Rewarding Learning

Centre Number

71

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2011

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination 2

[AC132]

AC132

WEDNESDAY 11 MAY

TIME

2 hours 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Answer **all five** 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 and 5 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 marks awarded to each question or part question.
A Periodic Table of Elements (including some data) is provided.

Question Number	Marks	
	Teacher Mark	Examiner Check
1		
2		
3		
4		
5		
Total Marks		

Section A

Tea… Mar…	…emark

1 Titration exercise

Vinegar is a 4–5% aqueous solution of ethanoic acid.

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

You are provided with:

Sodium hydroxide solution of concentration $0.05\,\text{mol}\,\text{dm}^{-3}$
A sample of vinegar of unknown concentration
Phenolphthalein indicator

(a) Carry out the titration by:

- rinsing out a burette with the $0.05\,\text{mol}\,\text{dm}^{-3}$ sodium hydroxide solution
- filling the burette with the $0.05\,\text{mol}\,\text{dm}^{-3}$ sodium hydroxide solution
- transferring $25.0\,\text{cm}^3$ of the vinegar to the conical flask
- adding 2–3 drops of phenolphthalein indicator to the solution in the conical flask and titrating until the end point is reached

Present your results in a suitable table and calculate the average titre.

[12]

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

_____ to _____ [1]

(c) Write the equation for the reaction of ethanoic acid with sodium hydroxide.

_____ [2]

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

_____

_____ [1]

(ii) Calculate the number of moles of ethanoic acid in 25.0 cm^3 of vinegar.

_____ [1]

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

_____ [2]

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

_____ [1]

(v) Calculate the percentage of ethanoic acid in vinegar assuming the density of vinegar to be 1 g cm^{-3}.

_____ [1]

(e) Anhydrous (concentrated) ethanoic acid is called glacial ethanoic acid as it freezes to form ice-like crystals. Describe how you would prepare a diluted solution of glacial ethanoic acid from 1 cm^3 of the concentrated acid to make 250 cm^3 of diluted solution and safely transfer 25.0 cm^3 of the diluted solution to a conical flask ready for titration.

Tea Mar | Remark

_____

_____

_____

_____

_____

_____ [4]

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(Questions continue overleaf)

2 Observation/deduction

Tea... Mar...	...emark

Safety glasses must be worn at all times and care should be taken 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 A.	[1]	[1]
2 **(a)** Make a solution of A by dissolving a spatula measure of A in a test tube half full of water. **(b)** Acidify 2 cm^3 of this solution with 1 cm^3 of dilute nitric acid and then add 1 cm^3 of silver nitrate solution. **(c)** Add 5 cm^3 of dilute ammonia solution to the test tube.	[3]	[3]
3 **(a)** Add 1 cm^3 of the solution formed in part 2(a) above to another test tube. **(b)** Acidify with 3 drops of dilute nitric acid and then add 3 drops of barium chloride solution.	[1]	[1]
4 **(a)** Make a solution of A by dissolving half a spatula measure of A in a test tube one third full of water. **(b)** Add 3 drops of dilute ammonia solution to the test tube. **(c)** Add excess dilute ammonia solution to the same test tube.	[3]	[2]
5 **(a)** Place a spatula measure of A on a watch glass and add a few drops of **concentrated** hydrochloric acid. **(b)** Use a clean loop of nichrome wire to place a small amount of this acidified sample of A in a blue Bunsen flame.	[2]	[2]
6 Place a spatula measure of A in a dry test tube and heat gently.	[1]	[1]

Name the **two** salts present in A:

_____

_____ [2]

(b) You are supplied with three **primary** halobutanes labelled X, Y and Z. Carry out the experiment and complete the table below. Identify X, Y and Z.

Experiment	Observations	Deductions
Place 1 cm^3 of X, Y and Z separately into 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 50–60 °C. Leave for 5 minutes noting the relative rate of reaction.	**X** [1]	**X** [1]
	Y [1]	**Y** [1]
	Z [1]	**Z** [1]

Name the unknown samples.

X _____

Y _____

Z _____ [3]

Order of reactivity for X, Y and Z (most reactive first) _____ [1]

max [29]

Section B

Teacher's Mark	Remark

3 Planning

The value of x in the formula $Ni(NO_3)_2.xH_2O$ (hydrated nickel(II) nitrate) may be determined by gently heating a known mass of the solid to drive off all the water of crystallisation and reweighing.

(a) (i) What is meant by the term **water of crystallisation**?

_____

_____ [1]

(ii) Hydrated nickel(II) nitrate is a green crystalline solid. State **one** observation which may be made during the dehydration of the hydrated nickel(II) nitrate.

_____ [1]

(iii) State how you could ensure, using weighings, that all of the water was removed.

_____

_____ [2]

(b) In an experiment 3.22 g of hydrated nickel(II) nitrate, $Ni(NO_3)_2.xH_2O$, produced 2.02 g of the anhydrous salt.

(i) Write the equation for the dehydration.

_____ [1]

(ii) Using the above data calculate the mass of water given off.

_____ [1]

(iii) Calculate the number of moles of water given off.

_____ [1]

(iv) Calculate the number of moles of anhydrous nickel(II) nitrate formed.

_____ [1]

(v) Determine the value of x in $Ni(NO_3)_2.xH_2O$.

_____

_____ [1]

(vi) Suggest **one** reason why the value of x determined by this experiment may be less than the actual value.

_____

_____ [1]

(vii) Prolonged strong heating will result in a higher value of x being determined. Suggest what effect strong heating may have on the salt.

_____ [1]

(c) Hydrated magnesium sulfate, $MgSO_4.7H_2O$, may be prepared by reacting magnesium metal with excess dilute sulfuric acid.

$$Mg(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2(g)$$

(i) State **two** observations during the reaction.

_____

_____ [2]

(ii) Crystals of the hydrated salt are obtained from the resulting solution. Describe how pure, dry crystals of the hydrated salt may be obtained from the solution.

_____

_____

_____

_____

_____ [4]

(iii) In an experiment a student reacted 2.34 g of magnesium ribbon with excess dilute sulfuric acid. A total of 16.35 g of the hydrated salt were obtained. Calculate the percentage yield of the hydrated salt.

_____

_____

_____

_____ [3]

4 Ethanal is a colourless, volatile liquid with a boiling point of 21 °C. It can be prepared by heating together a mixture of sulfuric acid, sodium dichromate and ethanol at 50 °C in a distillation apparatus.

Tea… Mar…	…emark

(a) Explain what is meant by the term **volatile**.

_____ [1]

(b) **(i)** State the function of the acidified sodium dichromate.

_____ [1]

(ii) State the expected colour change in the reaction vessel.

_____ [2]

(c) **(i)** Explain why the ethanal must be distilled off as quickly as it is formed.

_____ [1]

(ii) Name **two** organic impurities which may be present in the sample of ethanal collected.

_____ [2]

(iii) State **two** reasons why the yield obtained would be less than 100%.

_____

_____

_____ [2]

5 **(a)** Explain, with expected observations, how you would use aqueous ammonia to distinguish between aqueous solutions containing dissolved aluminium ions and zinc ions.

_____

_____

_____

_____ [3]

(b) State **two** tests, including expected observations, which would confirm that a solution contains both potassium ions and thiocyanate ions (SCN^-).

potassium ion test _____

_____

_____ [2]

thiocyanate ion test _____

_____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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