

Friday 16 June 2017 – Morning

LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE IN THE WORKPLACE

R075/02 How scientific data is used

Candidates answer on the Question Paper.
A calculator may be used for this paper.

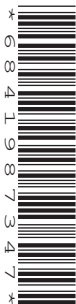
OCR supplied materials:

None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 1 hour



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **50**.
- The quality of written communication is assessed in questions marked with a pencil (✎).
- This document consists of **20** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Rose works for a food quality laboratory.

She uses titrations to find out the concentration of acid in bottles of vinegar.

She adds a few drops of indicator to 20.0 cm^3 samples of vinegar and then adds dilute sodium hydroxide from a burette.

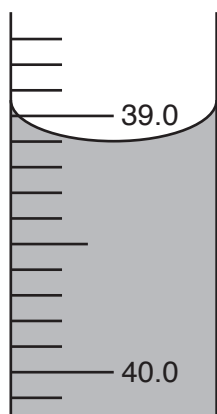
(a) These are some of her results.

	Rough	Titration 1	Titration 2	Titration 3
End volume sodium hydroxide (cm^3)	21.0	41.5	20.4	
Start volume sodium hydroxide (cm^3)	0.0	21.0	0.0	
Volume sodium hydroxide used (cm^3)	21.0	20.5	20.4	

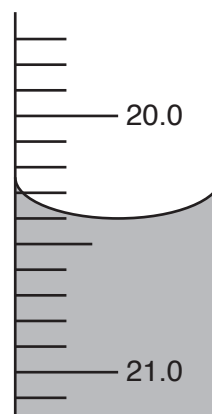
(i) How does Rose know when to stop adding sodium hydroxide from the burette to the vinegar?

.....
 [1]

(ii) The diagrams show the start and final burette readings for **titration 3**.



End volume of sodium hydroxide (cm^3)



Start volume of sodium hydroxide (cm^3)

Use the diagrams to complete the table above for **titration 3**.

[3]

(iii) Do you think Rose needs to do a fourth titration?

Use data from the table opposite to support your answer.

.....

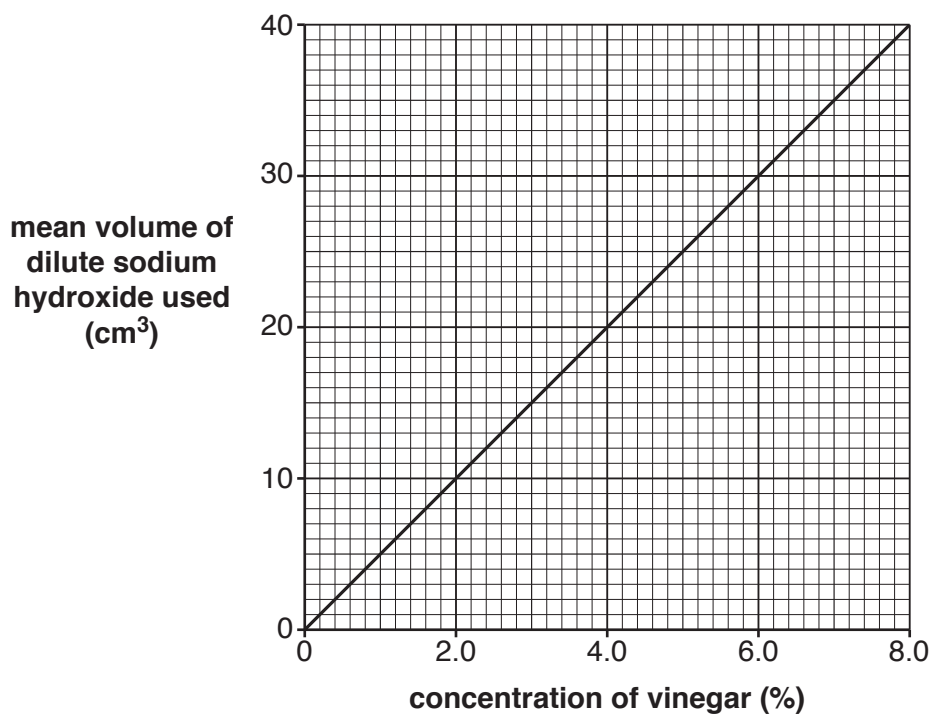
..... [2]

(b) Rose does titrations using 20.0 cm^3 of five different types of vinegar, **A**, **B**, **C**, **D** and **E**.

The table shows the mean volume of dilute sodium hydroxide used for each vinegar.

Vinegar	Mean volume of dilute sodium hydroxide used (cm^3)
A	15.0
B	19.0
C	22.0
D	25.0
E	43.5

She uses this calibration graph to work out the percentage concentration for each vinegar.



2 Liz works for a laboratory which tests the quality of seawater.

She uses test tube tests to identify ions in the seawater.

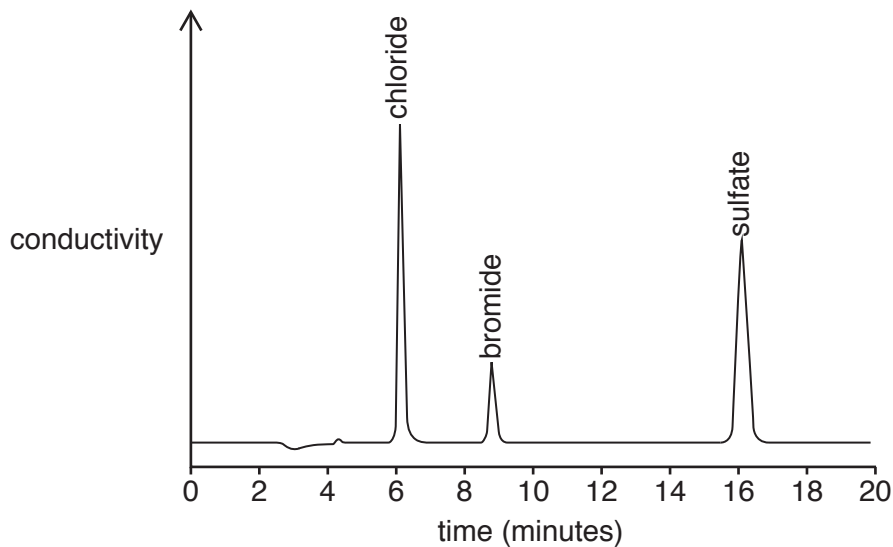
In her test tube tests she adds dilute silver nitrate solution and dilute barium nitrate solution to separate samples of seawater.

She also uses ion chromatography to identify ions in the seawater.

These are the results of her test tube tests.

Test tube test	Result
dilute silver nitrate	white precipitate
dilute barium nitrate	white precipitate
add dilute hydrochloric acid	no reaction

This is the result of her ion chromatography.



(a) How does the ion chromatography result **agree** with the results of the test tube tests?

Explain your answer.

.....

.....

.....

..... [3]

(b) What extra information about the ions in the seawater does the ion chromatography show?

.....
..... [1]

(c) Ion chromatography is both a qualitative and a quantitative technique.

Explain the differences between qualitative and quantitative techniques.

.....
.....
..... [2]

[Total: 6]

3 A company makes metal salts for use in medicines and agriculture.

Ben tests the properties of some solutions of metal salts.

(a) Ben uses pH indicator paper to test the pH of the salts.

He finds the pH by comparing the colour of the pH paper to a colour chart.

He also tests the pH using a pH meter.

These are Ben's results.

Metal salt solution	Colour of pH paper	pH from chart	pH meter reading
Copper sulfate	Yellow	6	5.6
Copper chloride	Yellow	6	5.8
Iron sulfate	Pink	3	2.9
Iron chloride	Pink	3	3.1

(i) Ben needs to avoid contaminating the solution he is testing with ions from any other solution.

Which technique, using pH paper or a pH meter, is **most** likely to cause contamination?

Explain your answer.

.....
 [1]

(ii) Give **two** advantages of using a pH meter instead of pH paper to test the metal salt solutions.

1

.....

2

..... [2]

(b) Ben looks at the results for the two copper salts he has tested.

Ben thinks that all copper salts might have the same pH.

Suggest one way that Ben could collect primary data and one way that he could collect secondary data to find out if he is right.

Primary data

.....

Secondary data

..... [2]

(c) Some of the solutions that Ben needs to test contain unknown metal ions.

What techniques could Ben use to identify the unknown metal ions?

Put ticks (✓) in the boxes next to the **two** correct answers.

flame tests

adding dilute sodium hydroxide

titration

colorimetry

[2]

[Total: 7]

4 Jill works for a mining company.

She tests samples of rock to see whether they contain minerals.

Pieces of rock are sent to the company from different places.

(a) How does Jill choose her samples so they are **representative**?

.....
..... [1]

(b) The rock contains crystals of minerals.

(i) Jill has a hand lens (magnifying glass), a light microscope and an electron microscope in her laboratory.

Jill chooses the hand lens to find out the shape and colour of the crystals.

Give **two** advantages of using the hand lens compared with using the light microscope or the electron microscope.

1
.....
2
..... [2]

(ii) Jill uses the light microscope with magnification **x50** to look at a crystal.

The length of the image is 3 mm.

Calculate the actual length of the crystal.

Show your working.

actual length of crystal = mm [2]

[Total: 5]

11
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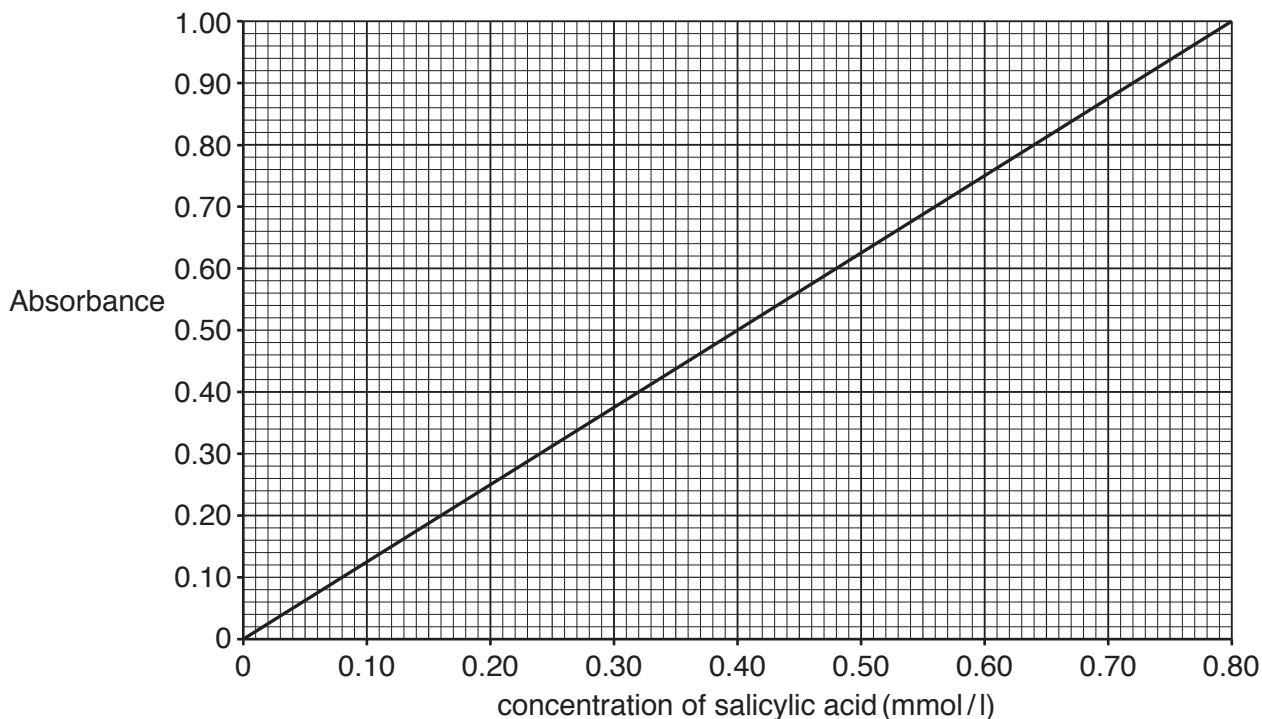
5 Abi works in the quality control department of a pharmaceutical company.

She tests aspirin tablets to check the percentage of salicylic acid in the tablets.

Abi dissolves an aspirin tablet in a solvent to prepare a solution.

She adds iron(III) chloride solution to the solution. Iron(III) chloride reacts with salicylic acid to give a purple product.

Abi uses an absorbance colorimeter with a green filter. Below is the calibration graph for the colorimeter that Abi uses.



(a) Explain why the absorbance of green light increases as the concentration of salicylic acid increases.

.....

.....

..... [2]

(b) Abi uses this formula to calculate the percentage of salicylic acid in the tablet.

$$\text{percentage of salicylic acid (\%)} = \frac{\text{concentration (mmol/l)}}{4}$$

The solution made from one tablet gives an absorbance of 0.95.

Use the calibration graph and the formula to calculate the percentage of salicylic acid in the tablet.

Show your working.

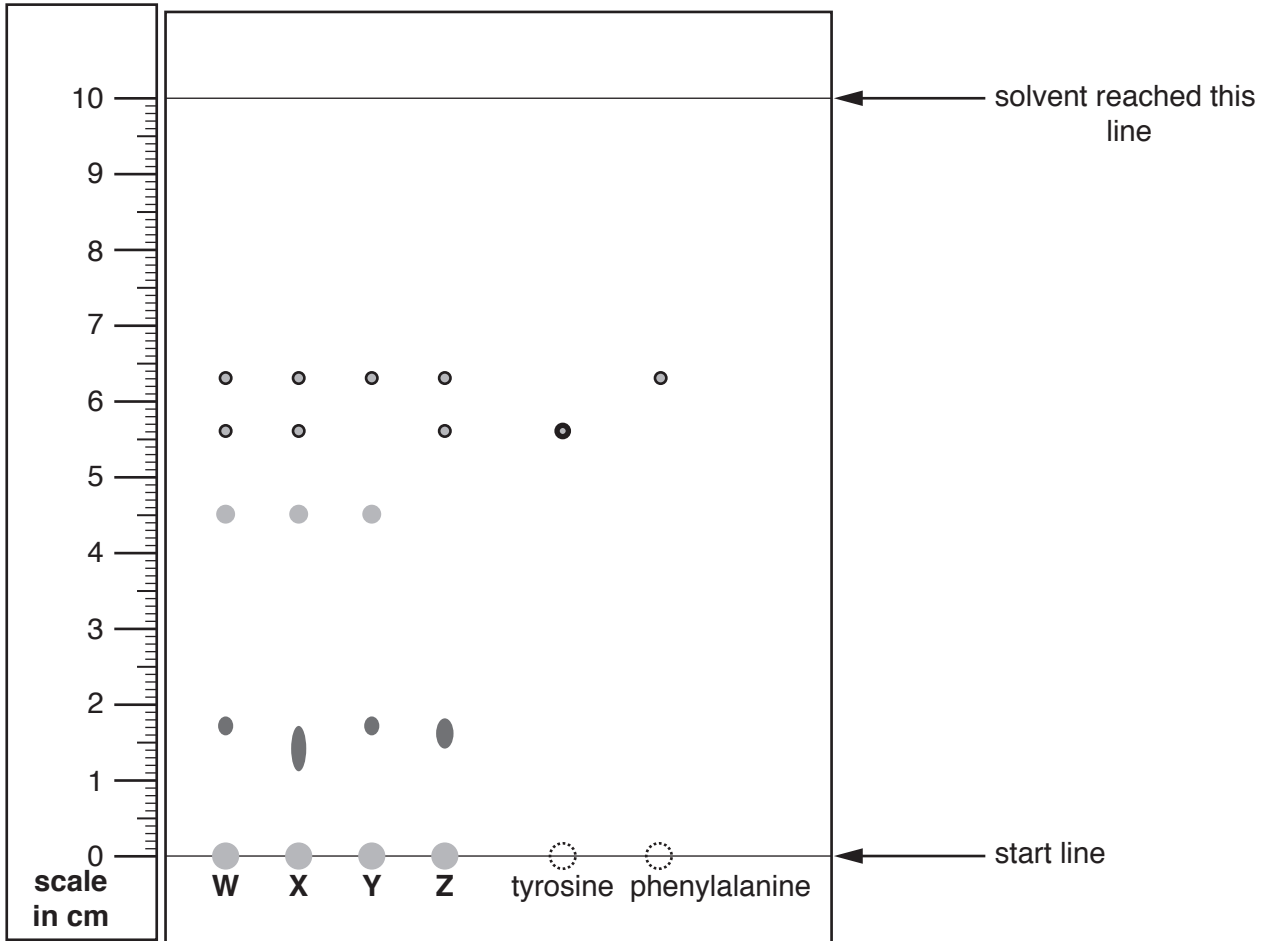
percentage of salicylic acid = [2]

6 Jake works in the pathology laboratory of a hospital. He tests the blood of new born babies to check for amino acid disorders.

(a) Jake uses chromatography to test the blood samples from four new born babies **W**, **X**, **Y** and **Z**.

He tests a drop of blood from each baby and a drop of each of the amino acids **tyrosine** and **phenylalanine**.

Here is Jake's chromatogram with a scale marked in cm.



The R_f value of a spot is calculated by using the formula:

$$R_f = \frac{\text{distance moved by spot}}{\text{distance moved by solvent}}$$

Use the scale and the chromatogram to calculate the R_f value for phenylalanine.

Show your working.

R_f value = [2]

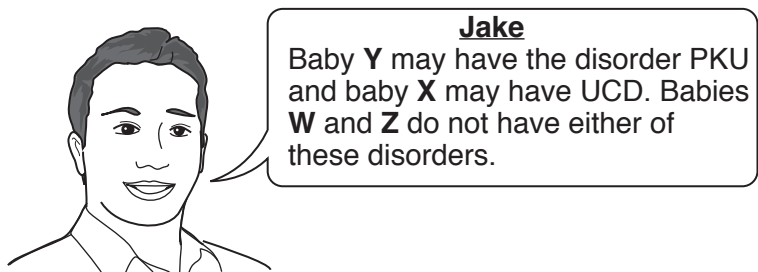
- (b) The blood from a baby with the amino acid disorder called **PKU** contains phenylalanine but **no** tyrosine.

Blood from a baby with the amino acid disorder called **UCD** does **not** contain the amino acid **arginine**.

Jake uses this data table to make conclusions from the chromatogram.

Amino acid	R _f value
Asparagine	0.21
Arginine	0.16
Cystine	0.14
Histidine	0.12

Jake makes these conclusions.



Do you agree with Jake's conclusions?

Use the chromatogram and the table to give reasons for your answer.

.....

.....

.....

.....

.....

..... [3]

- (c) Jake uses tyrosine and phenylalanine as **standard references**.

Explain what is meant by a standard reference.

.....

.....

..... [2]

- (d) Jake allows the chromatogram to continue until the solvent has almost reached the top of the chromatography paper.

Explain how this helps to make the results as accurate as possible.

.....
.....
..... [2]

- (e) The drops of blood on the start line are still coloured when the chromatogram is completed.

This indicates that there are some amino acids that are insoluble in the solvent.

Suggest one change Jake could make to his test to find out what other amino acids are in the drops.

.....
..... [1]

[Total: 10]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

A large area of lined paper for writing, consisting of 25 horizontal dotted lines. A solid vertical line runs down the left side of the page, creating a margin. The rest of the page is open for writing.

A large rectangular area with a solid vertical line on the left side and horizontal dotted lines extending across the page, providing a space for writing answers.



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