2011 Senior External Examination

Chemistry
Paper Two — Question book

Monday 7 November 2011
1 pm to 3:10 pm

Time allowed
- Perusal time: 10 minutes
- Working time: 2 hours

Examination materials provided
- Paper Two — Question book
- Paper Two — Resource book
- Paper Two — Response book

Equipment allowed
- QSA-approved equipment
- non-programmable calculator

Paper Two is an open book examination. You may refer to any paper-based material that you have brought into the examination room.

Directions
You may write in this book during perusal time.
Paper Two has five questions of equal value.
Attempt four questions only.

Assessment
Assessment standards are at the end of this book.

After the examination session
Take this book when you leave.
Planning space
Complex reasoning processes

Paper Two has **five** questions of equal value. Attempt **four** questions only.

In each response, give full reasoning in terms of your knowledge and application of chemistry and use the range of scientific processes and complex reasoning objectives learned during your study of the subject.

Write your responses in the response book.

Grade descriptions for each question are provided below.

A grade:
- Has arrived at a valid response.
- Has successfully demonstrated logical reasoning and critical thinking.
- Has made few, if any, (minor) errors.

B grade:
- Has made substantial progress towards an appropriate response.
- Has applied logical reasoning and critical thinking.

C grade:
- Has made some progress towards an appropriate response.
- Has demonstrated some logical reasoning and critical thinking.

D grade:
- Response is unintelligible or does not satisfy the requirements for any other grade.
Question 1

One way to cook foods such as minced meat or meat cut into cubes is to put the meat and some water into a saucepan on a hotplate and heat until cooked.

One method that reduces the cooking time involves the use of a pressure cooker instead of a saucepan. The meat and water are put into the pressure cooker and the lid is sealed. The pressure cooker is then put on a hotplate and heated until cooked.

In terms of chemical principles, explain why cooking time is significantly reduced when using a pressure cooker.

Question 2

Determine the minimum volume of $1 \times 10^{-5}$ M NaCl solution needed to dissolve 0.014 g of AgCl. Show all calculations.

Note: For AgCl, $K_{sp} = 1.6 \times 10^{-10}$.

Question 3

If silver-plated cutlery (knives, forks and spoons) is stored for a significant time, the surface of the silver goes almost black due to the formation of silver sulphide (Ag$_2$S).

One way to clean the silver is to use an abrasive* polish. A method that is less damaging to the surface of the silver is as follows:

- line a flat-bottomed glass tray with aluminium foil
- place the cutlery into the tray so each piece is in contact with the foil
- put 200 g of baking soda (NaHCO$_3$) into 1.5 L of water and bring to the boil
- pour this solution into the tray containing the cutlery
- leave it to sit for 10 minutes, then remove the cutlery and rub dry.

The black colour will have disappeared and the silver-plated cutlery will be restored to its original appearance.

Provide an explanation for the method described above that includes:

a. Equations for any chemical reactions that have occurred.

b. The roles that aluminium, baking soda and hot water play in this process.

c. One possible long-term advantage this method has over the use of an abrasive polish.

*abrasive: wearing away
**Question 4**

The ideal pH for a swimming pool is close to pH 7.4. This is because the pH of the fluid in the human eye is close to pH 7.4.

A pool owner had a 50000 litre pool with a pH of 8.2.

What volume of 6M hydrochloric acid would the owner need to add to the pool to change the pH to 7.4?

**Question 5**

The following processes can be observed in a typical school laboratory or household.

1. A crystal of salt will shatter easily and will dissolve in water.
2. A piece of glass will shatter easily but will not dissolve in water.
3. Distilled water will not conduct an electric current.
4. If salt is dissolved in distilled water, the solution will conduct an electric current.
5. If sugar is dissolved in distilled water, the solution will not conduct an electric current.
6. Oxygen has a normal boiling point of −183 °C and is a gas at room temperature.
7. Water has a normal boiling point of 100 °C and is a liquid at room temperature.
8. A sheet of copper can be bent out of shape and then back into its original shape without breaking.
9. A piece of iron will conduct an electric current.
10. A piece of plastic will not conduct an electric current.
11. Water and oil will not mix, and stay as separate layers.
12. Methylated spirits and water mix easily to form a homogeneous solution.

Explain how observations of at least six of the above processes can lead to an understanding of the forces that exist within and between particles.

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

<table>
<thead>
<tr>
<th>Criterion</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>Complex reasoning processes</td>
<td>A high ability to use complex reasoning in challenging situations involving the candidate’s understanding of subject matter, and a high ability to use scientific processes at an advanced level.</td>
<td>Competence in using complex reasoning in challenging situations involving the candidate’s understanding of subject matter, and competence in using scientific processes at an advanced level.</td>
<td>Some success in using complex reasoning in challenging situations involving the candidate’s understanding of subject matter, and some success in using scientific processes at an advanced level.</td>
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