Centre No.						Paper Reference						Surname	Initial(s)
Candidate No.						6	2	4	3	/	01A	Signature	

Paper Reference(s)

6243/01A

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Edexcel GCE

Chemistry

Advanced Subsidiary

Unit Test 3A: Practical Test

Thursday 10 January 2008 – Morning

Time: 1 hour 45 minutes

Question Number	Leave Blank
1	
2	
3	
4	
Total	

Materials required for examination

See Confidential Instructions (already issued to centres) relating to this practical test.

Items included with question papers

Nil

Candidates are allowed the use of textbooks and their own class notes during the practical test. Candidates may also use a calculator.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Answer **ALL** the questions. Write your answers in the spaces provided in this question paper.
Show all the steps in any calculations and state the units.
Final answers to calculations should be given to an appropriate number of significant figures.

Information for Candidates

The total mark for this paper is 50. The marks for individual questions and parts of questions are shown in round brackets: e.g. **(2)**. There are 12 pages in this question paper. All blank pages are indicated.

Advice to Candidates

You are reminded of the importance of clear English and careful presentation in your answers.
You are reminded that you should take all usual safety precautions when working in a chemistry laboratory.

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Answer ALL the questions. Write your answers in the spaces provided.

1. You are provided with a sample of a salt **A**.

A contains one cation and one anion. Carry out the following tests on **A**, recording your observations and inferences in the spaces provided.

(a) Transfer about one third of the sample of **A** to a dry test tube and then place a small plug of mineral wool loosely in the top of the test tube. Gently heat the test tube for about 30 seconds.

In your inferences, name the type of change that you observe and suggest the identity of the cation that may be present in **A**.

Observation	Inferences

(3)

(b) Transfer another one third of the sample of **A** to a boiling tube. Add about 6 cm^3 of dilute sodium hydroxide. Warm the mixture gently, testing any gas evolved with both damp red litmus paper and damp blue litmus paper.

In your inferences, suggest the identity of the gas evolved and of the ion, in **A**, that led to its formation.

Observations	Inferences

(3)

Leave blank

(c) Dissolve the remainder of **A** in about 3 cm^3 of distilled water in a boiling tube. Add 6 drops of dilute nitric acid followed by 4 drops of aqueous silver nitrate. Shake the tube gently. Then add dilute aqueous ammonia, shaking the tube gently, until there is no further change.

For your inference, suggest the identity of the anion in **A** by writing its formula **or** name.

Observations	Inference

(3)

(d) Explain why, in test (c), dilute nitric acid is added to the solution of **A** before aqueous silver nitrate.

.....

.....

(1)

(Total 10 marks)

Q1

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2. You are provided with:

- Solution **B**, aqueous hydrochloric acid.
- Solution **C**, aqueous sodium hydroxide of concentration 0.100 mol dm^{-3}.
- Phenolphthalein indicator.
- An empty volumetric flask, labelled **D**.

You are required to dilute the hydrochloric acid, then to titrate portions of the diluted acid with aqueous sodium hydroxide, solution **C**.

$$NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l)$$

(a) **Procedure**

1. Rinse out the volumetric flask, labelled **D**, with distilled water. It will not affect your results if a small amount of water is left in the flask.
2. Rinse out the pipette with a small amount of solution **B**. Then use the pipette to transfer 25.0 cm^3 of solution **B** to the volumetric flask **D**. Add distilled water to make up the solution in the flask to exactly 250 cm^3. Stopper the flask and **shake it thoroughly to mix** the diluted acid. This is now solution **D**.
3. Rinse out the burette with a small amount of solution **C** and then fill the burette with solution **C**.
4. Rinse out the pipette with distilled water and then with a small amount of solution **D**. Use the pipette to transfer 25.0 cm^3 of solution **D** to a conical flask and add 4 drops of phenolphthalein indicator.
5. Titrate with solution **C** until the end-point is reached.
6. Record your burette readings and titre in **Table 1**.
7. Repeat the procedure until you obtain **two** titres that differ by no more than 0.20 cm^3. Record all your burette readings and titres in **Table 1**.

Table 1

Titration number	1	2	3	4	5
Burette reading (final) /cm^3					
Burette reading (initial) /cm^3					
Titre /cm^3					

Leave blank

List the numbers of the titrations that you will use to calculate the mean (or average) titre.

Calculate the mean titre.

Write the value of your mean titre in the space below:

..... cm^3 of 0.100 mol dm^{-3} aqueous sodium hydroxide, solution **C**, react with 25.0 cm^3 of aqueous hydrochloric acid, solution **D**.

(12)

(b) **Calculations**

(i) Calculate the amount (moles) of sodium hydroxide in the mean titre.

(1)

(ii) State the amount (moles) of hydrochloric acid in 25.0 cm^3 of solution **D**. Then calculate the amount (moles) of hydrochloric acid in 250 cm^3 of solution **D**.

(1)

(iii) Using your answer in (ii), calculate the concentration of hydrochloric acid in solution **B** in mol dm^{-3}.

(2)

Leave blank

(c) (i) The procedure could be modified by titrating the undiluted hydrochloric acid, solution **B**, from the burette into 25.0 cm^3 of solution **C**.

Explain why the titre in this modified procedure would be less accurate than those you obtained.

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(2)

(ii) Explain why the pipette and burette were rinsed out with the solutions to be measured, not with water, but the volumetric flask was rinsed out with water.

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(2)

Q2

(Total 20 marks)

Leave blank

3. You are provided with:

- Solution **B**, aqueous hydrochloric acid.
- Solution **E**, aqueous sodium hydroxide of concentration 1.00 mol dm^{-3}.

You are required to measure the temperature change when aqueous sodium hydroxide reacts with an excess of aqueous hydrochloric acid.

(a) **Procedure**

1. Use a measuring cylinder to measure 25 cm^3 of solution **B** into a dry polystyrene cup held firmly in a 250 cm^3 beaker.
2. Use a second measuring cylinder to measure 25 cm^3 of solution **E** into a 100 cm^3 beaker. Place and hold the thermometer in solution **E**. Measure the temperature of solution **E** to an accuracy of at least 0.5 °C. Record the temperature in **Table 2**.
3. Remove the thermometer from solution **E** then rinse it with water and dry it. Place the thermometer in solution **B** in the polystyrene cup. Measure the temperature of solution **B** to an accuracy of at least 0.5 °C. Record the temperature in **Table 2**.
4. Add solution **E** to solution **B**. Stir the mixture gently with the thermometer and measure the highest temperature reached to an accuracy of at least 0.5 °C. Record the temperature in **Table 2**.

Table 2

$\mathbf{T_1}$, temperature of solution **E**	°C
$\mathbf{T_2}$, temperature of solution **B**	°C
$\mathbf{T_3}$, highest temperature after mixing	°C

Calculate the temperature change using the formula given below.

$$T_3 - \frac{(T_1 + T_2)}{2}$$

Temperature change = ... °C

(6)

Leave blank

(b) **Calculations**

(i) Calculate the amount (moles) of sodium hydroxide in 25 cm^3 of solution **E**.

(1)

(ii) Calculate the heat change when 25 cm^3 of solution **E** reacts with 25 cm^3 of solution **B**.

Assume that the density of the solution after mixing **E** and **B** is 1.0 g cm^{-3} and that the specific heat capacity of the solution is 4.18 J g^{-1} °C^{-1}.

(1)

(iii) Use your answers to (i) and (ii) to calculate the molar enthalpy change when aqueous sodium hydroxide reacts with aqueous hydrochloric acid.

Give your answer in kJ mol^{-1} to **two** significant figures and include a sign.

(3)

(iv) Suggest TWO modifications to the procedure that may give a more accurate value for the enthalpy change.

1 .....

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2 .....

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(2)

Q3

(Total 13 marks)

Leave blank

4. Aqueous hydrochloric acid reacts with solid calcium carbonate as shown in the equation below. Carbon dioxide is given off as a gas.

$$2HCl(aq) + CaCO_3(s) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

You are required to plan an experiment to obtain results which can be used to calculate the **concentration of the hydrochloric acid**.

You are provided with 100 cm^3 of hydrochloric acid, of suitable concentration, and a sample of calcium carbonate (an excess) as small pieces.

You may use any laboratory apparatus you require **but no other chemical substances**, apart from water.

Include in your plan:

- the apparatus you would use (include a diagram if you wish)
- the procedure you would follow
- the measurements you would make
- an explanation of how you would use your results to calculate the concentration of the hydrochloric acid in units of mol dm^{-3}.

You may need to use some of the data below.

Molar masses / g mol^{-1}; C = 12.0 O = 16.0 Ca = 40.0

At the temperature of the experiment, 1 mol of carbon dioxide has a volume of 24 000 cm^3.

You are not required to carry out your plan.

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Q4

(Total 7 marks)

TOTAL FOR PAPER: 50 MARKS

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