OCR
Oxford Cambridge and RSA

Friday 17 June 2016 – 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

R075/02

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 bar codes.

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 Magnifying glasses (hand lenses), light microscopes and electron microscopes are used to look at specimens so that more details can be seen.

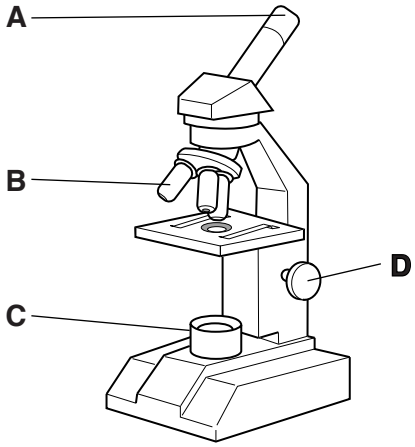
(a) Draw one straight line from each **specimen** to the best **apparatus** through which to view it.

Specimen	Apparatus
living human cells	electron microscope
the surface of a pollen grain	light microscope
the writing on a coin	magnifying glass

[3]

(b) Jake uses a light microscope to look at a specimen.

This is a diagram of the light microscope, with some of the parts labelled **A**, **B**, **C** and **D**.



(i) The specimen is not in focus.

Which part of the microscope does Jake adjust to make the specimen in focus?

Put a (ring) around the correct answer.

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

(ii) Jake wants to see more of the specimen in his view through the microscope.

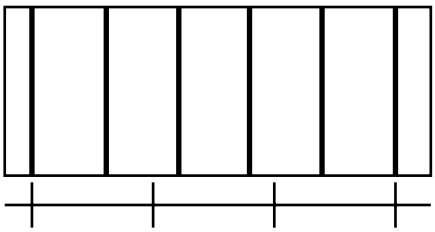
Which part does he adjust to see more?

Put a (ring) around the correct answer.

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

(c) Jake uses an electron microscope to examine part of an electronic circuit.

This is the image produced by the electron microscope.



Jake estimates that the black lines are 2.5 micrometres apart.

Use the image and the scale to do a calculation to see if Jack is correct.

Explain your method.

distance apart = ... micrometres **[3]**

(d) Give **one disadvantage** of using an electron microscope compared with using a light microscope.

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

[Total: 9]

2 Izzy works in the quality control department of a company that manufactures many different chemicals.

Each chemical is produced in a batch and then put into boxes.

The company manufactures a number of batches of each chemical.

Izzy takes samples from the boxes for testing.

(a) (i) Izzy takes a **representative** sample.

How does she choose which boxes to take the samples from?

.....

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

(ii) How does Izzy avoid contamination of the samples?

.....

.....

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

(b) One box has lost its label and Izzy needs to find out what chemical compound is in the box.

She makes a solution of the compound by dissolving some of it in water.

She divides the solution into three test tubes, **A**, **B** and **C**.

She adds a test solution to each test tube.

Here are her results.

Test tube	Test solution added	Result
A	sodium hydroxide	green precipitate
B	silver nitrate	no change
C	barium chloride	white precipitate

Izzy concludes that the compound is copper sulfate.

Explain how she makes this conclusion from her test results.

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

(c) (i) Izzy's colleague says that she should use more than one technique to check the identity of the compound.

Explain why this is a good idea.

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

(ii) Izzy does a flame test on the copper sulfate.

What colour is the flame?

Put a (ring) around the correct answer.

green **lilac** **orange** **red** **[1]**

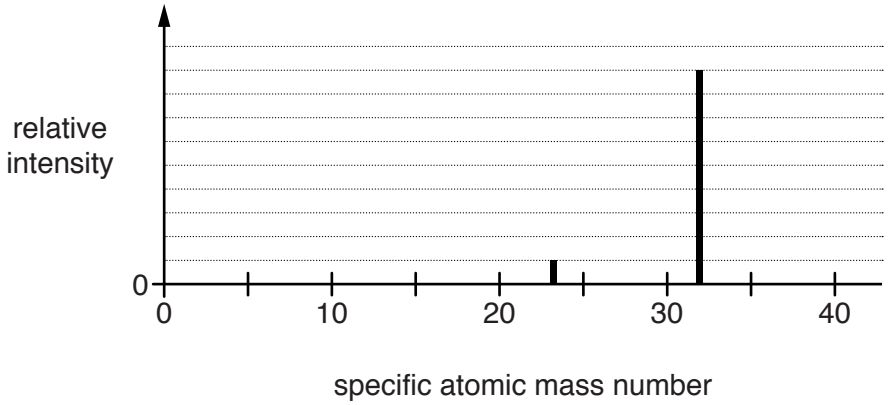
(d) The company also supplies copper chloride. The copper chloride is supplied in three grades of purity.

The three grades are shown in the table.

Purity grade	% of copper chloride in box
analytical	99
laboratory	95
technical	85

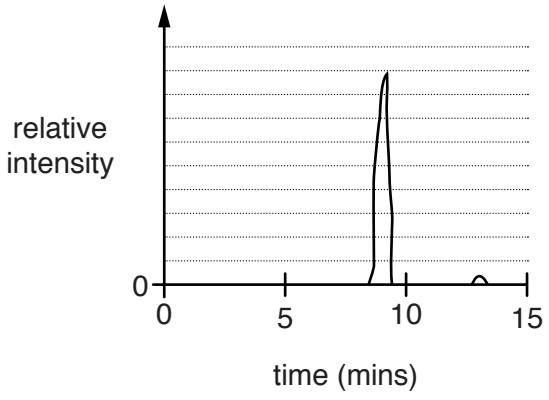
Izzy tests a sample of copper chloride for cations (positive ions) using a **mass spectrometer**.

This is the result.



She also tests for anions (negative ions) using an **ion chromatography** technique.

This is the result.



These are the data tables Izzy uses to make conclusions.

Mass spectrometer

Cation	Specific atomic mass number
calcium	20
copper	32
iron(II)	28
potassium	39
sodium	23

Ion chromatography

Anion	Time (mins)
bromide	13
chloride	9
fluoride	6
nitrate	11

Izzy makes this conclusion:

'I think that there are other ions in this sample of copper chloride. The graphs show that it has a purity which is less than 95% so it is not laboratory grade.'

Explain how the graphs and tables support Izzy's conclusion.

Give reasons for your answer and show your working.

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

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

[Total: 13]

3 Mike and Abi work for a company that monitors the quality and effectiveness of medicines.

They test different types of antacid tablets.

Excess acid in the stomach can cause pain. Antacid tablets contain a base that lowers the acidity in the stomach.

(a) Mike dissolves one antacid tablet in 100.0 cm^3 of water.

He uses universal indicator to test the pH of the solution.

Here is the chart he uses to interpret his results.

4	5	6	7	8	9	10	11
orange	yellow	yellow-green	green	green-blue	blue	blue-purple	purple

He does the same experiment for three different tablets, **A**, **B** and **C**.

Here are his results.

Tablet	**Colour of solution**
A	blue
B	green-blue
C	blue-purple

Mike also uses a pH meter to test the solutions.

Here are his results.

Tablet	**pH**
A	9.0
B	8.1
C	10.8

(i) Do the results using universal indicator agree with those using the pH meter?

Use the data to give reasons for your answer.

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..... **[3]**

(ii) Both of the techniques used by Mike have advantages.

Give **one** advantage of each.

universal indicator .....

.....

pH meter .....

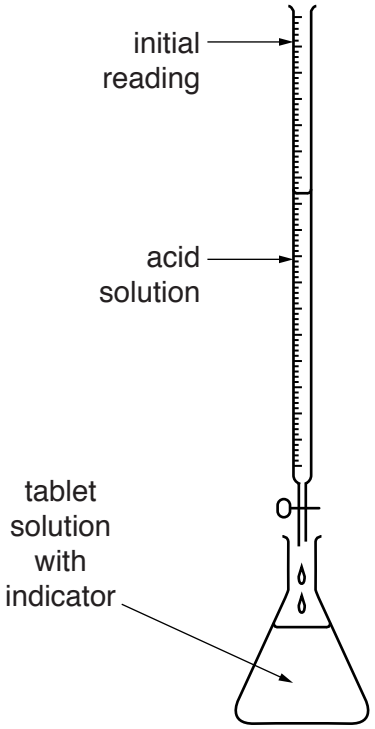
..... **[2]**

(b) Mike uses a titration to find out how much acid can be neutralised by the antacid tablet.

He uses an acid similar to stomach acid.

Mike dissolves the tablet in 25.0 cm^3 of water and puts the tablet solution in a flask with the indicator.

He uses the same solution of acid for each titration.



Mike does the titration three times.

Here are his results when he dissolves **one tablet** in the water.

Volume of acid added (cm^3)				Range (cm^3)
1st titration	**2nd titration**	**3rd titration**	**Mean**	
22.1	22.5	22.3	22.3	0.4

He also does titrations for two and three tablets.

Here are his mean results and ranges.

Number of tablets	Mean volume of acid added (cm^3)	Range (cm^3)
2	44.8	0.3
3	67.2	0.4

Different patients take different numbers of tablets because they have different amounts of excess acid.

What conclusions can you make from these results?

Explain your reasoning.

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

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

[Total: 11]

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4 Grace works in the safety department of an airline.

She does quality control tests on aircraft fuel to find the concentration of anti-freeze in the fuel.

She uses a colorimeter to measure the concentration of the anti-freeze.

(a) Before testing the anti-freeze, Grace uses a solvent to calibrate the colorimeter.

(i) Describe how she calibrates the colorimeter.

.....

.....

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

(ii) Why does she need to calibrate the colorimeter?

.....

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

(b) Coloured light is shone onto a sample of the fuel.

The colorimeter measures how much coloured light is absorbed by the sample of fuel.

The colorimeter has three filters that are marked with the wavelength of light that they transmit.

Colour of filter	**Wavelength of light (nanometres)**
red	700 to 580
green	610 to 490
blue	500 to 450

The colour of the anti-freeze is orange and has a wavelength of 600 nanometres.

Grace decides to use the blue filter.

Explain why this is the best filter to use.

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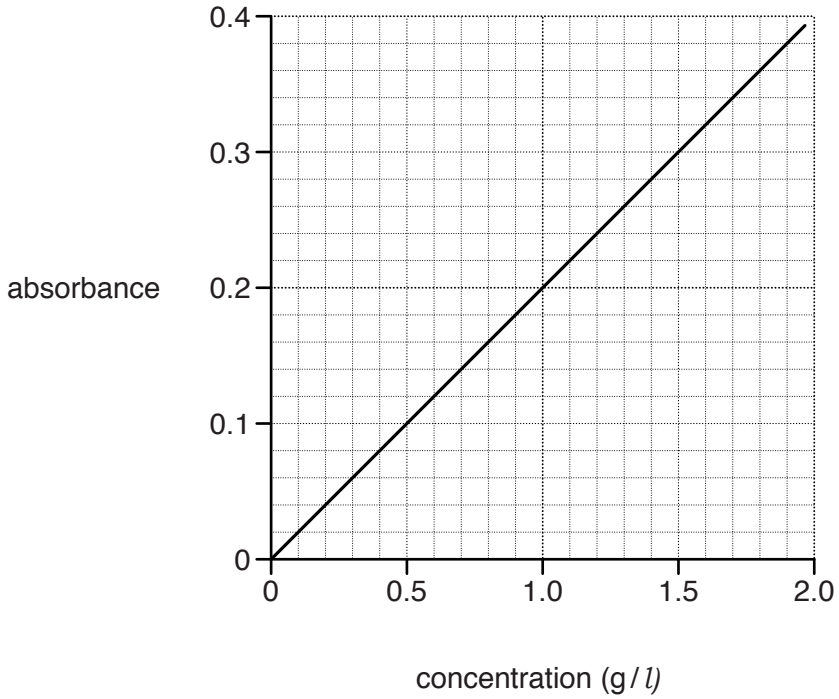
..... **[3]**

(c) Grace tests four samples from the same fuel.

Here are her results.

Sample	Absorbance
1	0.33
2	0.31
3	0.25
4	0.35

(i) This is the calibration curve Grace uses.



Use her results and the calibration graph to calculate the mean concentration of anti-freeze in the fuel.

Explain your method.

mean concentration = ... g/*l*

Explanation .....

..... **[4]**

(ii) To pass the quality control tests the samples of fuel used to calculate the mean concentration must have a similar concentration of anti-freeze.

The concentration of the samples must be within 10% of each other.

Is Grace justified in saying that these samples pass the quality control test?

Show your working.

.....

.....

..... **[3]**

(d) What else could Grace do to confirm her value of the mean concentration?

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

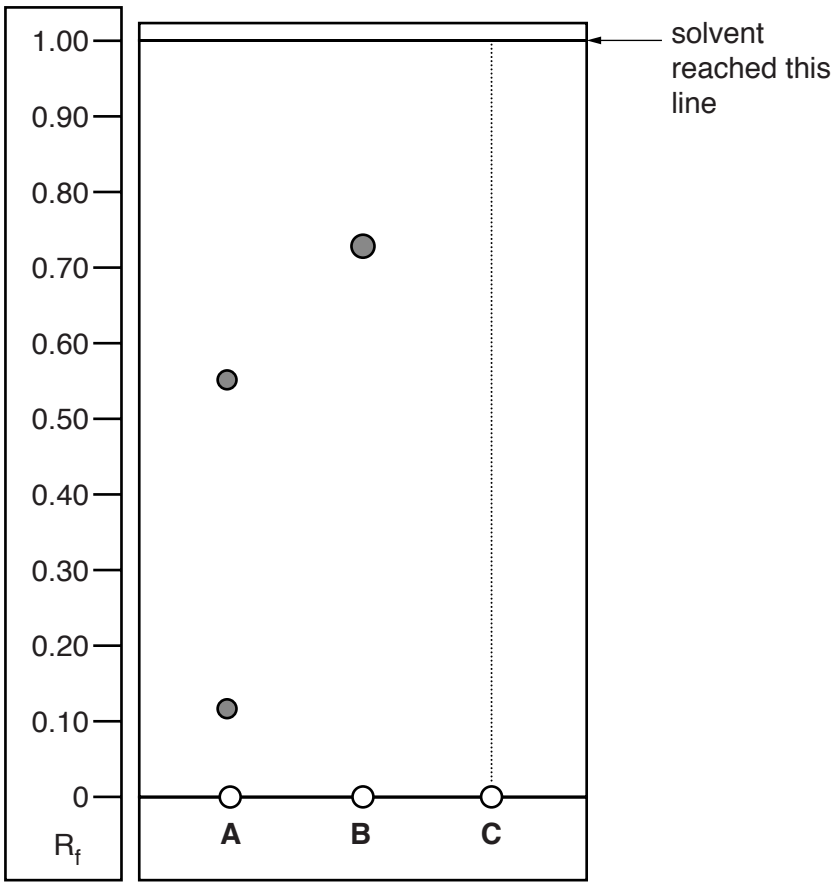
[Total: 14]

5 Kris works for a health diagnostic company.

He tests food to identify which amino acids are present.

He uses chromatography to test samples from three foods, **A**, **B** and **C**.

This is the chromatogram he produces for foods **A** and **B**.



This is the data table he uses to identify the amino acids.

Amino acid	**R_f value**
Histidine	0.11
Isoleucine	0.72
Leucine	0.73
Methionine	0.55
Threonine	0.35
Tryptophan	0.66
Valine	0.61

(a) Kris concludes that food **A** contains histidine and another amino acid.

What is the name of the other amino acid?

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

(b) Kris thinks that food **B** may contain isoleucine and leucine, but he is not sure.

Explain why Kris cannot be sure that food **B** contains isoleucine and leucine.

Use the results of the chromatogram to support your answer.

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

(c) On the chromatogram opposite, draw what is seen if food **C** contains threonine and valine.**[1]**

[Total: 3]

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).