OCR
Oxford Cambridge and RSA

Friday 16 June 2017 – Morning

LEVEL 1 CAMBRIDGE NATIONAL IN SCIENCE IN THE WORKPLACE

R075/01 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	

Centre number						Candidate number				

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.

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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**	**Titration 4**
End volume sodium hydroxide (cm^3)	21.0	41.5	20.6	41.5	20.4
Start volume sodium hydroxide (cm^3)	0.0	21.0	0.0	20.6	0.0
Volume sodium hydroxide used (cm^3)	21.0	20.5	20.6	20.9	20.4

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

.....

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

(ii) Rose calculates a mean value for the volume of dilute sodium hydroxide used in the titrations.

To calculate her mean, Rose uses the three titration results which are closest to each other.

Which **three** titration results does she use?

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

21.0 ☐

20.5 ☐

20.6 ☐

20.9 ☐

20.4 ☐

[1]

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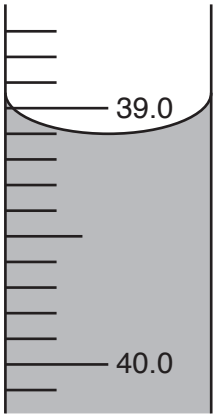
(iii) Calculate a mean value for the titration results you have chosen in **(a)(ii)**.

Show your working.

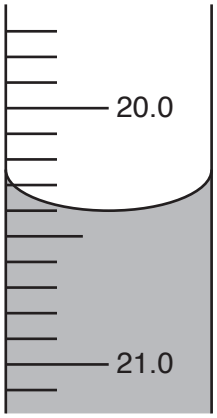
mean value = ... cm^3 **[2]**

(iv) Rose does another titration, **titration 5**.

The diagram shows the end and start burette readings for titration **5**.



End volume of sodium hydroxide (cm^3)



Start volume of sodium hydroxide in cm^3

Use the diagram to complete the table for **titration 5**.

	Titration 5
End volume sodium hydroxide (cm^3)	
Start volume sodium hydroxide (cm^3)	
Volume sodium hydroxide used (cm^3)	

[3]

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(b) Vinegar is safe to use in foods if it has an acid concentration between 4% and 6%.

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

She also does titrations for safe vinegar of 4% concentration and safe vinegar of 6% concentration.

The table shows her results.

Vinegar	Mean volume of dilute sodium hydroxide used (cm^3)
A	15.0
B	19.0
C	22.0
D	25.0
E	43.0
Safe 4%	20.0
Safe 6%	30.0

Use the information to decide whether each vinegar, **A**, **B**, **C**, **D** and **E**, is safe for using in foods and explain how you can tell.

The quality of written communication will be assessed in your answer.

.....

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.....

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.....

.....

..... **[6]**

[Total: 13]

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

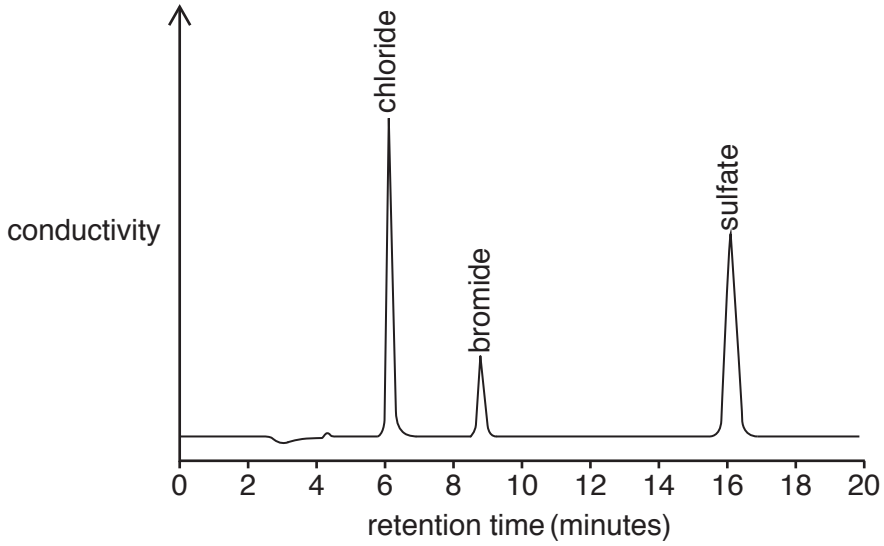
She uses test tube tests to find out which ions are present in the seawater.

She also uses ion chromatography.

Test tube tests results.

Test tube test	Result
chloride test	white precipitate
sulfate test	white precipitate
carbonate test	no reaction

Ion chromatography results.



(a) **(i)** Which ion gives the longest retention time in the ion chromatography test?

Put a ring around the correct answer.

chloride **bromide** **sulfate** **[1]**

(ii) Which **two** ions do both tests show that the seawater contains?

.....and ..... **[1]**

(iii) What extra information does each test show about the ions in the seawater?

Extra information from test tube tests .....

.....

Extra information from ion chromatography test .....

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

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(b) Ion chromatography can be used as a quantitative technique.

Which statement describes a quantitative technique?

Put a tick (✓) in the box next to the correct answer.

- gives information about amounts ☐
- can be used to test many different samples ☐
- automatic ☐
- gives results by colour ☐

[1]

[Total: 5]

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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 uses the same pH meter to test all four metal salt solutions.

Explain why this could contaminate his solutions and suggest what he should do to solve the problem.

.....

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

(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 where Ben could look for secondary data to find out if he is correct.

.....

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

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(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]

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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) Give **one** advantage of using the light microscope compared with using the hand lens.

.....

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

(iii) Jill uses the light microscope with magnification **×50** 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]**

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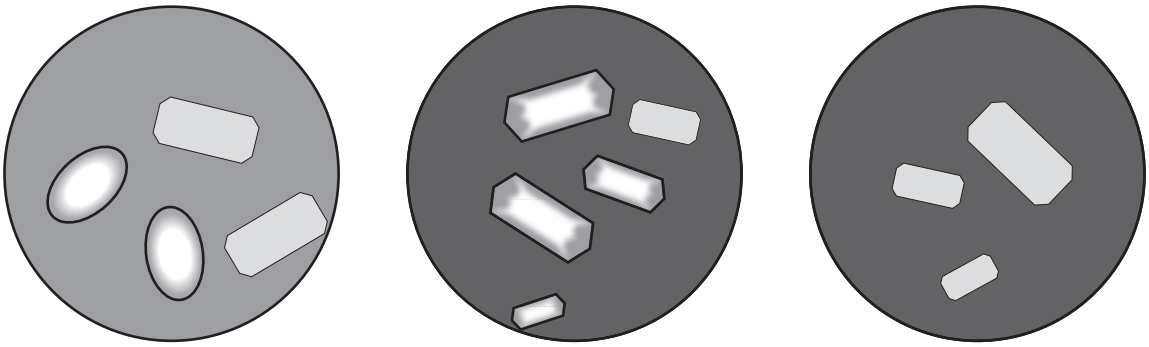
(c) Jill looks at three samples of rock, **A**, **B** and **C**.

In each sample the crystals appear to be the same colour.

Here is what she sees.



Sample A **Sample B** **Sample C**

She uses the data in this table to identify the minerals present in each sample.

Mineral	Shape of crystal
Emerald	
Forsterite	
Dioptase	
Chrysoberyl	

(i) Which sample contains chrysoberyl?

Put a ring around the correct answer.

A **B** **C** **D** **[1]**

(ii) Which sample contains only **one** mineral?

Put a ring around the correct answer.

A **B** **C** **D** **[1]**

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(iii) Jill compares her observations of sample **B** to the data in the table.

She says she cannot be certain whether sample **B** contains emerald or dioptase.

Why is it not possible to be certain?

.....

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

[Total: 9]

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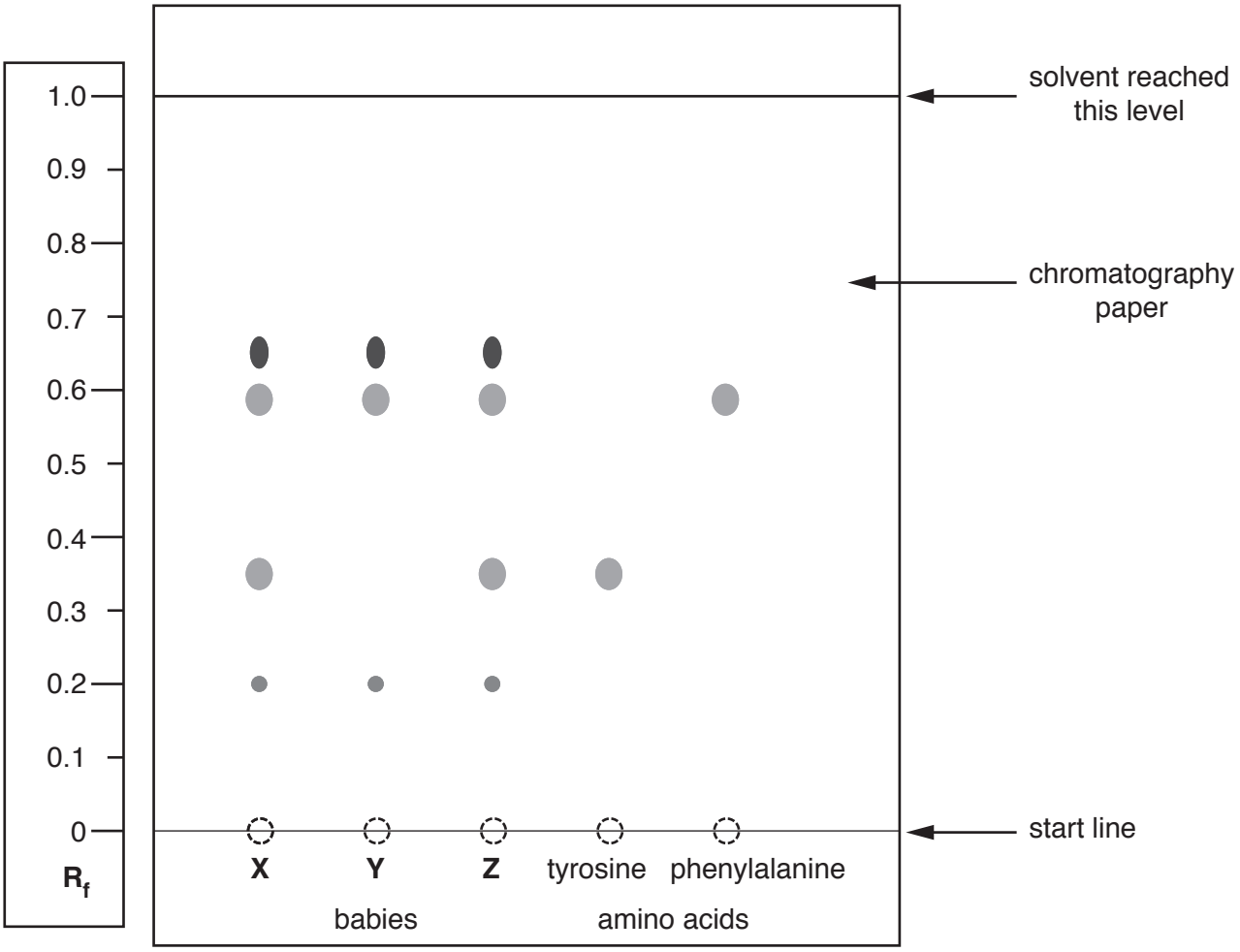
5 Jake works in the pathology laboratory of a hospital.
He tests the blood of new born babies to check for amino acid disorders.

(a) Jake uses chromatography to test blood samples from three new born babies **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 with R_f values



(i) How does the chromatogram show that phenylalanine is in every blood sample?

.....

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

(ii) What is the R_f value of phenylalanine?

R_f = …….. **[1]**

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(iii) The chromatogram tests for four amino acids in each baby's blood.

One baby's blood samples only contains three amino acids.

Which sample contains only three amino acids and which amino acid is missing?

Sample .....

Name of missing amino acid ..... **[2]**

(b) Jake uses the scale to find the R_f value of the **bottom** spot in each blood sample.

He uses this data table to identify the name of the amino acid.

Amino acid	**R_f value**
Glutamic acid	0.25
Glycine	0.15
Histidine	0.20
Proline	0.40

Which amino acid produces the bottom spot?

Put a ring around the correct answer.

Glutamic acid **Glycine** **Histidine** **Proline** **[1]**

(c) Jake thinks that the top spot in each blood sample may be produced by two amino acids with similar R_f values.

Which of these changes could separate these amino acids?

Put a tick (✓) next to the correct answer.

Put the chromatography paper further into the solvent. ☐

Use more of the same solvent. ☐

Use a different solvent. ☐

[1]

(d) Give **one** benefit of using two techniques to make a conclusion.

.....

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

[Total: 7]

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

Aspirin tablets can contain small amounts of a harmful impurity called salicylic acid.

Abi uses colorimetry to find the concentration of salicylic acid in aspirin tablets.

(a) Abi uses some solutions of salicylic acid to produce a calibration graph.

What solutions does Abi use to produce the calibration graph?

Put a tick (✓) in the box next to the correct answer.

- Solutions of the acid of known concentration. ☐
- Solutions of the acid of unknown concentration. ☐
- Different volumes of solutions of the acid. ☐

[1]

(b) Abi uses the same procedure and colorimeter to find out the concentration of salicylic acid in other aspirin tablets.

What should Abi do so that she can use the same calibration graph to compare the tablets?

Put a tick (✓) in the box next to the correct answer.

- Dissolve every tablet in the same volume of solvent. ☐
- Measure the absorbance for the same amount of time. ☐
- Use a new filter to take each reading. ☐

[1]

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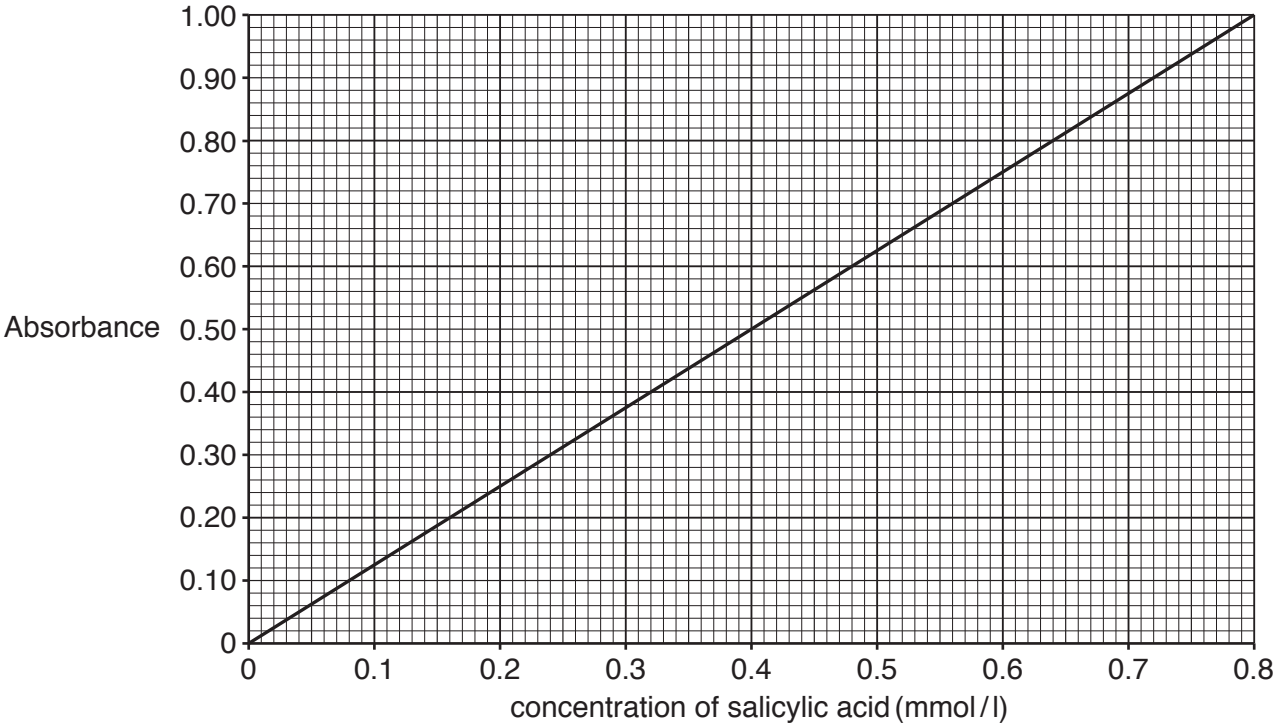
(c) The company sends packets of aspirin tablets to shops.

Abi checks tablets to find out how much salicylic acid impurity they contain.

Abi tests several tablets from two packets of aspirins, **A** and **B**.

This is the calibration graph she uses for the colorimeter.



Here are Abi's results from her tests.

Packet	Mean absorbance	Range of absorbance
A	0.60	0.50 to 0.70
B	0.35	0.25 to 0.45

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The tablets are of suitable quality to send to shops if the concentration of salicylic acid in the solution is less than 0.5 mmol/l.

What conclusions can you make about the quality of the aspirins in each packet?

Use the data from the calibration graph and the table to support your conclusions.

The quality of written communication will be assessed in your answer.

.....

.....

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.....

..... **[6]**

(d) Abi also uses a different technique to find the concentration of salicylic acid in aspirin tablets.

Which of these techniques could she use to find the concentration?

Put a tick (✓) in the box next to the correct answer.

- flame testing ☐
- spectrophotometry ☐
- electron microscopy ☐
- gas chromatography ☐

[1]

[Total: 9]

END OF QUESTION PAPER

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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).

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