Centre Number

71	

Candidate Number

Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2009

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination 1

[ASC31]

ASC31

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 four** questions.
Write your answers in the spaces provided.

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.
Questions 1 and 2 are practical exercises each worth 25 marks.
Question 3 is a planning exercise worth 20 marks.
Question 4 is a written question testing aspects of experimental chemistry worth 20 marks.
You may have access to notes, textbooks and other materials to assist you.
A Periodic Table of Elements (including some data) is provided.

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
Total Marks	

1 Observation/deduction

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

Answer parts **(a)** and **(b)** of question 1.

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

Experiment	Observations	Deductions
(i) Describe the appearance of X.		
(ii) Add half a spatula-measure of X to a test tube a quarter full of water. Stir or shake the solid with the water. Add an equal volume of dilute hydrochloric acid. Add 1 cm^3 of barium chloride solution.		
(iii) Place a half spatula-measure of X on a watch-glass and add 3 drops of **concentrated** hydrochloric acid. Use a clean loop of nichrome wire to place a small amount of this acidified sample of X in a blue Bunsen flame.		
(iv) Place a spatula-measure of X in a test tube, add 2 cm^3 of dilute sodium hydroxide solution and warm gently. Test any gas evolved with damp Universal Indicator paper.		

Name the **two** salts in X ______________________________

____

(b) You are supplied with three halobutanes labelled A, B and C. Carry out [illegible]ment and complete the table below. Identify A, B and C.

Experiment	**Observations**	**Deductions**
Place 1 cm^3 of A, B and C separately in three test tubes. Label the test tubes with their contents. Add 1 cm^3 of ethanol and 1 cm^3 of silver nitrate solution to each test tube. Place the three test tubes in a beaker of water heated to just below boiling point. Leave for 5 minutes.	A	A
	B	B
	C	C

A is ______________________________

B is ______________________________

C is ______________________________ [25]

2 Titration

(a) You are provided with:

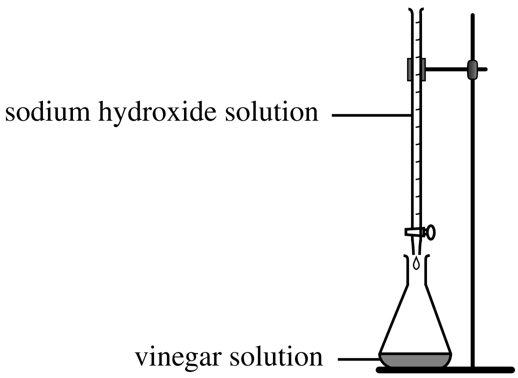
sodium hydroxide solution, 0.05 mol dm^{-3}
vinegar solution of unknown concentration
phenolphthalein indicator

You are required to:

(i) titrate the vinegar solution against the sodium hydroxide solution using phenolphthalein as indicator;

(ii) use your results to determine the concentration of the vinegar.

Procedure



- Rinse out a pipette with the vinegar solution.
- Using the pipette and pipette filler, place 25.0 cm^3 of the vinegar solution in the conical flask.
- Rinse out a burette with the sodium hydroxide solution.
- Fill the burette with the sodium hydroxide solution.
- Add 2 or 3 drops of phenolphthalein indicator to the conical flask, and titrate until the end point is reached.
- Record the results of one rough and two accurate titrations in the table.

Results

	Initial burette reading/cm^3	**Final burette reading/cm^3**	**Titre/cm^3**
Rough			
1st accurate			
2nd accurate			

Average titre ____________ cm^3 [15]

Examiner Only	
Marks	Remark

(b) (i) State the colour change at the end point.

from ______________________ to ______________________ [1]

(ii) Calculate the number of moles of sodium hydroxide used in the titration.

____

____ [2]

(iii) Write an equation for the reaction of sodium hydroxide with ethanoic acid, CH_3COOH.

____ [2]

(iv) Deduce the number of moles of ethanoic acid present in 25.0 cm^3 of the vinegar solution.

____ [1]

(v) Calculate the number of moles of ethanoic acid present in 1 dm^3 of the vinegar solution.

____

____

____ [2]

(vi) Convert your value of moles of ethanoic acid calculated in **(v)** into grams of ethanoic acid.

____

____ [2]

3 Planning

You are required to plan an experiment to convert ethanol to ethene by dehydration. You are provided with the following:

- test tubes
- delivery tube
- water trough
- Bunsen burner
- retort stand, clamp and boss
- ceramic wool
- ethanol
- aluminium oxide

An appropriate procedure would involve

- soaking some ceramic wool with ethanol and placing it in the bottom of a test tube,
- clamping the test tube horizontally and placing a spatula-measure of aluminium oxide half way down the tube,
- passing ethanol vapour over heated aluminium oxide and collecting the gas formed over water.

(a) Draw a labelled diagram of how the apparatus could be arranged to carry out this reaction.

[4]

(b) State **two** weighings required to determine the mass of ethanol at the start of the experiment.

____

____ [2]

(c) (i) Why is the aluminium oxide heated?

____ [1]

(ii) Although the Bunsen burner is to be placed under the aluminium oxide, why is it occasionally used to heat the ceramic wool soaked in ethanol?

____

____ [1]

(d) Explain why the first few bubbles given off are not collected.

____ [1]

(e) One of the main hazards in this procedure is the possibility of water being drawn back into the heated tube (suck back).

(i) Explain why water may be drawn back into the heated test tube.

____

____ [1]

(ii) State what should be done if water is seen rising up the delivery tube towards the heated test tube.

____

____ [1]

(f) (i) What is meant by the term **dehydration**?

____ [1]

(ii) Write an equation for the dehydration of ethanol.

____ [1]

(iii) Calculate the maximum volume of ethene which could be produced, at 20°C and 1 atmosphere pressure, if 1.30 g of ethanol was used.

____

____ [2]

(iv) Suggest why the volume of ethene collected is less than the calculated volume.

____ [1]

(v) Describe a chemical test which would confirm that the product is an unsaturated hydrocarbon.

____

____ [3]

(vi) Explain why no ethanol is found in the sample of ethene collected over water.

____ [1]

4 Structured

An early edition of a Practical Organic Chemistry manual reported:

The preparation of ethanal (b.p. 21°C).

Weigh 7.5 g of sodium dichromate and place in a distillation flask with 15 cm^3 of water. Fit the flask to the rest of the distillation apparatus. Mix 3 cm^3 of concentrated sulphuric acid and 6 cm^3 of ethanol (density = 0.79 g cm^{-3}), adding the acid slowly, with shaking and cooling, and transfer the mixture to a tap funnel.

Heat the dichromate solution to 50 °C and allow the mixture in the tap funnel to run in slowly with occasional shaking. When the reaction begins, remove the flame until the vigour of the reaction subsides, then distil and collect the first 6 cm^3 which will contain a mixture of ethanol, water and ethanal.

(a) Ethanol is a liquid.

(i) Suggest why its volume is measured rather than its mass.

____

____ [1]

(ii) Calculate the mass of ethanol used.

____

____ [2]

(b) Suggest why the procedures in the experiment are carried out **slowly**.

____

____ [2]

(c) If the colour remaining in the flask after the experiment has finished is orange, explain which reactant is in excess.

____

____ [2]

(d) In this method the ethanal formed is not oxidised.
Suggest why the experimental procedure prevents this oxidation.

____ [1]

(e) If the ethanal is refluxed with the oxidising agent it is oxidised further.

(i) Draw a diagram of a flask showing a condenser in the reflux position. There is no need to label the diagram.

[2]

(ii) What is the ethanal oxidised to?

____ [1]

(f) Suggest why the distillate is best collected in a flask surrounded by ice.

____

____ [1]

(g) The equation for the reaction is:

$$3C_2H_5OH + Na_2Cr_2O_7 + 4H_2SO_4 \rightarrow 3CH_3CHO + 7H_2O + Na_2SO_4 + Cr_2(SO_4)_3$$

Examiner Marks | Remark

(i) Calculate the molar mass of ethanol.

____

____ [1]

(ii) Calculate the number of moles of ethanol used.

____ [1]

(iii) If 0.1 mole of ethanal is produced calculate the percentage yield.

____

____

____ [2]

(h) Suggest how you could obtain ethanal from the mixture collected at the end of the experiment.

____

____

____ [2]

(i) The student, having finally obtained the distillate containing ethanal, ethanol and water added a few drops to a beaker of boiling water. Explain what would happen.

____

____

____ [2]

THIS IS THE END OF THE QUESTION PAPER