CHEMISTRY

Paper 1 Multiple Choice

May/June 2008

1 hour

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.

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.
1  Oxygen was prepared from hydrogen peroxide and collected as shown in the diagram.

\[ 2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2 \]

The first few tubes of gas were rejected because the gas was contaminated by

A  water vapour.
B  hydrogen peroxide.
C  hydrogen.
D  nitrogen.

2  The table gives the properties of four substances.

Which substance is a solid metal at room temperature?

<table>
<thead>
<tr>
<th></th>
<th>melting point /°C</th>
<th>boiling point /°C</th>
<th>electrical conductivity when solid</th>
<th>electrical conductivity when molten</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>808</td>
<td>1465</td>
<td>(x)</td>
<td>(✓)</td>
</tr>
<tr>
<td>B</td>
<td>98</td>
<td>890</td>
<td>(✓)</td>
<td>(✓)</td>
</tr>
<tr>
<td>C</td>
<td>119</td>
<td>445</td>
<td>(x)</td>
<td>(x)</td>
</tr>
<tr>
<td>D</td>
<td>–39</td>
<td>357</td>
<td>(✓)</td>
<td>(✓)</td>
</tr>
</tbody>
</table>

key

\(✓\) = conducts

\(x\) = does not conduct
3 Nitrogen dioxide is a dark brown gas and is more dense than air.

A gas jar containing nitrogen dioxide is sealed with a glass plate and is then inverted on top of a gas jar containing air.

The glass plate is removed.

Which one of the following correctly describes the colours inside the gas jars after a long period of time?

<table>
<thead>
<tr>
<th></th>
<th>upper gas jar</th>
<th>lower gas jar</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>brown</td>
<td>brown</td>
</tr>
<tr>
<td>B</td>
<td>dark brown</td>
<td>light brown</td>
</tr>
<tr>
<td>C</td>
<td>colourless</td>
<td>dark brown</td>
</tr>
<tr>
<td>D</td>
<td>light brown</td>
<td>dark brown</td>
</tr>
</tbody>
</table>

4 A student tested a solution by adding aqueous sodium hydroxide. A precipitate was not seen because the reagent was added too quickly.

What could not have been present in the solution?

A Al$^{3+}$  B Ca$^{2+}$  C NH$_4^+$  D Zn$^{2+}$

5 Which substance has a giant molecular structure at room temperature?

A methane  B sand  C sodium chloride  D water
6 When a covalent liquid boils its molecules become more widely spaced.

Which property of the molecules has the most influence on the energy required to boil a covalent liquid?

A the forces of attraction between the molecules  
B the reactivity of the molecules  
C the shape of the molecules  
D the strength of the covalent bonds in the molecules

7 The diagram shows the chromatogram obtained by analysis of a single dye.

Three measurements 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 $\frac{y}{x+y+z}$

8 The atoms $^{64}_{29}$Cu and $^{65}_{30}$Zn have the same

A nucleon number.  
B number of electrons.  
C number of neutrons.  
D proton number.
9 Why does molten sodium chloride conduct electricity?
   A An electron is completely transferred from sodium to chlorine.
   B Sodium ions are only weakly attracted to the chloride ions.
   C The electrons in the sodium chloride are free to move.
   D The sodium ions and the chloride ions are free to move.

10 Which equation describes the most suitable reaction for making lead sulphate?
   A Pb + H₂SO₄ → PbSO₄ + H₂
   B PbCO₃ + H₂SO₄ → PbSO₄ + CO₂ + H₂O
   C Pb(NO₃)₂ + H₂SO₄ → PbSO₄ + 2HNO₃
   D Pb(OH)₂ + H₂SO₄ → PbSO₄ + 2H₂O

11 In which oxide does X have the same oxidation state as in the chloride, XCl₃?
   A X₃O   B X₂O   C XO₂   D X₂O₃

12 A sample of copper contains a metal impurity which is below copper in the reactivity series. The diagram shows the apparatus used for refining the sample.

![Diagram of refining process]

The loss in mass of the anode (positive electrode) is 50 g and the gain in mass of the cathode (negative electrode) is 45 g.

What is the percentage purity of this sample of copper?
   A 10.0 %   B 11.1 %   C 90.0 %   D 95.0 %

13 One mole of a sample of hydrated sodium sulphide contains 162 g of water of crystallisation.

What is the correct formula of this compound?
   A Na₂S.3H₂O   B Na₂S.5H₂O   C Na₂S.7H₂O   D Na₂S.9H₂O
14 The diagram shows the electrolytic production of aluminium.

What are the products at the electrodes?

<table>
<thead>
<tr>
<th>negative electrode</th>
<th>positive electrode</th>
</tr>
</thead>
<tbody>
<tr>
<td>A solid aluminium</td>
<td>hydrogen</td>
</tr>
<tr>
<td>B solid aluminium</td>
<td>oxygen</td>
</tr>
<tr>
<td>C liquid aluminium</td>
<td>hydrogen</td>
</tr>
<tr>
<td>D liquid aluminium</td>
<td>oxygen</td>
</tr>
</tbody>
</table>

15 When dilute sulphuric acid is electrolysed between platinum electrodes, which statements are correct?

1 Hydrogen is released at the cathode.
2 Oxygen is released at the anode.
3 Sulphur is released at the anode.
4 The acid becomes more dilute.

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

16 Which of the following is an endothermic reaction?

A the combustion of ethanol in air
B the formation of a carbohydrate and oxygen from carbon dioxide and water
C the oxidation of carbon to carbon dioxide
D the reaction between hydrogen and oxygen
17 At 400 °C the reaction between hydrogen and iodine reaches an equilibrium.

\[
\text{H}_2(g) + \text{I}_2(g) \rightleftharpoons 2\text{HI}(g) \quad \Delta H = -13 \text{kJ}
\]

Which change in conditions would increase the percentage of hydrogen iodide in the equilibrium mixture?

A a decrease in pressure
B a decrease in temperature
C an increase in pressure
D an increase in temperature

18 The diagram shows the reaction pathway for a reaction without a catalyst.

Which diagram shows the addition of a catalyst which speeds up the reaction?

A

B

C

D
19 Sulphur dioxide reacts with aqueous bromine according to the following equation.

\[ \text{SO}_2(g) + \text{Br}_2(aq) + 2\text{H}_2\text{O}(l) \rightarrow \text{H}_2\text{SO}_4(aq) + 2\text{HBr(aq)} \]

Which element has been oxidised?

A bromine  
B hydrogen  
C oxygen  
D sulphur

20 When 20 cm\(^3\) of a 2 mol/dm\(^3\) solution of potassium hydroxide is mixed with 20 cm\(^3\) of a 1 mol/dm\(^3\) solution of sulphuric acid, the temperature of the mixture rises.

What best explains this?

A Sulphuric acid is a strong acid.  
B The potassium hydroxide solution is more concentrated than the sulphuric acid solution.  
C The reactants have a higher energy content than the products.  
D Potassium hydroxide is a very strong alkali.

21 A colourless gas is passed into each of three different solutions. The results for each solution are shown in the table.

<table>
<thead>
<tr>
<th>solution</th>
<th>result</th>
</tr>
</thead>
<tbody>
<tr>
<td>potassium iodide</td>
<td>stays colourless</td>
</tr>
<tr>
<td>acidified potassium dichromate(VI)</td>
<td>orange to green</td>
</tr>
<tr>
<td>acidified potassium manganate(VII)</td>
<td>purple to colourless</td>
</tr>
</tbody>
</table>

What is the colourless gas?

A an acid  
B an alkali  
C an oxidising agent  
D a reducing agent

22 Which observation is typical of a solid non-metal element?

A It reacts vigorously with chlorine.  
B It conducts electricity.  
C It has more than one oxidation state.  
D It forms an acidic oxide.
23 Which equation represents the reaction between hydrochloric acid and sodium hydroxide?

A  \( \text{Cl}^- + \text{Na}^+ \rightarrow \text{NaCl} \)

B  \( 2\text{H}^+ + \text{O}^{2-} \rightarrow \text{H}_2\text{O} \)

C  \( \frac{1}{2} \text{O}_2 + \text{H}_2 \rightarrow \text{H}_2\text{O} \)

D  \( \text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O} \)

24 The following statements about dilute sulphuric acid are all correct.

1. A white precipitate is formed when aqueous barium chloride is added.
2. The solution turns anhydrous copper(II) sulphate from white to blue.
3. Addition of Universal Indicator shows that the solution has a pH value of less than 7.0.
4. The solution reacts with copper(II) oxide, forming a blue solution.

Which two statements confirm the acidic nature of the solution?

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

25 Ammonia gas is produced when solid ammonium chloride is heated with

A  calcium hydroxide.

B  calcium sulphate.

C  hydrochloric acid.

D  magnesium nitrate.

26 Sulphur and selenium (Se) are in the same group of the Periodic Table.

From this, we would expect selenium to form compounds having the formulae

A  SeO, \( \text{Na}_2\text{Se} \) and \( \text{NaSeO}_4 \).

B  SeO\(_2\), \( \text{Na}_2\text{Se} \) and \( \text{NaSeO}_4 \).

C  SeO\(_2\), \( \text{Na}_2\text{Se} \) and \( \text{Na}_2\text{SeO}_4 \).

D  SeO\(_3\), NaSe and NaSeO\(_4\).
27 X and Y are diatomic elements. X is less reactive than Y.

What are elements X and Y?

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>chlorine</td>
<td>iodine</td>
</tr>
<tr>
<td>B</td>
<td>fluorine</td>
<td>nitrogen</td>
</tr>
<tr>
<td>C</td>
<td>iodine</td>
<td>bromine</td>
</tr>
<tr>
<td>D</td>
<td>oxygen</td>
<td>nitrogen</td>
</tr>
</tbody>
</table>

28 A metal X, in Group I of the Periodic Table, would be expected to

A form a nitrate of formula $X(\text{NO}_3)_2$.
B form an acidic oxide.
C form an insoluble chloride.
D produce hydrogen from cold water.

29 Four test-tubes were set up as shown.

Each piece of iron was protected on one side by a different coating.

In which test-tube is the iron least likely to rust?
30  Three types of steel have different properties.

  steel 1  easily shaped
  steel 2  brittle
  steel 3  resistant to corrosion

What are the names of these three types of steel?

<table>
<thead>
<tr>
<th></th>
<th>steel 1</th>
<th>steel 2</th>
<th>steel 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>high carbon</td>
<td>mild</td>
<td>stainless</td>
</tr>
<tr>
<td>B</td>
<td>high carbon</td>
<td>stainless</td>
<td>mild</td>
</tr>
<tr>
<td>C</td>
<td>mild</td>
<td>high carbon</td>
<td>stainless</td>
</tr>
<tr>
<td>D</td>
<td>mild</td>
<td>stainless</td>
<td>high carbon</td>
</tr>
</tbody>
</table>

31  Aluminium is used to make saucepans because of its apparent lack of reactivity.

Which property of aluminium explains its unreactivity?

  A  It has a high electrical conductivity.
  B  It has a low density.
  C  It has a surface layer of oxide.
  D  It is in Group III of the Periodic Table.
32 The diagram shows the apparatus used in an experiment to reduce substance Q with the gas generated in the flask.

What are substances P and Q?

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>copper</td>
<td>copper(II) oxide</td>
</tr>
<tr>
<td>B</td>
<td>lead</td>
<td>lead(II) oxide</td>
</tr>
<tr>
<td>C</td>
<td>magnesium</td>
<td>zinc oxide</td>
</tr>
<tr>
<td>D</td>
<td>zinc</td>
<td>copper(II) oxide</td>
</tr>
</tbody>
</table>

33 The flow chart shows how impure water can be treated to produce drinkable water.

What is not removed from the water by this process?

A clay particles
B microbes
C nitrates
D odours
34 A solid substance Z burns in air to form a product that is gaseous at 20°C.

What is Z?
A hydrogen
B carbon monoxide
C carbon
D magnesium

35 A section of a polymer is shown.

The structure of its monomer is

H—O—□—O—H

The monomer undergoes condensation polymerisation to form the polymer.

What is made each time a monomer adds to the polymer?
A hydrogen molecules, H₂
B hydroxide ions, OH⁻
C oxygen atoms, O
D water molecules, H₂O

36 Carboxylic acids react with alcohols to form esters.

Which acid and alcohol react together to form the following ester?

CH₃CH₂—□—OCH₃

A propanoic acid and ethanol
B propanoic acid and methanol
C ethanoic acid and ethanol
D ethanoic acid and methanol
37 Which two compounds are members of the same homologous series?

\[ \text{1} \quad \text{2} \]
\[ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \]
\[ \text{H} \quad \text{C} = \text{O} \quad \text{H} \quad \text{H} \]
\[ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \]
\[ \text{H} \quad \text{C} = \text{O} \quad \text{H} \quad \text{H} \]
\[ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \]

\[ \text{3} \quad \text{4} \]
\[ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \]
\[ \text{H} \quad \text{C} = \text{C} \quad \text{O} \quad \text{H} \]
\[ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \]
\[ \text{H} \quad \text{C} = \text{O} \quad \text{C} = \text{C} \quad \text{H} \]
\[ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \]

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

38 The diagram shows the structure of the compound 1,3-butadiene.

\[ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \]
\[ \text{C} = \text{C} \quad \text{C} = \text{C} \]
\[ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \]

How many molecules of hydrogen are needed to saturate one molecule of 1,3-butadiene?

A 1  B 2  C 3  D 4

39 Which compound has more than two carbon atoms per molecule?

A ethyl ethanoate  B ethene  C ethane  D ethanoic acid

40 Alkanes are a homologous series of organic compounds.

Which statement about alkanes is correct?

A Their boiling points increase as the length of the carbon chain increases.

B Their general formula is \( \text{C}_n\text{H}_{2n} \).

C They are unsaturated hydrocarbons.

D They take part in addition reactions.
The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).