Rewarding Learning

ADVANCED
General Certificate of Education
2015

Centre Number

Candidate Number

Chemistry

Assessment Unit A2 3
assessing
Module 3: Practical Examination
Practical Booklet B

ML

[AC234]
MONDAY 11 MAY, MORNING

TIME

1 hour 15 minutes, plus your additional time allowance.

INSTRUCTIONS TO CANDIDATES

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

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Question 1 is a practical exercise worth 17 marks.
Question 2 is a practical exercise worth 13 marks.
Question 3 is a planning exercise worth 20 marks.
Quality of written communication will be assessed in **Question 3**.
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.
You may not have access to notes, textbooks and other material to assist you.

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

Examiner Mark	Remark

1 People with anaemia often take 'iron' tablets which contain hydrated iron(II) sulfate, $FeSO_4 \cdot 6H_2O$.

(a) The composition of these tablets can be analysed by titration with acidified potassium manganate(VII) solution.

(i) Write the ionic equation for this reaction.

_____ [2]

(ii) State the colour observed at the end point of this titration.

_____ [1]

(iii) Write down the formula of the ion responsible for the colour observed at the end point of this reaction.

_____ [1]

(iv) One of the major sources of error in this titration is overshooting the end point. State **two** practical techniques used to minimise this error.

_____

_____ [2]

(b) 6.0 g of crushed iron tablets were dissolved in deionised water. This solution was then made up to 250 cm^3 in a volumetric flask. Describe how the solution containing the iron tablets was prepared.

_____

_____

_____

_____

_____ [4]

Examiner Mark	Remark

(c) Titration of 25.0 cm^3 samples of the iron tablets solution with 0.020 mol dm^{-3} potassium manganate(VII) solution resulted in an average titre value of 22.4 cm^3. Calculate the percentage of $FeSO_4 \cdot 6H_2O$ in the tablets.

[4]

(d) Over time the percentage of iron(II) sulfate decreases due to the oxidation of the iron(II) to become iron(III). A reagent which can be used to detect the presence of iron(III) salts is potassium thiocyanate solution.

(i) What will be observed if potassium thiocyanate solution is added to a solution containing iron(III) ions?

[1]

(ii) Write down an ionic equation for the reaction that occurs.

[2]

2 Deductions exercise

(a) (i) Based on the following observations, make deductions for salt **A**.

Test	Observations	Deductions
1 Dissolve **A** in 20 cm^3 of water.	*Orange solution.*	
2 Add a few drops of concentrated ammonia solution to 2 cm^3 of the solution of **A** in a test tube.	*Rust precipitate forms immediately.*	[1]
3 Add 1 cm^3 of barium chloride solution to 2 cm^3 of the solution of **A** in a test tube. Allow the mixture to settle.	*White precipitate.*	[1]

(ii) Write down the formula of salt **A**.

_____ [1]

Examiner Mark	Remark

(b) (i) Interpret the following data and identify the structural formula of the organic compound **B**, which has the *empirical* formula C_2H_4O.

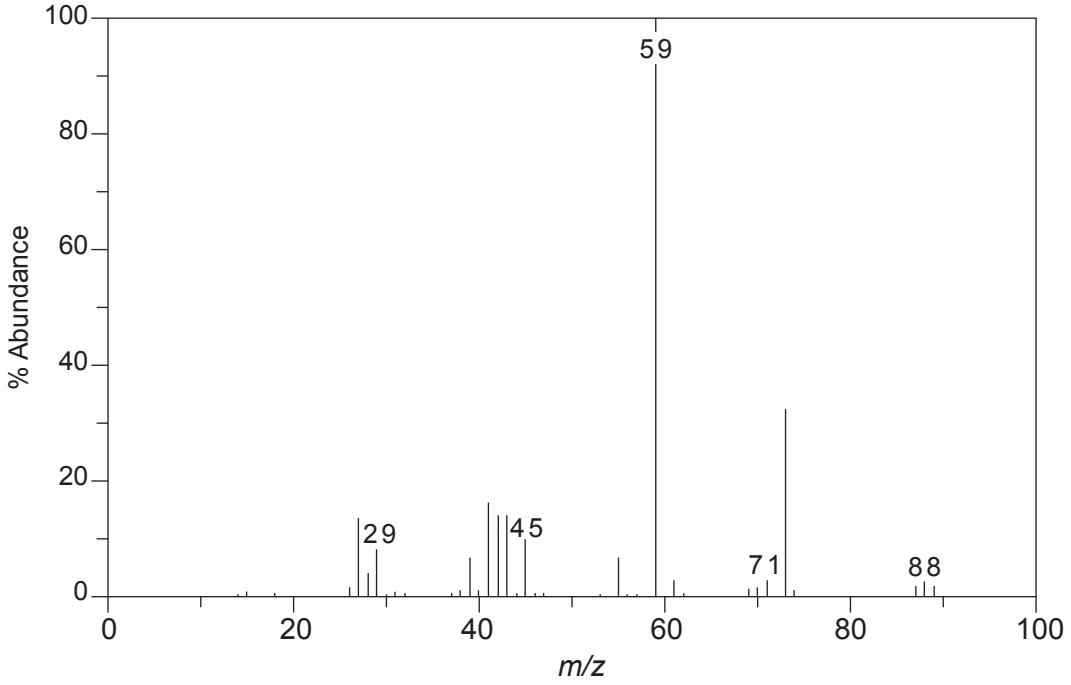
	Test	Observations	Deductions
1	Describe the appearance of **B**.	*Colourless liquid.* *Pungent smell.*	
2	Add 2 cm^3 of deionised water to 2 cm^3 of **B** in a test tube.	*One layer forms.*	[1]
3	Add 10 drops of **B** to 2 cm^3 of acidified potassium dichromate solution in a test tube. Place the test tube in a hot water bath.	*Solution stays orange.*	[1]
4	Place 2 cm^3 of **B** into a test tube. In a fume cupboard, **cautiously** add a very small spatula measure of phosphorus(V) chloride to the test tube.	*Fizzing.* *Solid reacts.* *White fumes.*	[1]
5	Place 5 cm^3 of **B** in a boiling tube. Add 5 cm^3 of ethanol, and then 1 cm^3 of concentrated sulfuric acid. Heat the boiling tube in a water bath. **Cautiously** smell the contents of the boiling tube.	*Sweet smell.*	[1]
6	Add a spatula measure of sodium carbonate to 2 cm^3 of **B** in a test tube.	*Fizzing.* *Solid dissolves.*	[2]

(ii) To what homologous series does **B** belong?

_____ [1]

Examiner Mark	Remark

The mass spectrum of **B** is shown below:



(iii) Draw a structure for **B** showing all the bonds present.

[2]

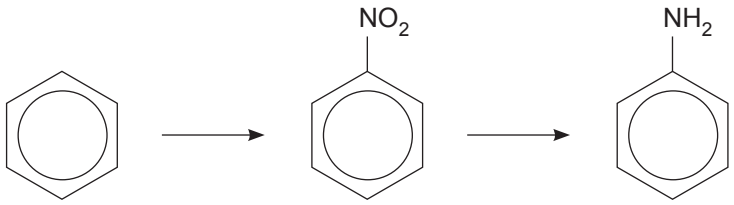
(iv) Identify the species responsible for the base peak in the spectrum above.

[1]

Examiner Mark	Remark

Examiner Mark	Remark

3 Benzene is used to prepare nitrobenzene (b pt. 211 °C), which is then used to make phenylamine (b pt. 184 °C).



Nitrobenzene is prepared from benzene as follows:

Concentrated nitric acid, concentrated sulfuric acid and benzene (density 0.88 g cm^{-3}) are mixed slowly in a round-bottomed flask, ensuring the temperature does not rise above 60 °C.
A reflux condenser is attached and the mixture is heated on a water bath for thirty minutes. The mixture is poured into 100 cm^3 of water and the acidic impurities are removed.
The organic layer is run off, dried with anhydrous sodium sulfate and placed into a round-bottomed flask.
The apparatus is rearranged for distillation and the contents of the round-bottomed flask are distilled using an air condenser (a condenser where no water flows through the outside jacket), collecting the fraction boiling between 207–211 °C.

(a) Suggest why ammonia will **not** react with benzene.

_____ [1]

(b) (i) Define the term **reflux**.

_____

_____ [1]

(ii) Draw a labelled diagram of the apparatus used for this distillation.

[4]

Examiner Mark	Remark

(c) Calculate the volume of benzene required to synthesise 7 g of nitrobenzene assuming a 90% yield.

[4]

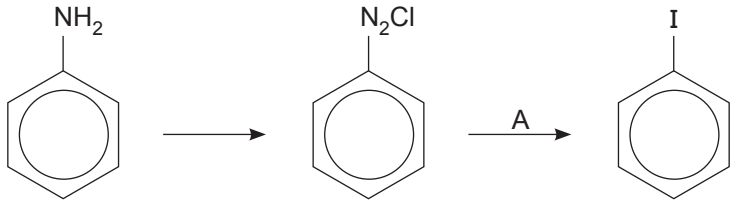
(d) Outline, giving practical details, how acidic impurities can be removed from the crude liquid prior to distillation.

[4]

Quality of written communication [2]

Examiner Mark	Remark

(e) Phenylamine can be converted to iodobenzene, according to the following flow scheme:



(i) Draw the structure of the benzenediazonium ion.

[2]

(ii) Identify the reagents and conditions for stage A.

_____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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