OCR
Oxford Cambridge and RSA

Wednesday 11 January 2017 – Afternoon

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

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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 **16** pages. Any blank pages are indicated.

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PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

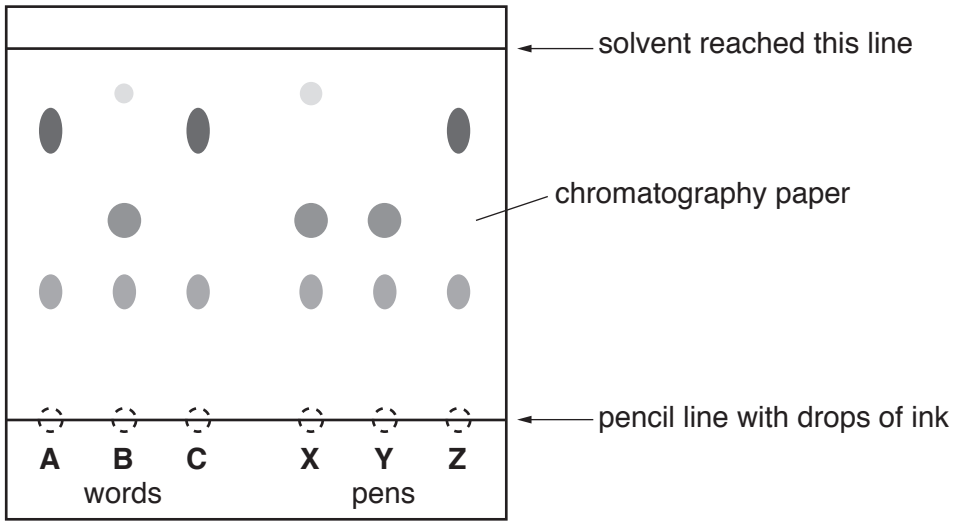
1 Jez works in a forensics laboratory.

(a) He uses chromatography to find out which pens have been used to write words in a letter.

For his chromatogram he takes a drop of ink from three words, **A**, **B** and **C**, in the document.

He also takes a drop of ink from three pens, **X**, **Y** and **Z**.

This is the chromatogram he produces.



(i) Why does Jez use a pencil to draw the line on the chromatogram?

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

(ii) How does putting the drops of ink on the line help to make the comparison between the results more accurate?

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

(iii) Which **two words** were written using the same pen?

Explain your answer.

.....

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

(iv) The lowest spot for all three pens is the same.

What conclusion can you make about the ink from all the pens?

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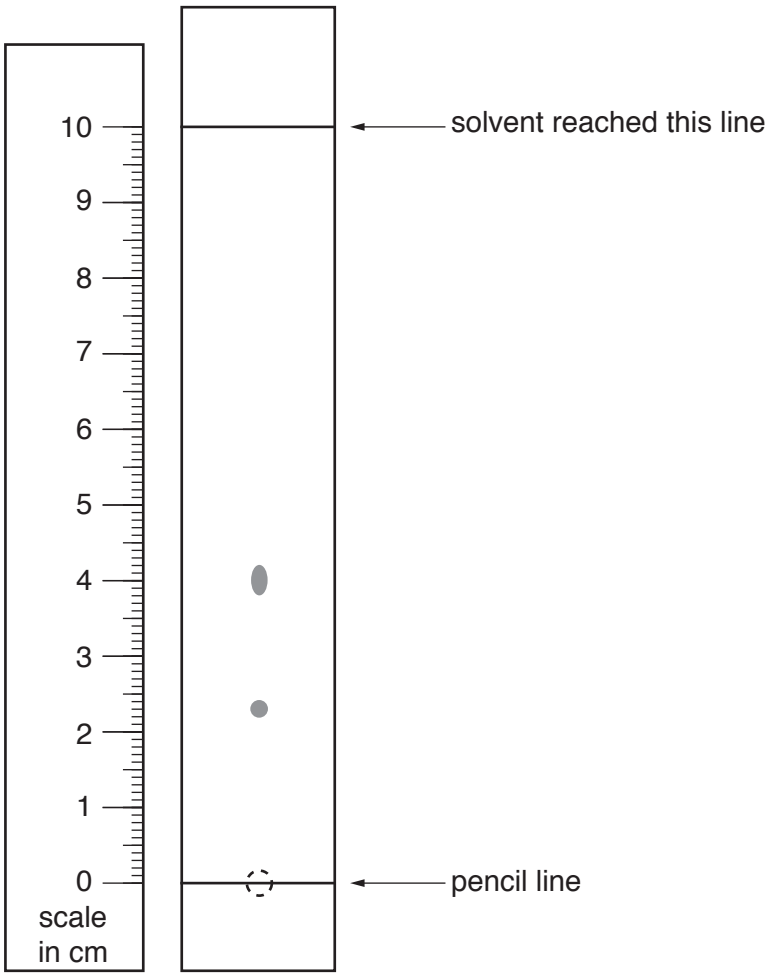
..... **[1]**

(b) Jez does a chromatogram with ink from another pen.

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



(i) The R_f value for a spot is calculated by using the formula:

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

Use the scale next to Jez's chromatogram to calculate the R_f value for the **lower** spot.

Show your working.

R_f value = ... **[2]**

(ii) Jez uses this data table to identify the dye in the **upper** spot.

Dye	R_f value
Clariant	0.20
Eijon	0.62
Margarita	0.42
Sunbrite	0.38

Jez makes a conclusion that the upper spot is the dye margarita.

Do you agree with Jez?

Use data from the chromatogram to support your answer.

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

(iii) Jez wants to collect more evidence to make his conclusion more secure.

He repeats the chromatography test using exactly the same procedure.

Suggest **two** other things he could do to collect more evidence for his conclusion.

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

[Total: 12]

2 Eve works for a laboratory that checks the quality of vinegar for use with foods.

Vinegar contains dilute ethanoic acid.

Eve does some titrations to check the concentration of the ethanoic acid in the vinegar.

She measures the volume of alkali needed to neutralise 20.0 cm^3 of vinegar.

These are her results.

	Rough	**Titration 1**	**Titration 2**	**Titration 3**	**Titration 4**
End volume (cm^3)	25.0	49.8	25.3	46.7	28.8
Start volume (cm^3)	0.0	25.0	0.0	25.3	0.0
Volume of alkali used (cm^3)	25.0	24.8	25.3	21.4	28.8

(a) Eve thinks that the data from her titrations is poor.

(i) Use the data to explain why she is correct.

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

(ii) Eve calculates the percentage error of her burette.

She uses this equation.

$$\text{error \%} = \frac{0.1}{\text{volume alkali used } (cm^3)} \times 100$$

Use the equation to calculate the percentage error of the burette for the rough titration.

error = ... % **[2]**

(iii) What happens to the **size** of the percentage error of the burette when the volume of alkali used is larger?

Explain your answer.

.....

.....

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

(b) Eve thinks that her data is poor because her burette has a leaking tap.

She repeats the titration using a new burette.

These are her results.

	Rough	**Titration 1**	**Titration 2**	**Titration 3**
End volume (cm^3)	25.0	49.8	24.7	49.4
Start volume (cm^3)	0.0	25.0	0.0	24.7
Volume of alkali used (cm^3)	25.0	24.8	24.7	24.7

(i) Eve stops her experiment after three titrations.

Explain why she does not do any more titrations.

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

(ii) Which errors in Eve's titration are **random** and which are **systematic**?

Put a tick (✓) in one box in each row.

	Random error	**Systematic error**
percentage error of burette reading		
errors caused by leaking burette		
small differences in titration results		

[2]

[Total: 9]

3 Harmful ions can get into water from industrial wastes.

Liz makes a plan to test the water in lakes and rivers around a town to find out if any of the water contains harmful ions.

(a) Liz collects 100 samples of water to test.

(i) One factor Liz includes in her plan is to take 5 samples of water in the morning and 5 samples at night.

Suggest **two** other factors that Liz needs to include in her plan.

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

(ii) How should she collect and transport the samples to make sure that her tests give accurate results?

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

(b) Liz collects three different samples of water, **A**, **B**, and **C**.

She adds dilute test solutions to each sample of water to find out if they contain harmful lead or copper ions.

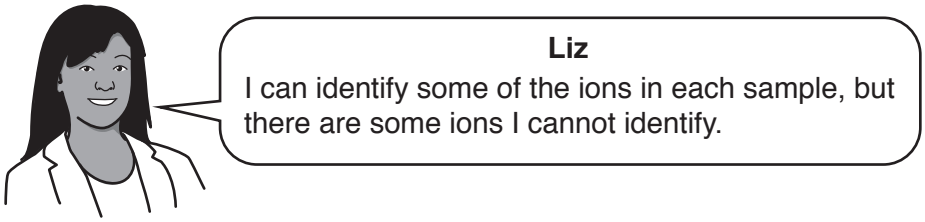
The table shows her results.

Water sample	**Dilute test solution added**			
	Sodium hydroxide	**Acid**	**Silver nitrate**	**Barium nitrate**
A	white precipitate	no change	white precipitate	no change
B	blue precipitate	no change	no change	white precipitate
C	purple precipitate	bubbles form, gas turns lime water milky	no change	no change

Liz uses this information to help her to make conclusions from her results.

Dilute test solution	Positive result	Ion present
sodium hydroxide	white precipitate	zinc or lead
	blue precipitate	copper
acid	gas which turns limewater milky	carbonate
silver nitrate	white precipitate	chloride
barium nitrate	white precipitate	sulfate

Liz talks about her results.



Use the information to identify ions in each sample of water, **A**, **B** and **C** and give reasons why some ions cannot be identified.

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

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

[Total: 10]

4 Ben works for a mining company which extracts metals from rocks.

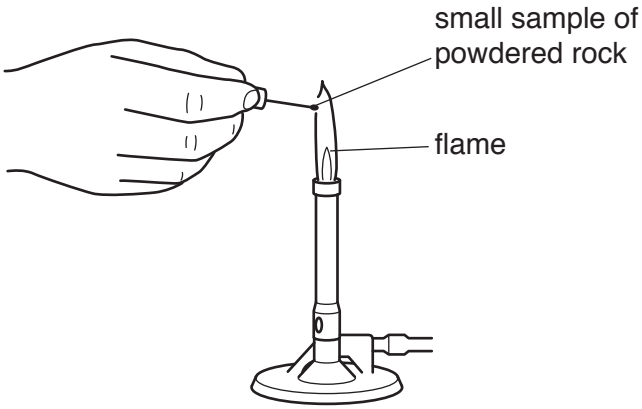
The company are considering building a mine in a new area.

Ben takes samples of different types of rocks in the area to find out if they contain useful metals.

Ben uses a flame test to identify the metals in each type of rock.

He grinds each rock to make a powder.

He heats a small sample of the powdered rock on a wire in a flame.



(a) How does Ben use the flame test to identify the metals in each type of rock?

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

(b) Ben wants to use other techniques to identify the metals in the rocks.

Which **two** techniques can be used?

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

ion chromatography	☐
light microscopy	☐
titration	☐
emission spectroscopy	☐
electron microscopy	☐

[2]

(c) Ben finds copper in some samples of rocks.

If there is enough copper in the area, the company may build a new mine.

The company asks Ben to collect more evidence.

What can Ben do to collect more evidence?

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

[Total: 6]

5 Milk from farms is processed before it is sent to shops.

Before processing: Heidi tests milk from three farms, **A**, **B** and **C**, to check its quality.

Heidi tests the milk with **resazurin**.

Resazurin gives a colour which indicates the quality of the milk.

Colour of resazurin	blue	purple	light-pink	white
Quality of milk	excellent	good	poor	very bad

Only milk with good or excellent quality is sent for processing.

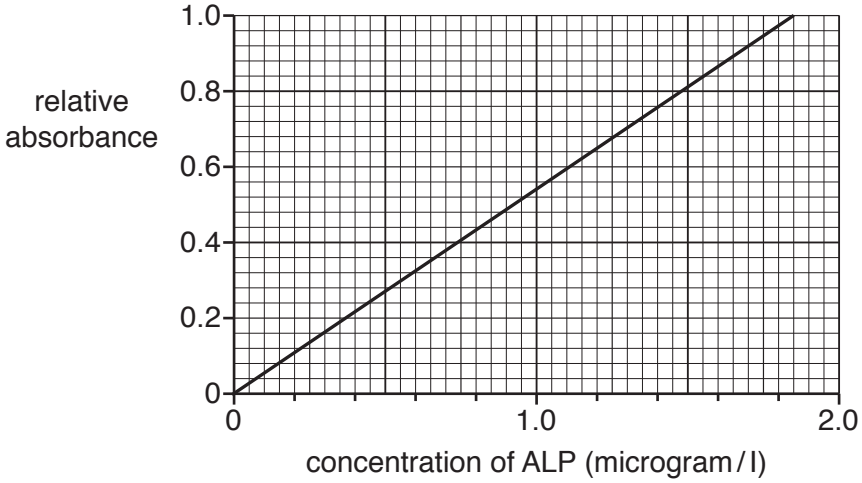
The milk sent for processing is in three batches, **X**, **Y** and **Z**.

After processing: Heidi adds a **phosphatase** reagent to the milk to find out how well the milk has been processed and whether it is suitable for sending to shops.

This phosphatase reagent produces a substance called ALP that turns the milk blue.

Heidi uses a colorimeter to measure the intensity of the blue colour.

Here is the calibration graph Heidi uses.



Concentration of ALP > 1.5 microgram/l indicates improper processing.

Concentration of ALP between 1.5 and 1.0 microgram/l indicates adequate processing.

Concentration of ALP < 1.5 microgram/l indicates proper processing.

Milk which has had adequate or proper processing is suitable for sending to shops.

Here are Heidi's results for milk from three farms, **A**, **B** and **C**.

Before processing: Resazurin test

Farm	A	B	C
Colour	white	pinkish-purple	blue

After processing: Phosphatase test

Batch	X	Y	Z
Relative absorbance	0.82	0.35	0.74

What conclusions can you make about the milk from the farms and the batches of milk after processing?

Use evidence from the graph and tables to support your conclusions.

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

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

[Total: 6]

6 Seb works in the pathology laboratory at a hospital.

He uses a light microscope to look at a slide containing a specimen of blood from a patient.

He sees red blood cells like this.

The red blood cell's actual diameter is 8.0×10^{-3} mm.

(a) Measure the diameter of the image of the red blood cell and calculate the magnification of the image.

Show your working.

magnification of image = × ..... **[3]**

(b) Seb **increases** the magnification of the microscope to look at the same specimen slide.

(i) How does he increase the magnification?

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

He chooses an objective lens with greater power.	☐
He moves the stage closer to the objective lens.	☐
He uses a brighter light source.	☐
He rotates the eyepiece lens.	☐

[1]

(ii) Which of these occurs when he increases the magnification?

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

He sees a brighter image.	☐
He sees fewer cells in the image.	☐
He sees a 3D image.	☐
He only sees a black and white image.	☐

[1]

(c) The number of white blood cells in a person's blood indicates whether a person has an infection.

The person has an infection if the ratio of white cells to red cells is greater than 0.001 : 1.

Seb does a full blood count for a specimen of blood from a patient.

He counts the number of red blood cells and white blood cells.

Here are his results.

Red blood cells in specimen	White blood cells in same specimen
750	12

Seb concludes that the patient has an infection.

Use the data to show that Seb's conclusion is correct.

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

[Total: 7]

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).