Rewarding Learning

Centre Number

71

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2009

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination 1

[AC131]

AC131

MONDAY 11 MAY, AFTERNOON

TIME

2 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Answer **all seven** questions.
Write your answers in the spaces provided.

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.
Section A
Question 1 is a practical exercise worth 25 marks.
Question 2 is a practical exercise worth 29 marks.
Section B
Question 3 is a planning exercise worth 20 marks.
Questions 4–7 are written questions worth a total of 16 marks, testing aspects of experimental chemistry.
Figures in brackets printed down the right-hand side of pages indicate the mark awarded to each question or part question.
A Periodic Table of Elements (including some data) is provided.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
Total Marks	

Section A

1 Titration exercise

You are provided with:

Sodium hydroxide solution of concentration 0.10 mol dm^{-3}.
Vinegar (ethanoic acid) of unknown concentration.
Phenolphthalein indicator.

You are required to carry out a titration and use your results to calculate the concentration of ethanoic acid in the vinegar.

(a) Give details of the procedure you intend to use:

_____

_____

_____

_____

_____

_____

_____ [4]

(b) Carry out your procedure. Present your results in a suitable table and calculate the average titre.

[12]

(c) State the colour change at the end point of your titration

_____ to _____ [1]

(d) Write the equation, including state symbols, for the reaction of sodium hydroxide with the ethanoic acid present in vinegar.

_____ [2]

(e) **(i)** Calculate the number of moles of sodium hydroxide used in the titration.

_____

_____ [2]

(ii) Calculate the number of moles of ethanoic acid neutralised in the titration.

_____

_____ [1]

(iii) Calculate the concentration (in mol dm^{-3}) of ethanoic acid in the vinegar.

_____

_____ [2]

(iv) Calculate the concentration (in g dm^{-3}) of ethanoic acid in the vinegar.

_____

_____ [1]

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(Questions continue overleaf)

2 Observation/deduction

Safety goggles must be worn at all times and care should be exercised during this practical examination.

(a) You are provided with a mixture of two salts, labelled A, which have a common cation. Carry out the following experiments on the mixture. Record your observations and deductions in the spaces below and identify the two salts.

Experiment	Observations	Deductions
1 Describe the appearance of A.		
2 Dip a wire loop in concentrated hydrochloric acid; touch sample A with the wire, then hold it in a blue Bunsen flame.		
3 In a fume cupboard, add about 1 cm^3 of concentrated sulphuric acid to a half spatula-measure of A in a test tube. Test the gas given off using a glass rod which has been dipped into concentrated ammonia solution.		
4 Make a solution of A by dissolving a quarter spatula-measure of A in a test tube quarter-full of dilute nitric acid. Put 1 cm^3 of the solution into each of two separate test tubes. **(a) (i)** Add a few drops of silver nitrate solution into the first test tube. **(ii)** Then add about 1 cm^3 of concentrated ammonia into the same test tube. **(b)** Add a few drops of barium chloride solution into the second test tube.		

Name the two salts present in A:

_____

_____

(b) You are provided with an aqueous solution containing an organic substance X. Carry out the following experiments. Record your observations and deductions in the spaces below.

Experiment	Observations	Deductions
1 Describe the solution and test it with Universal Indicator paper.		
2 In a fume cupboard, shake a small volume of the solution with bromine water.		
3 Heat about 2 cm^3 of the solution with 2 cm^3 of potassium dichromate solution and 2 cm^3 of dilute sulphuric acid.		

Based on the above tests, suggest

A functional group which may be present in X:

_____

A functional group which the tests used above show is absent from X:

_____ [29]

Section B

3 Planning

You are required to plan an experiment to determine the degree of hydration in a sample of sodium carbonate. If the sample of hydrated sodium carbonate is heated in a crucible to constant mass and appropriate masses measured, the value of x in the formula $Na_2CO_3.xH_2O$ can be found.

(a) (i) Explain the meaning of the term "**hydrated** sodium carbonate".

_____

_____ [1]

(ii) Draw a labelled diagram to show the apparatus which could be used to heat the hydrated sodium carbonate.

[3]

(b) (i) What masses should be recorded before heating the hydrated sodium carbonate?

_____

_____ [2]

(ii) The hydrated sodium carbonate is heated to remove all the water. What steps would you take to ensure that it had all been removed?

_____

_____

_____ [3]

(iii) After heating, state **one** safety precaution which should be followed before weighing.

_____

_____ [1]

(c) When 11.44 g of hydrated sodium carbonate was heated, 4.24 g of anhydrous sodium carbonate was formed.

(i) What is the mass of water lost?

_____ [1]

(ii) What is the number of moles of water lost?

_____ [1]

(iii) What is the number of moles of anhydrous sodium carbonate formed?

_____ [1]

(iv) Calculate the value of x in $Na_2CO_3.xH_2O$.

_____

_____ [2]

(d) When 2.65 g of the anhydrous sodium carbonate was added to 50.0 cm^3 of a 2.0 mol dm^{-3} solution of hydrochloric acid (an excess) in a polystyrene cup, a temperature increase of 4.8 K was recorded.

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$

(i) Calculate the number of moles of sodium carbonate.

_____

_____ [1]

(ii) Assuming that the solution has a heat capacity of 4.2 J K^{-1} g^{-1} and that the density of the solution is 1.0 g cm^{-3}, calculate the heat energy (in J) released in this reaction.

_____

_____ [2]

(iii) Given that hydrochloric acid is present in excess, calculate the enthalpy change for the reaction (in kJ per mole of sodium carbonate).

_____

_____ [2]

4 A student used 13.7 cm^3 of butan-1-ol (density = 0.81 $g\,cm^{-3}$ and RFM = 74) to produce 10.28 g of 1-bromobutane (RFM = 137).

(a) Calculate the mass of butan-1-ol used.

_____

_____ [1]

(b) Calculate the number of moles of butan-1-ol used.

_____

_____ [1]

(c) What is the theoretical yield of 1-bromobutane in moles?

_____

_____ [1]

(d) Calculate the actual yield of 1-bromobutane in moles.

_____

_____ [1]

(e) State the equation which is used to calculate the percentage yield of a product.

_____ [1]

(f) Calculate the percentage yield of product.

_____

_____ [1]

5 Heating a reaction mixture under reflux is an important practical technique in organic chemistry.

(a) Draw a labelled diagram of the apparatus used to reflux a reaction mixture.

[3]

(b) Why are anti-bumping granules added to reaction mixtures which are being refluxed?

_____ [1]

6 Some qualitative tests are extremely sensitive and can detect very low concentrations of ions in solution.

(a) Name the reagent used to distinguish between $Fe^{2+}(aq)$ and $Fe^{3+}(aq)$.

_____ [1]

(b) Name another reagent which can be used to detect low concentrations of $Fe^{3+}(aq)$.

_____ [1]

(c) What would be observed in a positive test?

_____

_____ [1]

7 Separating funnels can be used to remove impurities from crude organic liquids. They are shaken with an aqueous solution and then separated from the aqueous layer.

(a) How would you decide which layer was the aqueous layer?

_____

_____

_____ [2]

(b) Why would anhydrous calcium chloride be added to the organic liquid after separation?

_____

_____ [1]

THIS IS THE END OF THE QUESTION PAPER