OCR
RECOGNISING ACHIEVEMENT

SPECIMEN L1

R075/01

Level 1/2 Cambridge National Certificate in
SCIENCE IN THE WORKPLACE

R075: How scientific data is used (Level 1)

Candidates answer on the question paper

OCR Supplied Materials:
- None

Other Materials Required:
- Pencil, ruler
- Calculator

Duration: 1 hour

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks for each question is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **50**.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** questions.

1 Julia works in a forensics laboratory.

She is trying to find out if different soil samples came from the same place.

Julia studies the soil samples with a microscope.

(a) Here are images of three soil samples Julia sees through the microscope.

The images have the same magnification.

sample A **sample B** **sample C**

Two of the samples are the **same** type of soil.

Which two are the same type? Explain your answer.

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.....

.....

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

(b) Here are some other features of the two soil samples.

Put a ring around the **one** feature which Julia could use to show that they are the same type of soil.

Colour **mass** **moisture content** **temperature**

Explain your answer.

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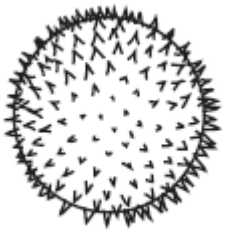
.....**[2]**

(c) Julia finds a pollen grain in one of the soil samples.

Here is the image of the pollen grain seen through the microscope.



The microscope has a magnification of x500.

Calculate the actual diameter of the pollen grain.

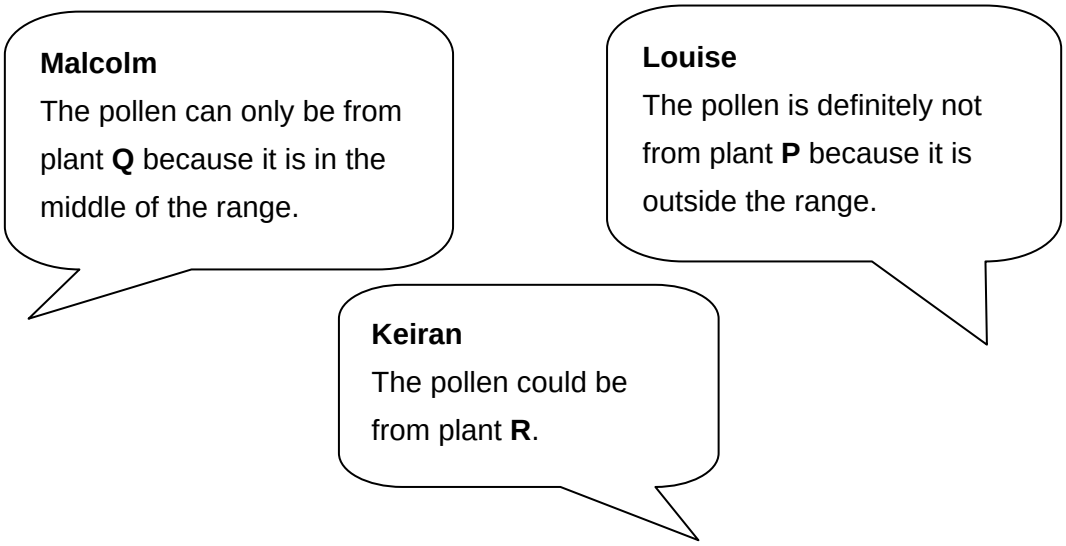
Show your working.

actual diameter = ... mm **[2]**

(d) Julia finds another pollen grain. It has a diameter of 0.07 mm.
Julia wants to know which plant the pollen grain comes from.
She finds this data about the pollen from three different plants P, Q, and R.

plant	range of pollen size in mm
P	0.12 - 0.17
Q	0.06 - 0.08
R	0.04 - 0.07

Julia asks three colleagues which plant the pollen comes from.
Here are their conclusions.



Comment on their conclusions.

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

[Total: 8 Marks]

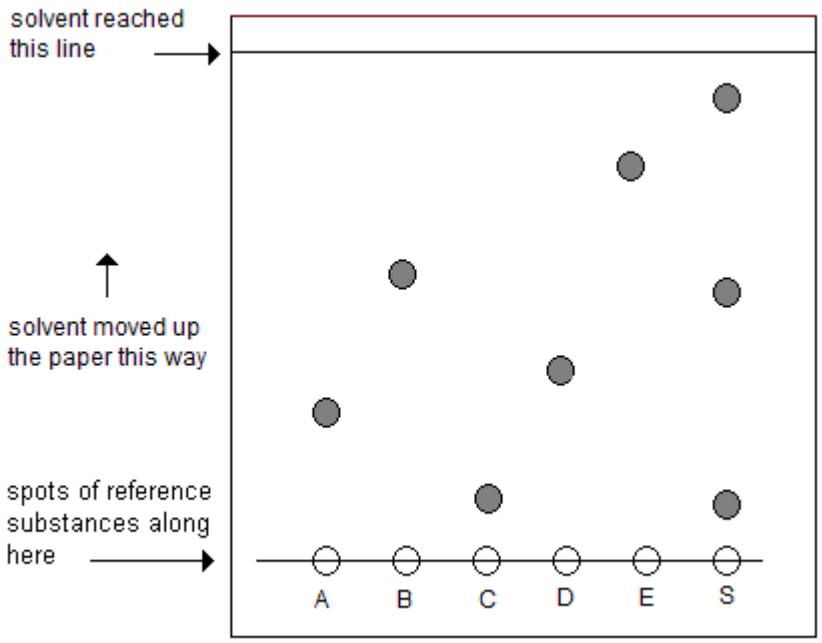
2 Jason works in a laboratory.

He uses chromatography to find the food colourings in a hard sweet.

Jason dissolves the sweet in water.

He places a drop of the dissolved sweet solution on chromatography paper.

(a) Here is the chromatogram obtained by Jason.



Labels **A**, **B**, **C**, **D** and **E** are the spots where the reference substances are.

The spot from the sweet is labelled **S**.

Explain what Jason can conclude about the colourings in the sweet.

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

(b) Paper chromatography has some limitations.

(i) Suggest an alternative technique that Jason could use to find the food colourings in the sweet.

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

(ii) How would the results from this technique be better?

.....

.....

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

[Total: 7 Marks]

3 Jake tests a drink.

(a) Jake uses a colorimeter to find the concentration of orange squash in a drink.
Which of the following best describes what a colorimeter measures?
Put a tick (✓) in the box next to the best answer.

the shade of a colour ☐

the name of a colour ☐

the grayscale of a colour ☐

the intensity of a colour ☐

[1]

(b) Jake starts off by putting a sample of distilled water in the colorimeter.

(i) Explain why he does this.

.....

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

(ii) What sort of error does this step help to avoid?
Put a ring around the correct answer.

cumulative **random** **systematic** **variable**

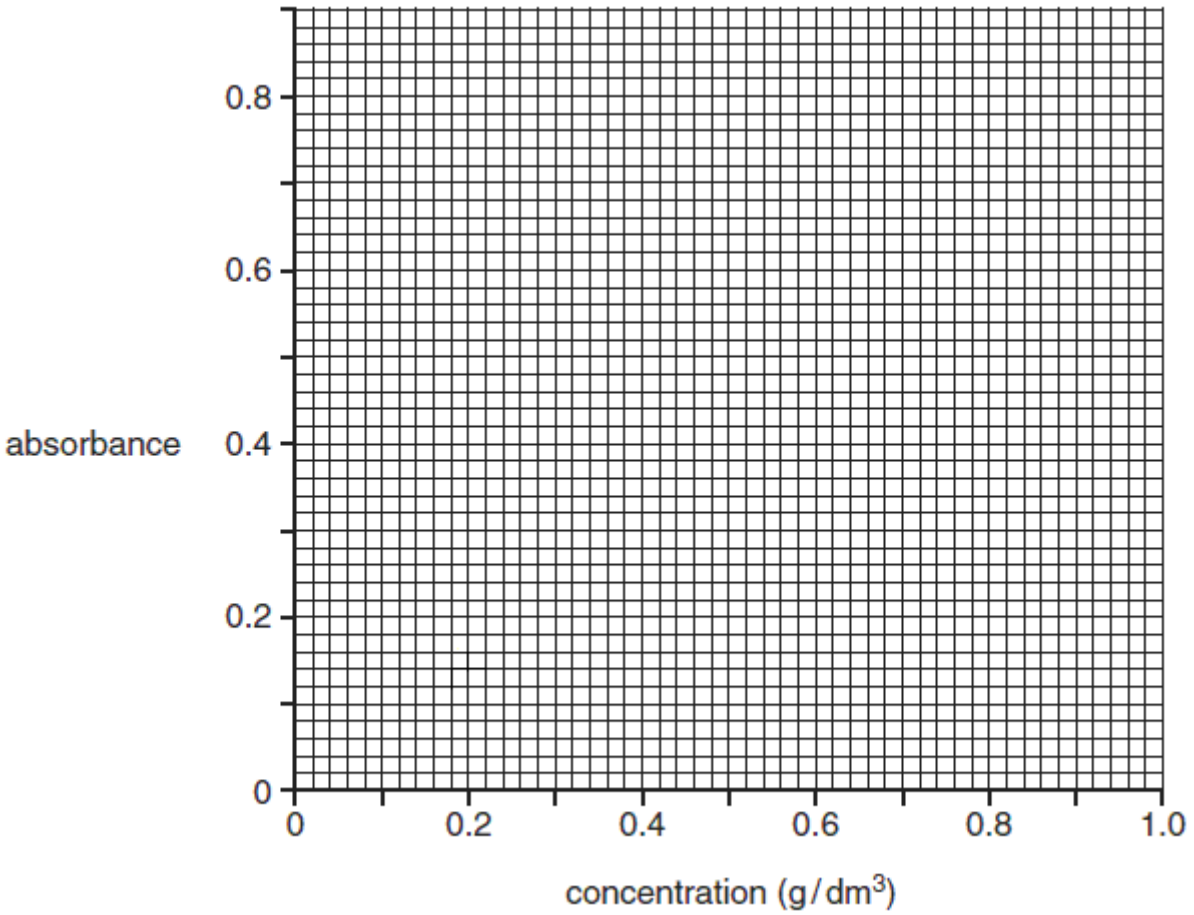
[1]

(c) The following data are obtained when Jake uses the colorimeter to test standard reference solutions of orange squash.

concentration (g/dm^3)	absorbance
0.20	0.15
0.40	0.30
0.60	0.55
0.80	0.60
1.00	0.75

(i) Plot the data on the calibration graph below.

[2]



(ii) Put a ring around the result which is an outlier.

[1]

(iii) Suggest a reason for the outlier.

.....

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

(iv) Draw a line of best fit on the graph. **[1]**

(v) Jake's drink gave an absorbance of 0.60 when it was put into the colorimeter. Use the graph to determine the concentration of the drink.

concentration = ... g/dm^3 **[1]**

[Total: 9 Marks]

4 Nina works in a laboratory.

She finds a bottle without a label. It contains a white powder.

(a) Nina uses a flame test to find out the metal cation in the powder.

Here are the steps she takes.

step 1	Heat a nichrome wire in a bunsen flame.
step 2	Dip the wire in hydrochloric acid.
step 3	Collect some of the powder on the end of the wire.
step 4	Hold the end of the wire in the flame and observe the colour.

(i) Explain the reason for step 2.

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

(ii) The flame glows **lilac** when the powder enters it.

Put a ring around the metal present in the powder.

calcium **copper** **potassium** **sodium**

[1]

(b) Nina decides to confirm this result by using an instrument to analyse the light from the flame.

(i) State the name of this instrument.

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

(ii) Describe two advantages of using this instrument to confirm the result.

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

(c) Nina then tests the powder for anions.

She tests for carbonate, sulfate and chloride anions.

One of the anion tests shows that the powder contains chloride anions.

Describe the test which shows that chloride ions are present.

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

(d) Here are some statements about the white powder so far.
Put a tick (✓) in the box next to the correct statement.

The powder only contains chloride anions.	
The powder only contains one metal cation.	
Nina has found the chemical name of the powder.	
Nina could do more tests to find other anions and cations.	

[1]

[Total: 9 Marks]

5 Liz is a laboratory technician.
Liz is testing a soil sample taken from a farm.
Liz has been asked to find out the copper content of the soil.

(a) Liz uses sodium hydroxide to test a sample of her soil for the presence of copper.
Here are the steps of the test.

A	Place a spatula of soil in a test tube and fill it with water.
B	Put a bung in the tube and shake it.
C	Pour the mixture through filter paper into another test tube.
D	Add several drops of sodium hydroxide solution.
E	Observe the colour of the precipitate.

Explain why the soil is mixed with water and filtered before adding the sodium hydroxide.
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.....**[3]**

(b) What colour precipitate would Liz expect to see if copper is present in the sample?
.... **[1]**

(c) What is the best description of this type of test?
Put a ring around the correct answer.

controlled **qualitative** **quantitative** **variable**

[1]

(d) When Liz does the test, there is no precipitate at all.
Explain what further things Liz could do to find out if there is copper in the farm soil.

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

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

[Total: 11 Marks]

6 A sample of cloth from a crime scene can be studied with three different instruments;

- a magnifying glass
- a light microscope
- an electron microscope.

Explain why the light microscope is the best instrument to study the sample of cloth.

You should consider the advantages and disadvantages of each instrument in your answer.

✎ *The quality of written communication will be assessed in your answer to this question.*

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

[Total: 6 Marks]

END OF QUESTION PAPER

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R075: How scientific data is used (Level 1)

MARK SCHEME

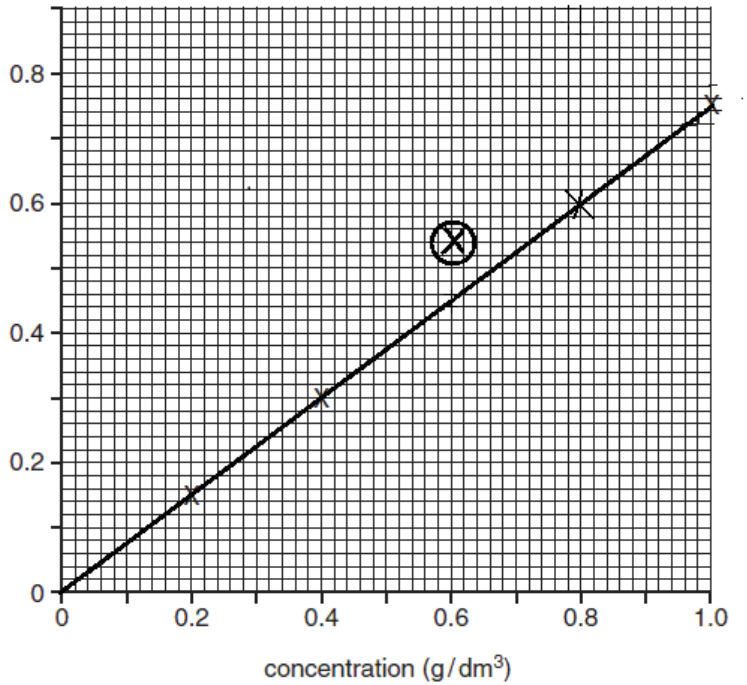
Duration: 1 hour

MAXIMUM MARK 50

This document consists of 7 pages

Question			Answer	Mark	Guidance
1	(a)		A and C are the same (no mark) because any of the following, [1] each: large / small lumps the same size in both similar proportion of large and small lumps only two size of lump in each sample	2	maximum of 1 mark if A and C not selected
	(b)		colour; because the other features depend upon the sample size / or can change depending upon the ambient conditions;	2	ora
	(c)		0.046 - 0.054 mm	2	1 mark for evidence of measuring the diagram (23-27 mm) 1 mark for evidence of x 500
	(d)		Keiran and Louise are correct; Malcolm is wrong because it could be Q or R;	2	

Question			Answer	Mark	Guidance
2	(a)		sweet contains colourings B and C; because two spots from S line up with spots from B and C; sweet contains an unknown colouring; because one spot from S doesn't line up with any others	4	
	(b)	(i)	gas chromatography (GC) / high performance liquid chromatography (HPLC) / mass spectrometer	1	
		(ii)	any two from (1 mark each) idea of improved separation / easier to read results; enhanced accuracy; greater sensitivity; tells you the (relative) amount of each colour; could identify the unknown colouring;	2	**accept** any relevant answer

Question			Answer	Mark	Guidance
3	(a)		the intensity of a colour	1	
	(b)	(i)	to set the zero on the meter	1	
		(ii)	systematic error	1	
	(c)	(i)		2	[1] for 2 or 3 correctly plotted, to the nearest square
		(ii)	correctly identified as shown above	1	
		(iii)	The solution may be contaminated / he misread the meter	1	**accept** any reason which would produce an outlier
		(iv)	line of best fit	1	**allow** ecf where points were incorrectly plotted on the graph
		(v)	0.78 - 0.82 g/dm3	1	

Question			Answer	Mark	Guidance
4	(a)	(i)	to clean the wire; so that no contamination of sample	2	
		(ii)	potassium	1	
	(b)	(i)	spectrophotometer / spectroscope	1	**accept** spectral analyser / diffraction grating
		(ii)	improved sensitivity / quantification; because of contamination / only part of the sample tested / more than one cation could be present	2	**accept** any relevant answer
	(c)		add silver nitrate look for white precipitate	2	
	(d)		Nina could do more tests to find other anions and cations	1	

Question			Answer	Mark	Guidance
5	(a)		to dissolve out copper ions; to remove soil particulates; so that you can see the precipitate if it forms	3	
	(b)		blue	1	
	(c)		qualitative	1	

Question			Answer	Mark	Guidance
5	(d) ✎		**[Level 3]** Discusses a complete plan which would deliver a clear answer to her question. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Discusses an incomplete plan which would deliver a clear answer to her question. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes some relevant points, but fails to present a plan which could deliver a clear answer to her question. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**Relevant points include:** • collect soil samples from all over the farm / several locations • in sealed and labelled containers • repeat the test(s) • to increase confidence in results • use alternative techniques for a quantitative test, increased sensitivity • with an instrument (mass spectrometer?) • use internet/library/books/journals • to find secondary sources of data of local soil analysis •

Question	Answer	Mark	Guidance
6	**[Level 3]** Includes one advantage and one disadvantage for each instrument which includes a reference to magnification and/or field of view. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** Includes at least one advantage or disadvantage for each instrument. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** Makes relevant statements about at least two of the instruments. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**Relevant points include:** **magnifying glass** • very portable • easy to use • no need for power • wide field of view • low magnification • cheap **light microscope** • can't use on site easily • needs some training • needs a light source • high magnification • variable magnification & field of view • not cheap **electron microscope** • must be used in laboratory • needs a lot of training • needs electricity, vacuum pumps etc. • very high magnification • expensive • can't identify colour • small field of view

ASSESSMENT GRID					
Question no. (and part)	Learning Outcomes				Total
	LO1	LO2	LO3	LO4	
1(a)		1	1		2
1(b)			2		2
1(c)		2			2
1(d)			2		2
2(a)		2	2		4
2(b)(i)	1				1
2(b)(ii)	2				2
3(a)	1				1
3(b)(i)			1		1
3(b)(ii)	1				1
3(c)(i)		2			2
3(c)(ii)		1			1
3(c)(iii)		1			1
3(c)(iv)		1			1
3(c)(v)		1			1
4(a)(i)	2				2
4(a)(ii)		1			1
4(b)(i)	1				1
4(b)(ii)			2		2
4(c)	2				2
4(d)			1		1
5(a)	3				3
5(b)	1				1
5(c)		1			1
5(d)✎			4	2	6
6✎	4			2	6
Totals	18	13	15	4	50