

Monday 13 January 2014 – 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



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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- 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**.
- Your quality of written communication is assessed in questions marked with a pencil (P).
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

- 1 Raj collects waste vegetable oil from fast food outlets. He makes the waste oil into biodiesel fuel.

The oil contains fatty acids which need to be neutralised.

Raj uses sodium hydroxide to neutralise the fatty acids.

He does a titration on samples of the waste oil to find out how much sodium hydroxide to use.

- (a) Fatty acids are weak acids. Sodium hydroxide is a strong alkali.

- (i) Which indicator should Raj use?

..... [1]

- (ii) Why is it important that he chooses the indicator carefully for this titration?

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

Some indicators would not change colour at the endpoint of the titration.

Some indicators would react with the acid to give off a gas.

The rate of reaction is different with different indicators.

Some indicators are too hazardous to use with weak acids. [1]

- (b) Raj adds sodium hydroxide from a burette.

He does this for three samples from the same batch of waste oil.

Each sample is 100 cm³.

The table shows his results.

	Sample 1	Sample 2	Sample 3
Volume of sodium hydroxide used in cm ³	3.7	3.5	2.5

3

- (i) He decided to test one more sample (Sample 4).

Suggest what made him test another sample.

Use data from the table to support your answer.

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..... [2]

- (ii) Sample 4 needed 3.4 cm^3 of sodium hydroxide to neutralise it.

Calculate the mean volume of sodium hydroxide to neutralise 100 cm^3 of waste oil.

Show your working.

mean volume = cm^3 [3]

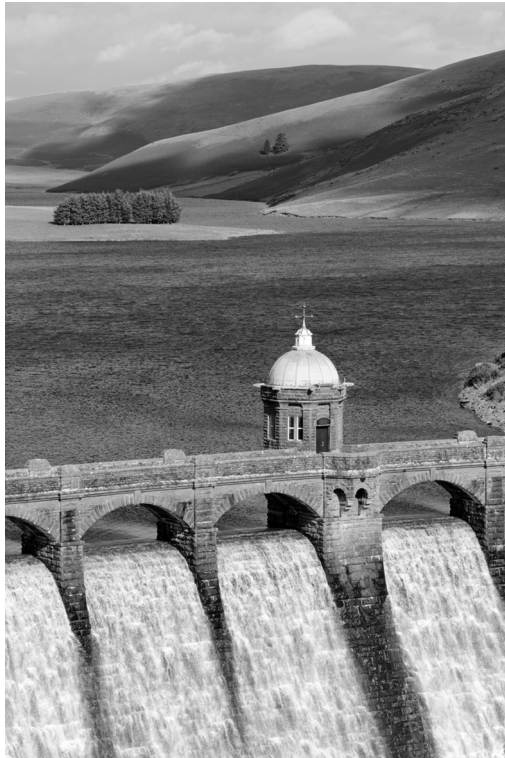
- (iii) Raj has 120 litres of waste oil to make into biodiesel fuel.

Calculate the volume of sodium hydroxide he should put in to neutralise the fatty acids.

volume = cm^3 [2]

[Total: 9]

2 Some of the water we use in our homes for drinking and cooking comes from large reservoirs.



It is Pat's job to do tests to check the quality of the water in one of these reservoirs.

She collects 10 samples of water from the reservoir each day.

(a) (i) Give **two** reasons why Pat collects 10 samples of water rather than just 1 sample.

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..... [2]

(ii) Pat needs to make sure her results are valid.

Where in the reservoir should she collect the samples of water from?

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..... [1]

(c) Pat takes the samples of water from the reservoir to the laboratory for testing.

She tests the samples of water for phosphates by adding a chemical that turns the samples blue.

The intensity of the blue colour is a measure of the concentration of phosphates in the water.

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

She has to calibrate the colorimeter at the beginning of each day.

(i) Explain why she must calibrate the colorimeter each day **and** state how this is done.

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..... [2]

(ii) Pat uses a **red** filter in the colorimeter for this test.

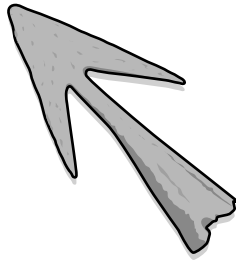
Explain why she uses a red filter but not a blue one.

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..... [2]

[Total: 13]

3 Jane is an archaeologist.

She finds this arrowhead in the ground.



Jane does some tests to find out if the arrowhead contains copper.

(a) First she does a simple flame test.

(i) What colour flame indicates the presence of copper?

answer [1]

(ii) She does the following flame test procedure.

- A She dips the platinum wire in hydrochloric acid.
- B She holds the wire in a bunsen flame.
- C She reacts a sample of the arrowhead in acid to form a solution.
- D She dips the platinum wire in the solution.
- E She holds the wire in a bunsen flame.

Explain why she does steps **A** and **B**.

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..... [2]

(iii) The flame test shows that the arrowhead contains some copper.

Jane thinks another metal may be present in the arrowhead.

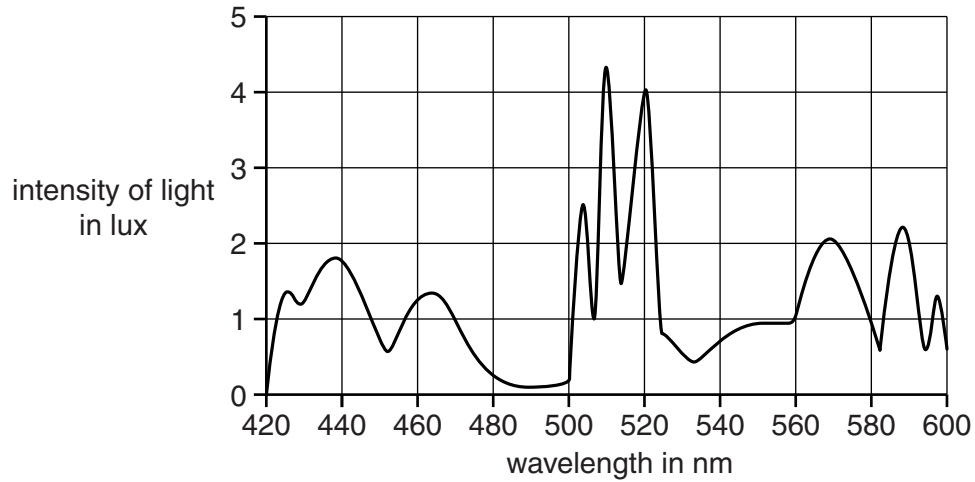
Suggest **one** reason why the other metal can't be detected using this flame test.

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

(b) Jane uses a spectrophotometer to confirm the presence of copper in the flame test.

The spectrophotometer measures the intensity of the wavelengths of light in the flame.

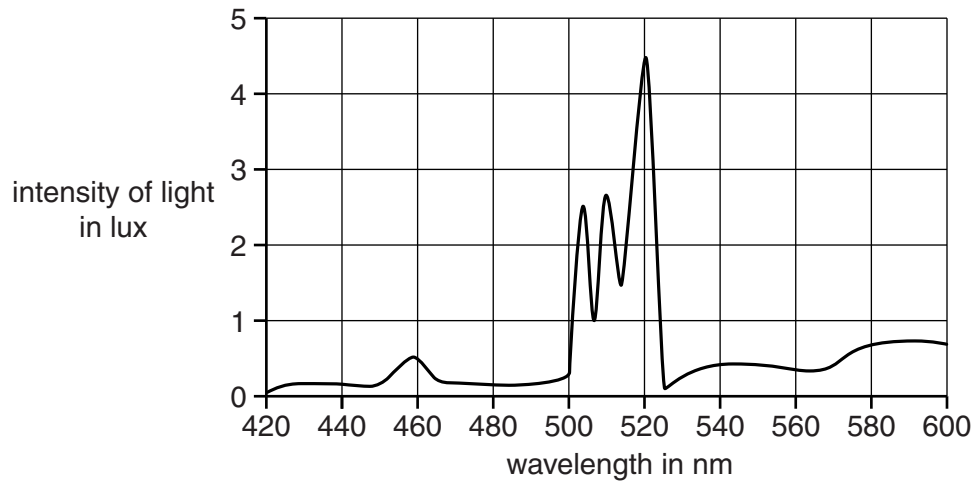
(i) The spectrophotometer produces this graph for a sample of the arrowhead.



Write down the intensity of light from the sample which has a wavelength of 505 nm.

intensity = lux [1]

(ii) The spectrophotometer produces this graph for a sample of pure copper.



What can Jane conclude from the two graphs about the metals in the arrowhead?



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

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..... [6]

(iii) Suggest what Jane could do to obtain more evidence for her conclusion.

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..... [2]

[Total: 13]

- 4 Ammonium sulfate is a white solid. It is used as a fertiliser.

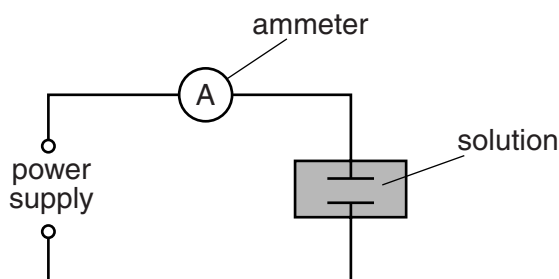
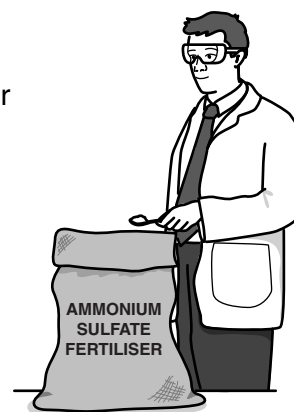
Sometimes the fertiliser is deliberately contaminated with other cheaper white solids. These include sodium carbonate and sodium chloride.

It is Leon's job to detect contaminated batches of ammonium sulfate.

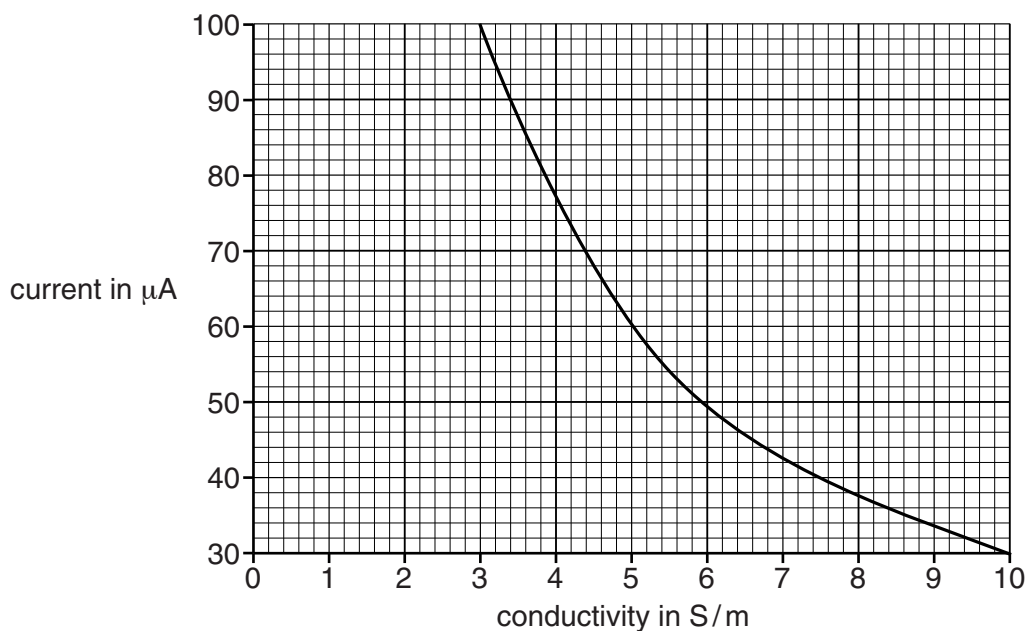
- (a) To test the fertiliser, he starts off by dissolving 50 g of fertiliser in 1.0 litre of water.

This solution is then made part of an electric circuit.

The current flowing around the circuit is measured.



Leon then uses this calibration curve to find the conductivity of the solution.



Leon also finds this table about conductivity from the internet.

Substance at concentration of 50 g/l	Conductivity in S/m
ammonium sulfate	5.5
sodium carbonate	4.5
sodium chloride	6.7

- (i) He tests a sample of fertiliser taken from a bag. It is dissolved in water and is used in the electric circuit. It gives a current of $60\ \mu\text{A}$.

What can Leon conclude about the purity of the fertiliser?

Use this result and information from the graph and the table in your answer.

.....

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..... [2]

- (ii) What could Leon do to increase his confidence in his conclusion about the purity of fertiliser in this bag?

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..... [1]

- (iii) Leon checks the calibration of his circuit at the start of each day.

Describe a suitable procedure for checking the calibration.

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..... [2]

(b) Leon tests for the presence of chloride ions in the fertiliser.

Describe a suitable procedure.

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..... [2]

(c) Leon tests for the presence of carbonate ions in the fertiliser.

Describe a suitable procedure.

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..... [2]

[Total: 9]

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Question 5 begins on page 14

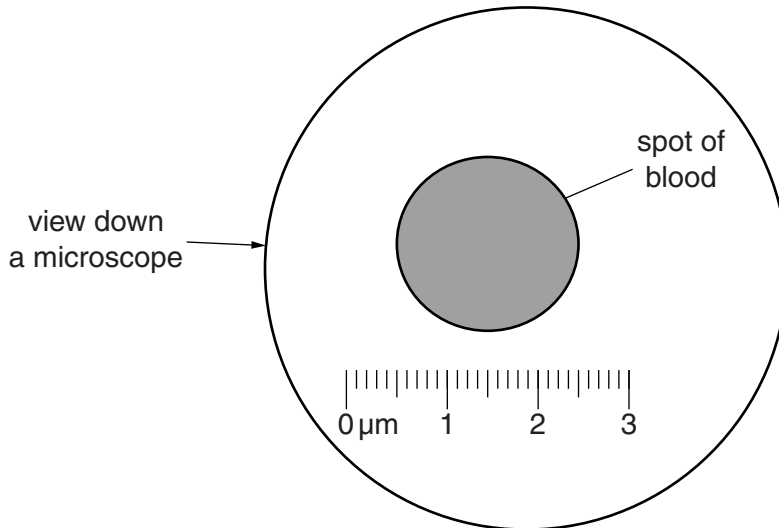
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5 Sam works in a forensics laboratory.

She looks at a piece of cloth from a crime scene using a microscope. The microscope has a scale built into the eyepiece.



(a) Sam finds what looks like a small spot of blood on the cloth.



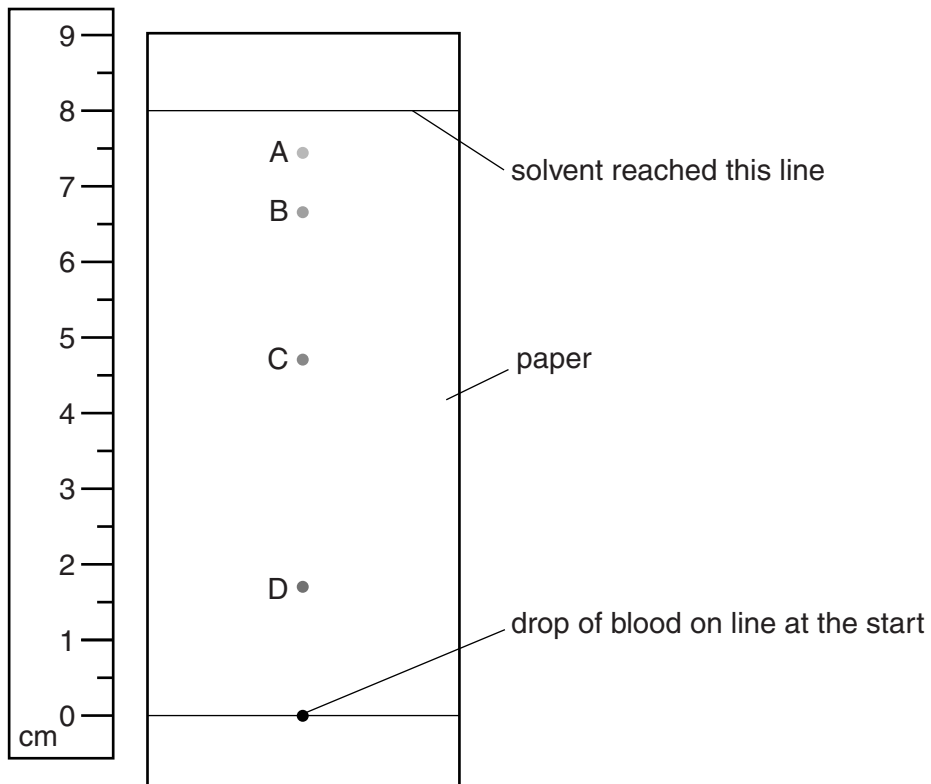
She uses the scale to measure the diameter of the spot of blood.

The microscope has a magnification $\times 4$.

Calculate the actual diameter of the spot of blood. Show your working.

..... μm [2]

- (b) Sam uses paper chromatography to identify the amino acids in a sample of blood from a victim. She obtains this chromatogram.



The chromatogram shows that the blood contains four different amino acids.

These spots are labelled **A**, **B**, **C** and **D**.

- (i) Use the ruler on the diagram to find the R_f value for spot **B**.

Show your working.

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

R_f value for spot B = [2]

- (ii) Sam uses this table of R_f values to identify the amino acid in spot **C**.

Amino acid	R_f value
isoleucine	0.72
methionine	0.55
serine	0.85
tryptophan	0.66
valine	0.61

She calculates that spot **C** has an R_f value of 0.59.

Which amino acid is most likely to be in spot **C**?

Use data in the table to justify your answer.

.....

.....

..... [2]

[Total: 6]

END OF QUESTION PAPER

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