CHEMISTRY 5070/12
Paper 1 Multiple Choice
May/June 2012
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.

This document consists of 13 printed pages and 3 blank pages.
1. The diagram shows some of the changes of state.

Which statement is correct?
A. Although the change is not shown on the diagram, a gas can change directly to a solid.
B. The changes 1 and 3 involve particles moving closer together.
C. The changes 2 and 4 involve particles moving further apart.
D. The changes 3, 4 and 5 all involve the release of energy.

2. Which gas is not obtained industrially by fractional distillation?
A. ammonia
B. argon
C. nitrogen
D. oxygen

3. When dilute hydrochloric acid is added to a white powder a gas is produced.

The solution remaining is tested separately with small volumes of both aqueous ammonia and aqueous sodium hydroxide.

A white precipitate is produced in both tests.

What is the white powder?
A. aluminium oxide
B. calcium oxide
C. copper(II) carbonate
D. zinc carbonate
4 A mixture of two substances is spotted onto a piece of chromatography paper.

The paper is inserted into a beaker containing a liquid.

For separation of the substances to occur the spot of mixture must

A be placed so that the spot is just below the level of the liquid.
B be soluble in the liquid.
C contain substances of the same \( R_f \) values.
D contain substances that are coloured.

5 Which reagent could be used to distinguish between dilute nitric acid and dilute hydrochloric acid?

A aqueous barium chloride
B aqueous silver nitrate
C aqueous sodium hydroxide
D copper(II) carbonate

6 What is the structure of sand?

A a macromolecule
B an ionic lattice
C a polymer
D a simple molecule

7 Pentane, \( C_5H_{12} \), has a higher boiling point than propane, \( C_3H_8 \). Which statement explains the difference in boiling point?

A Carbon-carbon single bonds are stronger than carbon-hydrogen bonds.
B Pentane has more covalent bonds to break.
C Pentane does not burn as easily as propane.
D The forces of attraction between pentane molecules are stronger than those between propane molecules
8 In which set of apparatus will the bulb be least bright?

A  
[Diagram of A with a bulb and a graphite rod]

B  
[Diagram of B with a bulb and inert electrodes, solid lead(II) bromide]

C  
[Diagram of C with a bulb and inert electrodes, molten sodium]

D  
[Diagram of D with a bulb and inert electrodes, liquid mercury]

9 Four substances have the following electrical properties.

<table>
<thead>
<tr>
<th>substance</th>
<th>property</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>does not conduct under any conditions</td>
</tr>
<tr>
<td>X</td>
<td>conducts only in aqueous solution</td>
</tr>
<tr>
<td>Y</td>
<td>conducts in both the molten and solid states</td>
</tr>
<tr>
<td>Z</td>
<td>conducts in both the molten and aqueous states</td>
</tr>
</tbody>
</table>

What are these four substances?

<table>
<thead>
<tr>
<th></th>
<th>W</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>HCl</td>
<td>S</td>
<td>NaCl</td>
<td>Pb</td>
</tr>
<tr>
<td>B</td>
<td>Pb</td>
<td>HCl</td>
<td>NaCl</td>
<td>S</td>
</tr>
<tr>
<td>C</td>
<td>S</td>
<td>HCl</td>
<td>Pb</td>
<td>NaCl</td>
</tr>
<tr>
<td>D</td>
<td>S</td>
<td>NaCl</td>
<td>HCl</td>
<td>Pb</td>
</tr>
</tbody>
</table>
10 The energy profile diagram shows the pathways for a reaction with and without a catalyst. Which energy change is the activation energy for the catalysed reaction?

11 Which statement about conduction of electricity is correct?
   A Electricity is conducted in aqueous solution by electrons.
   B Electricity is conducted in a metal wire by ions.
   C Electricity is conducted in a molten electrolyte by electrons.
   D Electricity is conducted in an acid solution by ions.
12 When the rubber bulb of the dropper in the diagram is squeezed, the aqueous silver nitrate drops into the aqueous sodium chloride and a white precipitate of silver chloride is formed.

![Diagram](rubber_bulb_dropper_silver_nitrate_sodium_chloride)

What happens to the total mass of the bottle and contents?

A It increases due to the formation of the heavy precipitate.
B It remains the same because only a physical change has taken place.
C It decreases because heat is evolved.
D It remains the same because none of the products escapes from the bottle.

13 What has the same mass as 0.25 mol of copper atoms?

A 0.5 mol of oxygen molecules
B 1 mol of sulfur dioxide molecules
C 1.5 mol of water molecules
D 2 mol of oxygen atoms

14 Which change **always** takes place when an aqueous solution of copper(II) sulfate is electrolysed?

A Copper is deposited at the negative electrode.
B Oxygen is evolved at the positive electrode.
C Sulfate ions move towards the negative electrode.
D The colour of the solution fades.
15 Which substance will conduct electricity without being chemically changed?

A sodium chloride solution  
B solid iron  
C solid sodium chloride  
D solid sulfur

16 A sample of air was bubbled into water. The pH of the water slowly changed from 7 to 6.

Which gas in the sample caused this change?

A carbon dioxide  
B carbon monoxide  
C nitrogen  
D oxygen

17 The oxide Q dissolves in water to form a colourless solution. This solution reacts with sodium carbonate to produce carbon dioxide.

What is Q?

A copper(II) oxide  
B sodium oxide  
C sulfur dioxide  
D zinc oxide

18 The following statements about dilute sulfuric acid are all correct.

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

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

19 Which ion reacts with aqueous ammonia to give a precipitate that dissolves in an excess of ammonia?

A Al\(^{3+}\)(aq)  
B Fe\(^{2+}\)(aq)  
C Fe\(^{3+}\)(aq)  
D Zn\(^{2+}\)(aq)
20 Which element is most likely to be used as an industrial catalyst?
A Li B Cs C Rh D Po

21 Which compound when reacted with sulfuric acid produces a product which is used as a fertiliser?
A ammonia B calcium carbonate C calcium hydroxide D sodium hydroxide

22 In which reaction is the underlined substance behaving as an oxidising agent?
A BaCl₂ + Na₂SO₄ → BaSO₄ + 2NaCl
B 3CuO + 2NH₃ → 3Cu + N₂ + 3H₂O
C 2FeCl₂ + Cl₂ → 2FeCl₃
D O₂ + 2SO₂ → 2SO₃

23 Which statements are true about all the noble gases?
1 The number of protons in their atoms equals the number of neutrons.
2 The number of protons in their atoms does not equal the number of electrons.
3 They all have eight electrons in their outer shell.
4 They do not react to form ionic compounds.
A 1, 2 and 3
B 1 and 3 only
C 3 only
D 4 only

24 How many electrons and protons are in an ion of an element in Group 2 of the Periodic Table?

<table>
<thead>
<tr>
<th></th>
<th>Number of electrons</th>
<th>Number of protons</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>C</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>D</td>
<td>139</td>
<td>137</td>
</tr>
</tbody>
</table>
25 A metal X forms oxides with the formulae XO and X₂O₃.

Where is X in the Periodic Table?
A in Group II
B in Group III
C the second Period
D in the transition elements

26 What is a characteristic of a weak acid?
A It does not react with sodium carbonate.
B It forms an aqueous solution with a pH of 8.
C It is only partially ionised when added to water.
D It turns litmus solution blue.

27 The reaction scheme represents the process for obtaining pure silicon.

\[
\begin{align*}
\text{SiO}_2 & \xrightarrow{\text{heat with carbon}} \text{Si} \text{(impure)} \xrightarrow{\text{react with chlorine}} \text{SiCl}_4 \text{(impure)} \xrightarrow{\text{distil}} \text{SiCl}_4 \text{(pure)} \xrightarrow{\text{heat with hydrogen}} \text{Si} \text{(pure)} \\
\end{align*}
\]

In which of the stages is the silicon reduced?
A I only
B I and II
C I and IV
D II and III

28 Which metal can be obtained from its oxide using hydrogen?
A calcium
B copper
C magnesium
D zinc

29 Which substance undergoes decomposition because of the high temperature in the blast furnace?
A coke
B calcium carbonate
C calcium silicate
D slag
30  Which reaction occurring in the blast furnace is an acid base reaction?

A  \( \text{C} + \text{CO}_2 \rightarrow 2\text{CO} \)

B  \( \text{C} + \text{O}_2 \rightarrow \text{CO}_2 \)

C  \( \text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3 \)

D  \( \text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2 \)

31  Three different beakers are set up as shown.

1  rod of metal Z
   aqueous metal W salt

2  rod of metal W
   aqueous metal X salt

3  rod of metal X
   aqueous metal Y salt

In beaker 1 metal W is displaced from solution.
In beaker 2 metal X is displaced from solution.
In beaker 3 metal Y is displaced from solution.

What is the order of decreasing reactivity of the four metals?

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

32  Aluminium is manufactured by the electrolysis of aluminium oxide.

Which substances are formed at the electrodes?

<table>
<thead>
<tr>
<th></th>
<th>positive electrode</th>
<th>negative electrode</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>aluminium</td>
<td>carbon dioxide</td>
</tr>
<tr>
<td>B</td>
<td>aluminium</td>
<td>oxygen</td>
</tr>
<tr>
<td>C</td>
<td>carbon dioxide</td>
<td>aluminium</td>
</tr>
<tr>
<td>D</td>
<td>oxygen</td>
<td>carbon dioxide</td>
</tr>
</tbody>
</table>
33 The processes photosynthesis, respiration and fermentation all change the amount of carbon dioxide in the atmosphere.

Which processes increase the amount of carbon dioxide in the atmosphere?

A photosynthesis and fermentation  
B photosynthesis only  
C respiration and fermentation  
D respiration only

34 Which process would destroy the bacteria in water?

A chlorination  
B desalination  
C filtration  
D treatment with carbon

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

A ethanoic acid  
B ethanol  
C ethene  
D ethyl ethanoate

36 The equations show some reactions of organic compounds.

Which is an addition reaction?

A \[ \text{CH}_4 + \text{Br}_2 \rightarrow \text{CH}_3\text{Br} + \text{HBr} \]  
B \[ \text{C}_2\text{H}_5\text{OH} + \text{O}_2 \rightarrow \text{CH}_3\text{CO}_2\text{H} + \text{H}_2\text{O} \]  
C \[ \text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{CO}_2\text{H} \rightarrow \text{CH}_3\text{CO}_2\text{C}_2\text{H}_5 + \text{H}_2\text{O} \]  
D \[ \text{C}_4\text{H}_4 + 2\text{Br}_2 \rightarrow \text{C}_4\text{H}_4\text{Br}_4 \]

37 Which statement about methanol is correct?

A It can be oxidised to form methanoic acid.  
B It is a constituent of alcoholic drinks.  
C It is formed by fermentation.  
D Its fully displayed structural formula is [structural formula shown]
38 A 10 cm³ sample of a gaseous hydrocarbon is completely burnt in oxygen. The total volume of the products is 70 cm³. All gas volumes are measured at room temperature and pressure.

Which equation represents the combustion of the hydrocarbon?

A \[ \text{CH}_4(g) + 2\text{O}_2(g) \rightarrow \text{CO}_2(g) + 2\text{H}_2\text{O}(g) \]

B \[ \text{C}_2\text{H}_4(g) + 3\text{O}_2(g) \rightarrow 2\text{CO}_2(g) + 2\text{H}_2\text{O}(g) \]

C \[ \text{C}_3\text{H}_8(g) + 5\text{O}_2(g) \rightarrow 3\text{CO}_2(g) + 4\text{H}_2\text{O}(g) \]

D \[ 2\text{C}_2\text{H}_6(g) + 7\text{O}_2(g) \rightarrow 4\text{CO}_2(g) + 6\text{H}_2\text{O}(g) \]

39 One mole of magnesium is dissolved in excess aqueous ethanoic acid, \( \text{CH}_3\text{COOH} \).

How many moles of hydrogen, \( \text{H}_2 \), will be produced?

A 0.5 \hspace{1cm} B 1 \hspace{1cm} C 2 \hspace{1cm} D 4

40 The section of a polymer chain is shown.

Which molecule would produce this polymer and by which type of polymerisation?

<table>
<thead>
<tr>
<th>molecule</th>
<th>type of polymerisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A [ \text{CH}_3–\text{CH}=\text{CH–CH}_3 ]</td>
<td>condensation</td>
</tr>
<tr>
<td>B [ \text{CH}_3–\text{CH}_2–\text{CH}=\text{CH}_2 ]</td>
<td>addition</td>
</tr>
<tr>
<td>C [ \text{CH}_3–\text{CH}_2–\text{CH}_2–\text{CH}=\text{CH}_2 ]</td>
<td>condensation</td>
</tr>
<tr>
<td>D [ \text{CH}_3–\text{CH}=\text{CH–CH}_3 ]</td>
<td>addition</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>4</td>
</tr>
<tr>
<td>1</td>
<td>He</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Group 1 (IA)**: Alkali Metals

- **Li**: Lithium
- **Na**: Sodium
- **K**: Potassium
- **Rb**: Rubidium
- **Cs**: Caesium
- **Fr**: Francium

**Group 2 (IIA)**: Alkaline Earth Metals

- **Be**: Beryllium
- **Mg**: Magnesium
- **Ca**: Calcium
- **Sr**: Strontium
- **Ba**: Barium
- **Ra**: Radon

**Group 3 (IIIA)**: Boron Family

- **Sc**: Scandium
- **Y**: Yttrium
- **La**: Lanthanum
- **Ac**: Actinium

**Group 4 (IVA)**: Carbon Family

- **Zr**: Zirconium
- **Hf**: Hafnium

**Group 5 (VA)**: Nitrogen Family

- **B**: Boron
- **N**: Nitrogen
- **P**: Phosphorus
- **As**: Arsenic

**Group 6 (VIA)**: Oxygen Family

- **O**: Oxygen
- **S**: Sulphur
- **Se**: Selenium
- **Te**: Tellurium
- **Xe**: Xenon

**Group 7 (VIIA)**: Fluorine Family

- **F**: Fluorine
- **Cl**: Chlorine
- **Br**: Bromine
- **I**: Iodine
- **Xe**: Xenon

**Group 8 (VIII)**: Helium Family

- **Ne**: Neon
- **Ar**: Argon
- **Kr**: Krypton
- **Xe**: Xenon

**Group 9 (IB)**: Transition Metals

- **Ni**: Nickel
- **Cu**: Copper
- **Zn**: Zinc
- **Cd**: Cadmium
- **Hg**: Mercury
- **Tl**: Thallium
- **Pb**: Lead
- **Bi**: Bismuth

**Group 10 (IIB)**: Transition Metals

- **Co**: Cobalt
- **Rh**: Rhodium
- **Ru**: Ruthenium
- **Os**: Osmium
- **Ir**: Iridium
- **Pt**: Platinum
- **Au**: Gold
- **Hg**: Mercury

**Group 11 (IIIA)**: Transition Metals

- **Cu**: Copper
- **Ag**: Silver
- **Au**: Gold
- **Hg**: Mercury

**Group 12 (IVA)**: Transition Metals

- **Zn**: Zinc
- **Cd**: Cadmium
- **Hg**: Mercury

**Group 13 (VA)**: Transition Metals

- **Al**: Aluminium
- **Ga**: Gallium
- **In**: Indium
- **Tl**: Thallium

**Group 14 (VIA)**: Transition Metals

- **Si**: Silicon
- **Ge**: Germanium
- **Sn**: Tin
- **Pb**: Lead

**Group 15 (VIA)**: Transition Metals

- **P**: Phosphorus
- **As**: Arsenic
- **Sb**: Antimony
- **Bi**: Bismuth

**Group 16 (VIA)**: Transition Metals

- **S**: Sulphur
- **Se**: Selenium
- **Te**: Tellurium
- **Po**: Polonium

**Group 17 (VIA)**: Transition Metals

- **Cl**: Chlorine
- **Br**: Bromine
- **I**: Iodine
- **At**: Astatine

**Group 18 (OIV)**: Noble Gases

- **He**: Helium
- **Ne**: Neon
- **Ar**: Argon
- **Kr**: Krypton
- **Xe**: Xenon

### Key

- **a**: relative atomic mass
- **b**: atomic symbol
- **c**: proton (atomic) number

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