THE UNITED REPUBLIC OF TANZANIA  
NATIONAL EXAMINATIONS COUNCIL  
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION  

032/2A  
CHEMISTRY 2A  
ALTERNATIVE A PRACTICAL  
(For Both School and Private Candidates)  

TIME: 3 Hours 30 Minutes  
2006/10/18 a.m.  

Instructions  

1. This paper consists of three (3) questions.  
2. Answer two (2) questions including question number 1.  
3. All questions carry equal marks.  
4. Quantitative Analysis Guidance Pamphlets may be used after a thorough check by the supervisor.  
5. Electronic calculators are not allowed in the examination room.  
6. Cellular phones are not allowed in the examination room.  
7. Write your Examination Number on every page of your answer booklet(s).  
8. The following constants may be used:  
    Atomic masses:  
    \[ H = 1, \ Cl = 35.5, \ Na = 23, \ C = 12, \ O = 16. \]  
    \[ 1 \, \text{dm}^3 = 1 \, \text{litre} = 1000 \, \text{cm}^3. \]  

CS. 06  
This paper consists of 3 printed pages.
1. You are provided with the following:
Solution AA containing 3.65 g of HCl per dm$^3$ of the solution.
Solution BB containing 7.15 g of hydrated sodium carbonate (Na$_2$CO$_3$ x H$_2$O) in 0.5 dm$^3$
of the solution.
Methyl orange indicator.

Determine the value of \(x\) in Na$_2$CO$_3$ xH$_2$O.

**Procedure**

Put the acid solution AA in the burette. Pipette 20 cm$^3$ (or 25 cm$^3$) of solution BB into the
titration flask. Add two drops of methyl orange indicator. Titrate solution BB against solution
AA from the burette until a colour change is observed. Note the reading of the burette. Repeat the
procedure to obtain three more readings.

(a) (i) Record your results in a table as shown below.

<table>
<thead>
<tr>
<th>Titration</th>
<th>Pilot</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final reading (cm$^3$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial reading (cm$^3$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume used (cm$^3$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(ii) The volume of pipette used was ____ cm$^3$.

(iii) Summary:
_____ cm$^3$ of solution BB required ____ cm$^3$ of solution AA for complete
reaction.

(iv) The colour change at the end point was from ___ to ____.

(v) Write the balanced chemical equation for the reaction between solution AA and
BB.

(c) Calculate the
a. concentration of solution AA in moles/dm$^3$
b. molarity of solution BB
c. determine the value of \(x\) in Na$_2$CO$_3$ xH$_2$O. (25 marks)
2. Sample Q is a pure salt containing one cation and one anion. Carry out carefully the experiments described below. Record all your observations and appropriate inferences. Identify the cation and anion present in sample Q.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Observation</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Appearance of sample Q.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) To half a spatula of sample Q in a test tube add concentrated H₂SO₄ and warm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c) To half a spatula of sample Q in a test tube add distilled water and stir then boil.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(d) Dissolve a spatula full of sample Q in dilute nitric acid. Divide the solution into three portions. To the first portion of the solution add sodium hydroxide solution till excess (i) second portion of the solution add NH₃(aq) till excess (ii) third portion of the solution add AgNO₃ solution followed by dil. HNO₃ acid then NH₃(aq).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion
The cation in sample Q is __________ and the anion is __________. Write the molecular formula of sample Q. (25 marks)

3. Sample M is a simple salt containing one cation and one anion. Using systematic qualitative analysis procedures carry out tests on sample M and make appropriate observations and inferences to identify the cation and anion in sample M.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Observation</th>
<th>Inference</th>
</tr>
</thead>
</table>

Conclusion
The cation in M is __________ and the anion is __________. (25 marks)