 25 cm³ samples of dilute hydrochloric acid with different volumes of aqueous sodium hydroxide.

In each case, the student measures the change in temperature to test if the reaction is exothermic.

Which piece of apparatus is not needed?

A burette  
B clock  
C pipette  
D thermometer
3 A solid X is purified in five steps.

The first four steps of the purification are shown in the diagram.

In step 5, how is a pure sample of solid X obtained from mixture Y?

A dissolving  
B distillation  
C evaporating  
D filtering

4 An atom has three electron shells. There are three electrons in the outer shell.

How many protons and how many neutrons are in this atom?

<table>
<thead>
<tr>
<th></th>
<th>protons</th>
<th>neutrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>B</td>
<td>13</td>
<td>27</td>
</tr>
<tr>
<td>C</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>D</td>
<td>21</td>
<td>24</td>
</tr>
</tbody>
</table>

5 Boron nitride is a compound of the elements boron and nitrogen.

It has a similar structure to diamond.

What is likely to be a property of boron nitride?

A It conducts electricity.  
B It is soluble in water.  
C It is used as a lubricant.  
D It is very hard.
6  Which row describes the formation of single covalent bonds in methane?

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>atoms share a pair of electrons</td>
<td>both atoms gain a noble gas electronic structure</td>
</tr>
<tr>
<td>B</td>
<td>atoms share a pair of electrons</td>
<td>both atoms have the same number of electrons in their outer shell</td>
</tr>
<tr>
<td>C</td>
<td>electrons are transferred from one atom to another</td>
<td>both atoms gain a noble gas electronic structure</td>
</tr>
<tr>
<td>D</td>
<td>electrons are transferred from one atom to another</td>
<td>both atoms have the same number of electrons in their outer shell</td>
</tr>
</tbody>
</table>

7  Which elements are in the compound BaCO₃?

A  barium and cobalt
B  boron, actinium and oxygen
C  carbon, oxygen and barium
D  oxygen, calcium and boron

8  Concentrated aqueous sodium iodide is electrolysed using platinum electrodes.

The solution contains the ions Na⁺, I⁻, H⁺ and OH⁻.

Which electrodes are the ions attracted to during this electrolysis?

<table>
<thead>
<tr>
<th></th>
<th>Cathode</th>
<th>Anode</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>H⁺ and Na⁺</td>
<td>I⁻ and OH⁻</td>
</tr>
<tr>
<td>B</td>
<td>H⁺ and OH⁻</td>
<td>I⁻ and Na⁺</td>
</tr>
<tr>
<td>C</td>
<td>I⁻ and Na⁺</td>
<td>H⁺ and OH⁻</td>
</tr>
<tr>
<td>D</td>
<td>I⁻ and OH⁻</td>
<td>H⁺ and Na⁺</td>
</tr>
</tbody>
</table>
9 Which apparatus could be used to electroplate an iron nail with copper?

A

+ –

aqueous copper(II) sulfate

B

+ –

aqueous iron(II) sulfate

C

+ –

d = copper sheet

D

+ –

= iron nail

10 10 g of ammonium nitrate are added to water at 25°C and the mixture stirred. The ammonium nitrate dissolves and, after one minute, the temperature of the solution is 10°C.

What word describes this change?

A endothermic
B exothermic
C neutralisation
D reduction

11 What is always produced when a fuel is burnt?

A carbon dioxide
B carbon monoxide
C heat energy
D oxides of nitrogen
An experiment X is carried out between a solid and a solution using the apparatus shown.

The volume of gas given off is measured at different times and the results plotted on a graph.

In a second experiment Y, the surface area of the solid is increased but all other factors remain the same.

Which graph shows the results of experiments X and Y?
13 Hydrated cobalt(II) chloride crystals are pink.

When they are heated, they lose water and form blue anhydrous cobalt(II) chloride.

hydrated cobalt(II) chloride $\leftrightarrow$ anhydrous cobalt(II) chloride + water

A few drops of vinegar were added to anhydrous cobalt(II) chloride.

There was a colour change from blue to pink.

What does this colour change show about vinegar?

A It contains an acid.
B It contains water.
C It is an alkali.
D It is anhydrous.

14 The equations for three reactions are shown.

1 \[ \text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O} \]
2 \[ \text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2 \]
3 \[ 2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O} \]

Which statement about the reactions is not correct?

A In reaction 1, copper(II) oxide is reduced to copper.
B In reaction 2, carbon monoxide is oxidised to carbon dioxide.
C In reactions 1 and 3, hydrogen is oxidised to water.
D In reaction 2, iron(III) oxide is oxidised to iron.
15 Part of the Periodic Table is shown.

![Periodic Table]

Which type of oxides do X and Y form?

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>acidic</td>
<td>acidic</td>
</tr>
<tr>
<td>B</td>
<td>acidic</td>
<td>basic</td>
</tr>
<tr>
<td>C</td>
<td>basic</td>
<td>acidic</td>
</tr>
<tr>
<td>D</td>
<td>basic</td>
<td>basic</td>
</tr>
</tbody>
</table>

16 Compound T is added to dilute hydrochloric acid and warmed gently.

The mixture gives off a gas which turns acidified aqueous potassium manganate(VII) from purple to colourless.

A flame test on compound T gives a lilac flame.

What is compound T?

A sodium sulfate  
B sodium sulfite  
C potassium sulfate  
D potassium sulfite

17 Acids can react with metal oxides, carbonates and metals.

Which reactions produce a gas?

<table>
<thead>
<tr>
<th></th>
<th>acid with metal oxide</th>
<th>acid with carbonate</th>
<th>acid with metal</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>x</td>
</tr>
<tr>
<td>C</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>D</td>
<td>x</td>
<td>✓</td>
<td>x</td>
</tr>
</tbody>
</table>

key = gas is produced  
X = no gas is produced
18 The apparatus shown is used to prepare aqueous copper(II) sulfate.

![Diagram of apparatus]

What are X and Y?

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>copper</td>
<td>aqueous iron(II) sulfate</td>
</tr>
<tr>
<td>B</td>
<td>copper(II) chloride</td>
<td>sulfuric acid</td>
</tr>
<tr>
<td>C</td>
<td>copper(II) oxide</td>
<td>sulfuric acid</td>
</tr>
<tr>
<td>D</td>
<td>sulfur</td>
<td>aqueous copper(II) chloride</td>
</tr>
</tbody>
</table>

19 Elements P and Q are in the same period of the Periodic Table.

P is a metal and Q is a non-metal.

Which statement is correct?

A P has a greater nucleon number than Q.
B P is to the right of Q in the period.
C Q has more electron shells than P.
D Q has more protons than P.

20 What is not a property of Group I metals?

A They are soft and can be cut with a knife.
B They react when exposed to oxygen in the air.
C They produce an acidic solution when they react with water.
D They react rapidly with water producing hydrogen gas.
21 A flammable gas needs to be removed from a tank at an industrial plant. 

For safety reasons, an inert gas is used.

Which gas is suitable?

A argon
B hydrogen
C methane
D oxygen

22 Which element is a transition element?

<table>
<thead>
<tr>
<th></th>
<th>colour of chloride</th>
<th>melting point of element / °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>orange</td>
<td>113</td>
</tr>
<tr>
<td>B</td>
<td>orange</td>
<td>1535</td>
</tr>
<tr>
<td>C</td>
<td>white</td>
<td>113</td>
</tr>
<tr>
<td>D</td>
<td>white</td>
<td>1535</td>
</tr>
</tbody>
</table>

23 Which statement about the element bromine is correct?

A It displaces chlorine from aqueous potassium chloride.
B It has a higher density than chlorine.
C It is a diatomic metal.
D It is a green gas at room temperature.

24 Four metals are listed in decreasing order of reactivity.

magnesium
zinc
iron
copper

Titanium reacts with acid and cannot be extracted from its ore by heating with carbon.

Where should titanium be placed in the list?

A below copper
B between iron and copper
C between magnesium and zinc
D between zinc and iron
25 Basic oxides and oxygen are used to convert iron into steel.

Which statement is not correct?

A  Carbon is converted into carbon dioxide.
B  Silicon is converted into silicon(IV) oxide.
C  The basic oxides react with acidic impurities to form slag.
D  The oxygen reacts with the iron to produce hematite.

26 A student added dilute hydrochloric acid to four metals and recorded the results.

Some of the results are not correct.

<table>
<thead>
<tr>
<th>results</th>
</tr>
</thead>
<tbody>
<tr>
<td>metal</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

Which two results are correct?

A  1 and 3  
B  1 and 4  
C  2 and 3  
D  2 and 4  

27 Some properties of aluminium are listed.

1  It conducts heat.
2  It has a low density.
3  It is mechanically strong.
4  It is resistant to corrosion.

Which properties make aluminium suitable for making food containers for chilled food products?

A  1, 2 and 4  
B  1, 3 and 4  
C  1 only  
D  4 only  

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28 The diagram represents the water cycle.

At which stage during the cycle are soluble impurities removed from the water?

![Water Cycle Diagram]

29 Air is a mixture of gases.

Which gas is present in the largest amount?

A argon
B carbon dioxide
C nitrogen
D oxygen

30 Which information about carbon dioxide and methane is correct?

<table>
<thead>
<tr>
<th></th>
<th>carbon dioxide</th>
<th>methane</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>B</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>C</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>D</td>
<td>x</td>
<td>✓</td>
</tr>
</tbody>
</table>

Key: ✓ = true, x = false
31 Calcium oxide and ammonium salts are used by farmers to treat soils. Why are these two substances added at different times?

A They are both acidic.
B They are both basic.
C They react with each other to produce ammonia.
D They react with each other to produce hydrogen.

32 The chart shows how a gas, G, is formed in four reactions, from glucose or from a solid, S.

What are the formulae of gas G and solid S?

<table>
<thead>
<tr>
<th></th>
<th>gas G</th>
<th>solid S</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>CH₄</td>
<td>Ca</td>
</tr>
<tr>
<td>B</td>
<td>CH₄</td>
<td>CaCO₃</td>
</tr>
<tr>
<td>C</td>
<td>CO₂</td>
<td>Ca</td>
</tr>
<tr>
<td>D</td>
<td>CO₂</td>
<td>CaCO₃</td>
</tr>
</tbody>
</table>

33 Slaked lime is used to neutralise an acidic soil. How does the pH of the soil change?

<table>
<thead>
<tr>
<th></th>
<th>from</th>
<th>to</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>6</td>
</tr>
</tbody>
</table>
34 Which list shows the fractions obtained from distilling petroleum, in order of increasing boiling point?

A  bitumen → diesel oil → fuel oil → lubricating oil
B  diesel oil → gasoline → naphtha → kerosene
C  gasoline → naphtha → kerosene → diesel oil
D  kerosene → lubricating oil → naphtha → refinery gas

35 Butane reacts as shown.

\[
\text{butane} \xrightarrow{\text{catalyst}} \text{butene} + \text{hydrogen}
\]

What is this type of reaction?

A  combustion
B  cracking
C  polymerisation
D  reduction

36 The structure of a compound, X, is shown.

To which homologous series does X belong?

A  alcohols
B  alkanes
C  alkenes
D  carboxylic acids
37 An organic compound has the following properties.

<table>
<thead>
<tr>
<th>colour</th>
<th>effect on Universal Indicator</th>
<th>flammability</th>
<th>effect on aqueous bromine</th>
<th>state at room temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>colourless</td>
<td>none</td>
<td>highly flammable</td>
<td>decolourises</td>
<td>gas</td>
</tr>
</tbody>
</table>

To which homologous series does this organic compound belong?

A  alcohols
B  alkanes
C  alkenes
D  carboxylic acids

38 The diagram shows some apparatus.

What is made using this apparatus?

A  ethane
B  ethanoic acid
C  ethanol
D  ethene

39 Which molecule can be polymerised?

A  \[
\text{H} \quad \text{C} \quad \text{H} \\
\text{H} \\
\]
B  \[
\text{H} \quad \text{C} \quad \text{C} \quad \text{H} \\
\text{H} \\
\]
C  \[
\text{H} \quad \text{C} = \text{C} \quad \text{H} \\
\text{H} \\
\]
D  \[
\text{H} \quad \text{C} \quad \text{C} \quad \text{O} \quad \text{O} \\
\text{H} \\
\]
Ethanol is used as a biofuel.

Which equation shows the complete combustion of ethanol?

A \( C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 2H_2O \)
B \( C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O \)
C \( 2C_2H_5OH + 6O_2 \rightarrow 4CO_2 + 4H_2O \)
D \( 2C_2H_5OH + 7O_2 \rightarrow 4CO_2 + 6H_2O \)
The Periodic Table of 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>VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Key</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>atomic number</td>
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<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
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</tr>
<tr>
<td>atomic symbol</td>
<td>Li</td>
<td>Be</td>
<td>B</td>
<td>C</td>
<td>N</td>
<td>O</td>
<td>F</td>
<td>Ne</td>
</tr>
<tr>
<td>name</td>
<td>lithium</td>
<td>beryllium</td>
<td>boron</td>
<td>carbon</td>
<td>nitrogen</td>
<td>oxygen</td>
<td>fluorine</td>
<td>neon</td>
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<tr>
<td>relative atomic mass</td>
<td>6.94</td>
<td>9.01</td>
<td>10.81</td>
<td>12.01</td>
<td>14.01</td>
<td>15.99</td>
<td>16.90</td>
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<td>14</td>
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<td>Al</td>
<td>Si</td>
<td>P</td>
<td>S</td>
<td>Cl</td>
<td>Ar</td>
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<td>name</td>
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<td>aluminium</td>
<td>silicon</td>
<td>phosphorus</td>
<td>sulphur</td>
<td>chlorine</td>
<td>argon</td>
</tr>
<tr>
<td>relative atomic mass</td>
<td>22.99</td>
<td>24.31</td>
<td>26.98</td>
<td>28.09</td>
<td>30.97</td>
<td>32.06</td>
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<td>name</td>
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<td>scandium</td>
<td>titanium</td>
<td>vanadium</td>
<td>chromium</td>
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<td>iron</td>
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<td>55.85</td>
<td>55.85</td>
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<tr>
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<td>42</td>
<td>43</td>
<td>44</td>
</tr>
<tr>
<td>atomic symbol</td>
<td>Rb</td>
<td>Sr</td>
<td>Y</td>
<td>Zr</td>
<td>Nb</td>
<td>Mo</td>
<td>Tc</td>
<td>Ru</td>
</tr>
<tr>
<td>name</td>
<td>rubidium</td>
<td>strontium</td>
<td>yttrium</td>
<td>zirconium</td>
<td>niobium</td>
<td>molybdenum</td>
<td>technetium</td>
<td>rhenium</td>
</tr>
<tr>
<td>relative atomic mass</td>
<td>85.47</td>
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<td>88.91</td>
<td>91.22</td>
<td>92.91</td>
<td>95.94</td>
<td>98.90</td>
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<td>57–71</td>
<td>72</td>
<td>73</td>
<td>74</td>
<td>75</td>
<td>76</td>
</tr>
<tr>
<td>atomic symbol</td>
<td>Cs</td>
<td>Ba</td>
<td>lanthanoids</td>
<td>Hf</td>
<td>Ta</td>
<td>W</td>
<td>Re</td>
<td>Os</td>
</tr>
<tr>
<td>name</td>
<td>caesium</td>
<td>barium</td>
<td>lanthanoids</td>
<td>hafnium</td>
<td>tantalum</td>
<td>tungsten</td>
<td>rhenium</td>
<td>osmium</td>
</tr>
<tr>
<td>relative atomic mass</td>
<td>133.34</td>
<td>137.34</td>
<td>157.25</td>
<td>178.49</td>
<td>186.24</td>
<td>183.85</td>
<td>190.23</td>
<td>192.22</td>
</tr>
<tr>
<td>atomic number</td>
<td>87</td>
<td>88</td>
<td>89–103</td>
<td>104</td>
<td>105</td>
<td>106</td>
<td>107</td>
<td>108</td>
</tr>
<tr>
<td>atomic symbol</td>
<td>Fr</td>
<td>Ra</td>
<td>actinoids</td>
<td>Db</td>
<td>Sg</td>
<td>Bh</td>
<td>Hs</td>
<td>Mt</td>
</tr>
<tr>
<td>name</td>
<td>francium</td>
<td>radium</td>
<td>actinoids</td>
<td>dubnium</td>
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The volume of one mole of any gas is 24 dm$^3$ at room temperature and pressure (r.t.p.)