2011 Senior External Examination

Chemistry

Paper One — Question and response book

Monday 7 November 2011
9 am to 11:40 am

Time allowed

- Perusal time: **10 minutes**
- Working time: **2 hours 30 minutes**

Examination materials provided

- Paper One — Question and response book
- Paper One Part A — Multiple-choice response sheet
- Paper One — Resource book

Equipment allowed

- QSA-approved equipment
- non-programmable calculator

Directions

Do not write in this book during perusal time.

Paper One has **two** parts:

- Part A — Knowledge and simple application:
  - Section 1 — Multiple choice (attempt **all** questions)
  - Section 2 — Short response (attempt **all** questions)
- Part B — Scientific processes (attempt **four** questions only)

Suggested time allocation

- Part A: 1 hour 50 minutes
- Part B: 40 minutes

Assessment

Assessment standards are at the end of this book.

After the examination session

The supervisor will collect this book when you leave.
Planning space
Part A — Knowledge and simple application

Part A assesses knowledge of subject matter and the simple application of that knowledge based on the eight topics in the 1998 senior external syllabus for Chemistry.

Part A is worth 80 marks.

Suggested time allocation: 1 hour 50 minutes.

Section 1 — Multiple choice

Section 1 has 10 questions of equal value. Attempt all questions.

Each question contains four options. Select the option that you think is correct or is the best option. Respond on the multiple-choice response sheet.

Question 1

The smallest electrically-neutral unit of a compound which retains the chemical properties of that compound is called

A  an ion.
B  a mole.
C  an atom.
D  a molecule.

Question 2

In gas laws, the conditions of S.T.P. are

A  0 °C and 1 atm pressure.
B  0 °C and 76 mm Hg pressure.
C  25 °C and 1 atm pressure.
D  25 °C and 76 mm Hg pressure.

Question 3

According to Dalton’s Law of Partial Pressure, in a mixture of gases each gas

A  exerts a pressure equal to the pressure it would exert if it alone occupied the total volume.
B  exerts a pressure equal to the total pressure of the mixture.
C  exerts only a fraction of its normal pressure.
D  exerts the same pressure as each other gas.
**Question 4**

Which of the following organic compounds is an alkyne?

A  $\text{C}_2\text{H}_4$

B  $\text{C}_4\text{H}_6$

C  $\text{C}_6\text{H}_6$

D  $\text{C}_8\text{H}_{18}$

**Question 5**

When carbon reacts rapidly with oxygen, heat is liberated. This chemical reaction is said to be

A  energetic.

B  exothermic.

C  endothermic.

D  thermochemical.

**Question 6**

If $H$ represents enthalpy (heat content) and $\Delta H$ represents change in enthalpy then, for an endothermic reaction,

A  $\Delta H = H(\text{products}) - H(\text{reactants})$ and is a positive value.

B  $\Delta H = H(\text{products}) - H(\text{reactants})$ and is a negative value.

C  $\Delta H = H(\text{reactants}) - H(\text{products})$ and is a positive value.

D  $\Delta H = H(\text{reactants}) + H(\text{products})$ and is a negative value.

**Question 7**

Forces holding atoms together in molecules are called

A  ionic bonds.

B  covalent bonds.

C  hydrogen bonds.

D  van der Waal’s forces.
Question 8
Which of the following is a correct statement regarding the components of an atom?

A The neutrons and electrons have the same mass.
B The protons and neutrons have the same charge.
C The nucleus provides the bulk of the volume of an atom.
D The electrons and protons have equal but opposite charge.

Question 9
Which of the following has the most mass?

A $6.02 \times 10^{23}$ atoms of helium
B 22.4 L of oxygen at S.T.P.
C 1 mole of chlorine gas
D 40 g of hydrogen

Question 10
When a chlorine atom becomes a chloride ion

A it loses one electron.
B it gains one electron.
C its mass number changes.
D it shares one electron with another chlorine atom.

End of Section 1
Section 2 — Short response

Section 2 has eight questions. Attempt all questions.

Write your responses in the spaces provided. You must show all working where applicable.

If you need more space for a response, continue on pages 24 and 25 of this book. Label any continued response with the question number.

Question 11 — Materials: Properties, bonding and structure

a. Explain the following terms:
   i. isotope .........................................................................................................
   ii. mass number ............................................................................................... (2 marks)

b. Diamond and graphite are the two main allotropes of carbon. In the table below, state the structure and one property of each allotrope.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond</td>
<td></td>
</tr>
<tr>
<td>Graphite</td>
<td></td>
</tr>
</tbody>
</table>

(2 marks)

c. The table below shows the differences in the boiling points and solubility in water of ethane and ethanol. Explain these differences in terms of the intermolecular forces.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Molecular mass g mol⁻¹</th>
<th>Boiling point °C</th>
<th>Solubility in water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethane (C₂H₆)</td>
<td>30</td>
<td>−89</td>
<td>Insoluble</td>
</tr>
<tr>
<td>Ethanol (C₂H₆O)</td>
<td>46</td>
<td>78.1</td>
<td>Very soluble</td>
</tr>
</tbody>
</table>

(3 marks)
d. Give the formula for the carbonate ion (including the charge).

..................................................

(1 mark)

e. Name the substance represented by the formula Al₂(SO₄)₃.

.........................................................................................................

(1 mark)

f. Draw Lewis diagrams to represent PCl₃ and H₂O.

<table>
<thead>
<tr>
<th>PCl₃</th>
<th>H₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(2 marks)

Question 12 — Reacting quantities and chemical analysis

a. Explain the following terms:

i. empirical formula

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.......................................................................................................

ii. molarity

.......................................................................................................

.......................................................................................................

(2 marks)

b. Rewrite the following as a balanced equation.

\[ C₃H₈ + O₂ \rightarrow CO₂ + H₂O \]

(2 marks)
c. Calculate:

i. the mass of 1.25 moles of SO$_2$

ii. the number of moles of solid NaF that need to be added to 750 mL of water to make a 1.5 M solution

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(2 marks)

(2 marks)

d. Explain what information the coefficients 3, 4, 1 (implied), and 4 provide about the following chemical equation.

\[ \text{3Fe(s)} + \text{4H$_2$O(l)} \rightarrow \text{Fe}_3\text{O}_4(s) + \text{4H$_2$(g)} \]

---

(1 mark)

e. The reaction between aluminium and hydrochloric acid may be represented by the following balanced equation.

\[ \text{2Al(s)} + \text{6HCl(aq)} \rightarrow \text{2Al}^{3+}(\text{aq}) + \text{6Cl}^-(\text{aq}) + \text{3H$_2$(g)} \]

What is the mass of hydrogen obtained when 54 g of aluminium reacts with excess hydrochloric acid?

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(2 marks)
Question 13 — Oxidation and reduction

a. Define the following terms:

i. cathode
   
   ..................................................................................................................
   ..................................................................................................................

ii. reducing agent
   
   ..................................................................................................................
   ..................................................................................................................

(2 marks)

b. Determine the oxidation number of S in H₂SO₄.
   
   ........................................................................................................

(1 mark)

Question 13 continues overleaf
c. In a test, candidates were asked to draw a diagram of an electrochemical (voltaic) cell that would give a cell potential (voltage) of 0.46 V when standard conditions were used. They were given the following list of materials:

- \( \text{CuSO}_4 \text{(aq)} \)
- \( \text{AgNO}_3 \text{(aq)} \)
- \( \text{KCl} \text{(aq)} \)
- \( \text{KNO}_3 \text{(aq)} \)
- two 250 mL beakers
- a U tube
- cotton wool
- leads
- silver electrodes
- copper electrodes
- distilled water
- the use of normal laboratory equipment including a multimeter, etc.

One candidate responded as follows:

![Diagram of a voltaic cell](image)

i. Give two reasons why this response does not fulfil task requirements.

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(2 marks)
ii. Draw a correct response. Ensure that you show and label:
• all components including positive and negative electrodes
• the flow of electrons in the wire
• the flow of ions in the solution.

Question 14 — Organic chemistry

a. The group of biochemical molecules called fats are classified as triple esters of glycerol. Draw a diagram to show the structure of these molecules.

b. Explain the term structural isomer. Draw two isomers of the molecular formula C₄H₁₀.

(1 mark)
c. Name the organic substance with the following structure.

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

......................................................................................................................

(1 mark)

d. Draw the structure of ethyl propanoate.

(1 mark)

e. A characteristic reaction of alkenes is the addition reaction.
Write an equation using structural formulas to show the reaction of Br\(_2\)(l) with any alkene.

(2 marks)

f. A scientist has put methanol into a beaker and propanoic acid into another but did not label the beakers and has forgotten which is which. Describe one reaction that could be attempted with each sample that would distinguish between the two liquids.

**Note:** You can describe the same reaction attempted with both samples or different reactions (one per liquid) attempted with each sample.

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(1 mark)
Question 15 — Chemical periodicity

a. Explain the trend in first ionisation energy displayed by the Group 1 elements (Lithium to Francium) of the Periodic Table.

b. Write the electron configuration for:
   i. magnesium atom
   ii. fluoride ion

c. Two laboratory technicians were discussing the electron configuration for calcium. One technician said it is 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^6\) 4s\(^2\) while the other said it should be 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^6\) 3d\(^2\). Which is correct? Explain why.

Question 16 — Gases and the atmosphere

a. Using the Kinetic Theory of Gases, explain why:
   i. gases are very compressible
   ii. gases diffuse quickly

(2 marks)
b. Calculate the partial pressure of the oxygen when 1 mole of oxygen and 2 moles of nitrogen are the only two gases in a container where the total pressure is 450 kPa.

(1 mark)

c. Calculate the volume occupied by 0.85 mole of a gas that is at 27 °C and 1.5 atm pressure.

(2½ marks)

**Question 17 — Energy and rates of chemical reactions**

a. Define the following terms:
   
i. entropy

(2 marks)

ii. catalyst

(2 marks)
b. Use the average bond energies given below to calculate the enthalpy change for the following reaction.

\[ \text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g}) \]

<table>
<thead>
<tr>
<th>Bond</th>
<th>Bond energy kJ mol(^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>H — H</td>
<td>436</td>
</tr>
<tr>
<td>Cl — Cl</td>
<td>242</td>
</tr>
<tr>
<td>H — Cl</td>
<td>431</td>
</tr>
</tbody>
</table>

(2 marks)

c. State two factors, other than catalysts, that affect the rate of a chemical reaction. Explain how changes to each factor cause changes in the rate of reactions.

(2 marks)

d. The equation for \( \text{H}^+ \) ions reacting with \( \text{OH}^- \) ions to form water, given below, represents both the stoichiometric equation and the reaction mechanism for the reaction:

\[ \text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(1) \]

However, the equation for ethane reacting with oxygen to give carbon dioxide and water, given below, represents the stoichiometric equation but not the reaction mechanism for the reaction:

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

Even though they are both stoichiometric equations, only the first equation represents the reaction mechanism. Explain why.

(2 marks)
Question 18 — Chemical equilibrium

a. Describe two characteristics of a system that is in a state of chemical equilibrium.

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(2 marks)

b. Define the term “strong acid”. Give an example.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>strong acid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(2 marks)

c. Write the equilibrium law expression for the following reaction.

\[
\text{SO}_4^{2-}(aq) + \text{H}_3\text{O}^+(aq) \leftrightarrow \text{HSO}_4^-(aq) + \text{H}_2\text{O}(l)
\]

(1 mark)

d. For each of the following reactions at equilibrium, state what the effect will be on the equilibrium concentrations of the substance underlined when the imposed change is made.

i. \[2\text{SO}_2(g) + \text{O}_2(g) \leftrightarrow 2\text{SO}_3(g) + 96 \text{kJ}\] (the temperature is decreased)

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(2 marks)

ii. \[\text{P}_4(g) + 6\text{H}_2(g) \leftrightarrow 4\text{PH}_3(g)\] (\text{P}_4(g) \text{ is added to the reaction chamber})

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(2 marks)
e. Use the Lowry-Bronsted theory of acids and bases to label the conjugate pairs in the following equation.

\[ \text{HClO}_2(\text{aq}) + \text{NH}_3(g) \leftrightarrow \text{ClO}_2^-(\text{aq}) + \text{NH}_4^+(\text{aq}) \]

(1 mark)

f. In the following system at equilibrium,

\[ \text{Fe}^{2+}(\text{aq}) + \text{Ag}^+(\text{aq}) \leftrightarrow \text{Fe}^{3+}(\text{aq}) + \text{Ag(s)} \]

what is the concentration of \( \text{Fe}^{2+}(\text{aq}) \) if the concentration of \( \text{Ag}^+(\text{aq}) \) is 0.60 M and \( \text{Fe}^{3+}(\text{aq}) \) is 3.60 M, given the equilibrium constant \( K=3 \)?

(2 marks)

g. The following equation shows the dissociation of cyanic acid.

\[ \text{HCNO}(\text{aq}) \leftrightarrow \text{H}^+(\text{aq}) + \text{CNO}^-(\text{aq}) \]

Calculate the value of \( K_a \) for a 0.10 M solution of cyanic acid which has a pH of 3.

(3 marks)

End of Section 2

End of Part A
Part B — Scientific processes

Part B assesses scientific processes based on the eight topics in the 1998 senior external syllabus for Chemistry and practical work undertaken during your study of the subject.

Part B has five questions of equal value. Attempt only four questions.

Write your responses in the spaces provided.

Suggested time allocation: **40 minutes.**

**Question 1**

In an experiment involving the reactivity of metals, students were given the following equipment:

- 12 strips of metal — three strips each of copper (Cu), lead (Pb), zinc (Zn) and tin (Sn)
- 0.20 M solutions of Cu(NO₃)₂, Pb(NO₃)₂, Zn(NO₃)₂ and Sn(NO₃)₂
- a supply of test tubes.

The strips of metal were put separately into test tubes containing 20 mL of different solutions. Observations of any reactions that occurred were noted and the results tabled as follows.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Cu(NO₃)₂ solution</th>
<th>Pb(NO₃)₂ solution</th>
<th>Zn(NO₃)₂ solution</th>
<th>Sn(NO₃)₂ solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu</td>
<td>Not tested</td>
<td>No reaction</td>
<td>No reaction</td>
<td>No reaction</td>
</tr>
<tr>
<td>Pb</td>
<td>Dark coating forms</td>
<td>Not tested</td>
<td>No reaction</td>
<td>No reaction</td>
</tr>
<tr>
<td>Zn</td>
<td>Dark coating forms</td>
<td>Dark coating forms</td>
<td>Not tested</td>
<td>Dark coating forms</td>
</tr>
<tr>
<td>Sn</td>
<td>Dark coating forms slowly</td>
<td>No reaction</td>
<td>No reaction</td>
<td>Not tested</td>
</tr>
<tr>
<td>Ni</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Use the results to develop a reactivity series for the first four metals (Cu, Pb, Zn and Sn) from the most reactive to the least reactive.

Justify your placement of each metal using the results in the table.

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b. Complete the shaded row in the table to show what happens when freshly cleaned strips of nickel are placed into test tubes containing 20 mL of different solutions.
Question 2

Students were asked to perform a series of reactions between KIO₃ solutions and NaHSO₃ solutions, with the reactions timed until a colour change occurred. The results were tabled as follows.

<table>
<thead>
<tr>
<th>Volume of KIO₃ (mL)</th>
<th>Volume of NaHSO₃ (mL)</th>
<th>Volume of water added (mL)</th>
<th>Reaction time (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.0</td>
<td>20.0</td>
<td>0.0</td>
<td>15</td>
</tr>
<tr>
<td>16.0</td>
<td>20.0</td>
<td>4.0</td>
<td>16.5</td>
</tr>
<tr>
<td>12.0</td>
<td>20.0</td>
<td>8.0</td>
<td>18</td>
</tr>
<tr>
<td>8.0</td>
<td>20.0</td>
<td>12.0</td>
<td>30</td>
</tr>
<tr>
<td>4.0</td>
<td>20.0</td>
<td>16.0</td>
<td>82</td>
</tr>
</tbody>
</table>

a. Draw a graph of the volume of KIO₃ versus reaction time.

b. Why is it important to add the water in order to keep the total volume the same for each reaction?

______________________________________________________________________________________________________________________________________________________________________________________________________________________________

______________________________________________________________________________________________________________________________________________________________________________________________________________________________

c. What conclusion can be made about the effect on the reaction time resulting from changing the concentration of reactants?

______________________________________________________________________________________________________________________________________________________________________________________________________________________________

______________________________________________________________________________________________________________________________________________________________________________________________________________________________

d. What information do the changes in reaction time provide about changes in the rate of reaction?

______________________________________________________________________________________________________________________________________________________________________________________________________________________________

______________________________________________________________________________________________________________________________________________________________________________________________________________________________
Question 3

Acid–base indicators change colour at different pH ranges.

The table below gives some indicators, the pH ranges across which they change colour and the colour changes that occur as the pH increases.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>pH range</th>
<th>Colour change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange IV</td>
<td>1.4 — 2.8</td>
<td>Red to yellow</td>
</tr>
<tr>
<td>Methyl orange</td>
<td>3.2 — 4.4</td>
<td>Red to orange/yellow</td>
</tr>
<tr>
<td>Litmus</td>
<td>4.5 — 8.3</td>
<td>Red to blue</td>
</tr>
<tr>
<td>Phenolphthalein</td>
<td>8.2 — 10</td>
<td>Colourless to pink</td>
</tr>
<tr>
<td>Alizarin yellow</td>
<td>10.1 — 12</td>
<td>Yellow to red</td>
</tr>
<tr>
<td>Indigo carmine</td>
<td>11.4 — 13</td>
<td>Blue to yellow</td>
</tr>
</tbody>
</table>

a. A chemist wanting to get a very accurate measure of the pH of a solution would not just use indicators. Explain why.

b. A solution of unknown concentration was tested with several indicators and the following results were noted.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litmus</td>
<td>Blue</td>
</tr>
<tr>
<td>Phenolphthalein</td>
<td>Pink</td>
</tr>
<tr>
<td>Indigo carmine</td>
<td>Blue</td>
</tr>
</tbody>
</table>

What is the possible pH for this solution?

c. What further test could be performed in Question 3b above to obtain a smaller possible pH range for the solution?
d. A chemistry student made three cups of strong tea using tea bags in hot water.
   - 10 drops of cold water were added to the first cup. No noticeable colour change was observed.
   - 10 drops of lemon juice were added to the second cup. The colour changed to light yellow.
   - 10 drops of a dilute solution of NaOH were added to the third cup. The colour changed to dark brown.

Could tea be used as an acid–base indicator? Justify your response.
**Question 4**

A chemist was investigating the relationship between pressure and volume for samples of gases.

A syringe was set up as shown below. Bricks were placed on the top of the plunger and the volume of the gas measured as the number of bricks on the plunger increased.

The results were tabled as follows:

<table>
<thead>
<tr>
<th>Bricks</th>
<th>Volume (mL)</th>
<th>$1/$Volume (mL$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>94.0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>74.5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>59.4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>49.5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>42.7</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>38.1</td>
<td></td>
</tr>
</tbody>
</table>

a. What conclusion can be drawn from the results table about the relationship between volume and pressure?

b. Complete the table by calculating values of $1/$volume.
c. Draw a graph of pressure (on the vertical axis) against $1/\text{volume}$ (on the horizontal axis).

\begin{figure}
\centering
\includegraphics[width=\textwidth]{graph}
\end{figure}

d. Why does the graph in Question 4c not pass through the origin?

\begin{itemize}
\item \text{Answer here.}
\positiveSpace
\item \text{Answer here.}
\end{itemize}

e. Use the graph above to determine the number of bricks that give a pressure equivalent to 1 atmosphere.

How many bricks are needed? \hfill \text{Answer here.}
Question 5

A laboratory assistant was given four substances and asked to perform a series of tests to determine whether they were metallic, covalent molecular, ionic or covalent network substances.

The results obtained from the tests are tabled below.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Melting point</th>
<th>Electrical conductivity as a solid</th>
<th>Electrical conductivity when molten</th>
<th>Electrical conductivity in water solution</th>
<th>Hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Liquid at room temperature</td>
<td>Not tested</td>
<td>Non conductive</td>
<td>Non conductive</td>
<td>Not tested</td>
</tr>
<tr>
<td>B</td>
<td>250 °C</td>
<td>Conducts</td>
<td>Conducts</td>
<td>Does not dissolve</td>
<td>Will bend</td>
</tr>
<tr>
<td>C</td>
<td>2760 °C</td>
<td>Non conductive</td>
<td>Non conductive</td>
<td>Does not dissolve</td>
<td>Very hard</td>
</tr>
<tr>
<td>D</td>
<td>1580 °C</td>
<td>Non conductive</td>
<td>Conducts</td>
<td>Conducts</td>
<td>Brittle</td>
</tr>
</tbody>
</table>
Complete the table as follows:

a. In the Bond type column, state whether each substance is metallic (m), covalent molecular (cm), ionic (i) or covalent network (cn).

b. In the Justification column, justify your decisions using the information in the table.

<table>
<thead>
<tr>
<th>Bond type</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
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End of Part B

End of Paper One
# Assessment standards from the 1998 senior external syllabus for Chemistry

## Paper One

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Very High Achievement</th>
<th>High Achievement</th>
<th>Sound Achievement</th>
<th>Limited Achievement</th>
<th>Very Limited Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of subject matter</td>
<td>A very high ability to recall and apply knowledge of chemistry in simple situations.</td>
<td>A high ability to recall and apply knowledge of chemistry in simple situations.</td>
<td>A satisfactory ability to recall and apply knowledge of chemistry in simple situations.</td>
<td>Limited ability to recall and apply knowledge of chemistry in simple situations.</td>
<td>Very limited ability to recall and apply knowledge of chemistry in simple situations.</td>
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<tr>
<td>Scientific processes</td>
<td>A very high ability to succeed in simple scientific process tasks — collecting and organising data, processing information, making simple judgments, communicating information in various contexts, devising and designing simple and/or single-step investigations.</td>
<td>A high ability to succeed in simple scientific process tasks — collecting and organising data, processing information, making simple judgments, communicating information in various contexts, devising and designing simple and/or single-step investigations.</td>
<td>A satisfactory ability to succeed in simple scientific process tasks — collecting and organising data, processing information, making simple judgments, communicating information in various contexts, devising and designing simple and/or single-step investigations.</td>
<td>Limited ability to succeed in simple scientific process tasks.</td>
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