OCR
RECOGNISING ACHIEVEMENT

Monday 13 January 2014 – Afternoon

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. 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 (✐).
- This document consists of **20** pages. Any blank pages are indicated.

OCR is an exempt Charity

Turn over

2
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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?

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

bromothymol blue ☐

methyl orange ☐

phenolphthalein ☐ **[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 four samples from the same batch of waste oil.

Each sample is 100 cm^3.

The table shows his results.

	Sample 1	Sample 2	Sample 3	Sample 4
Volume of sodium hydroxide used in cm^3	3.6	3.5	2.5	3.2

He decided not to use the result for Sample 3.

Using the data in the table, suggest why Raj decided not to use the result for Sample 3.

....

.... **[1]**

(c) Calculate the mean volume of sodium hydroxide required to neutralise 100 cm^3 of waste oil for samples 1, 2 and 4. Show your working.

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

(d) Raj used this graph to help him calculate how much sodium hydroxide to add to each litre of waste oil.

mean titration result in cm^3

volume of sodium hydroxide needed per litre of oil in cm^3
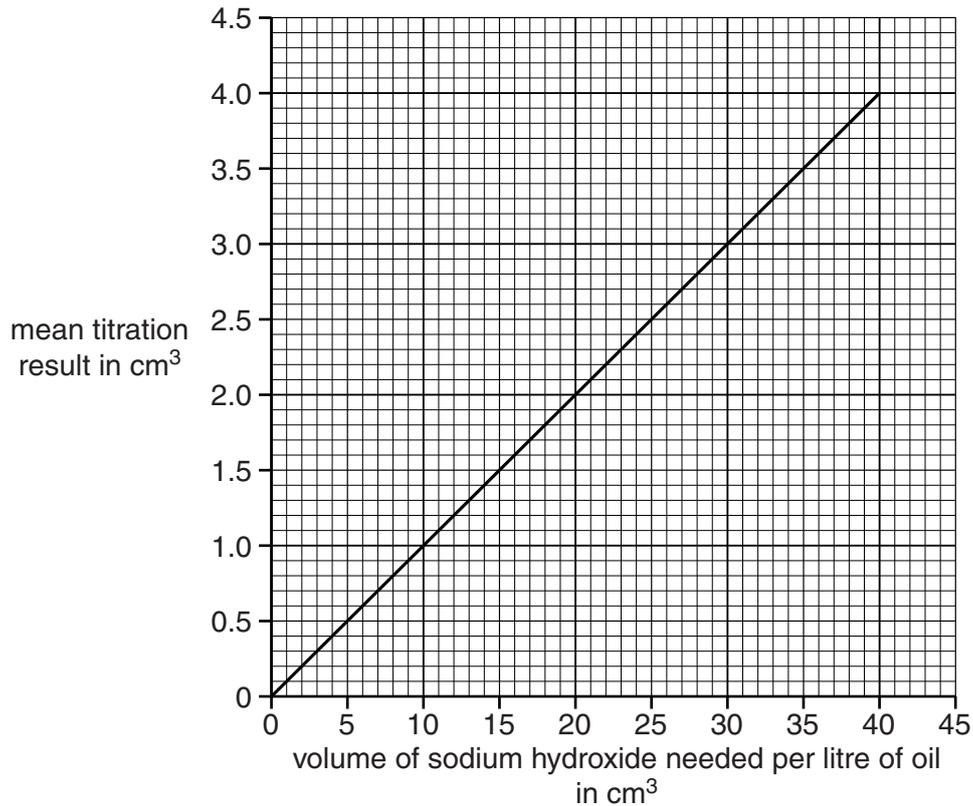
(i) Raj needs to neutralise the fatty acids in 1.0 litre of waste oil.

What volume of sodium hydroxide should he add to 1.0 litre of waste oil?

Use your answer to **(c)** and the graph.

volume = ... cm^3 **[1]**

(ii) Raj has collected 25 litres of waste oil.

What volume of sodium hydroxide should he put in to neutralise it?

Show your working.

volume = ... cm^3 **[2]**

[Total: 8]

Turn over

2 Some of the water we use in our homes for drinking and cooking comes from large reservoirs.
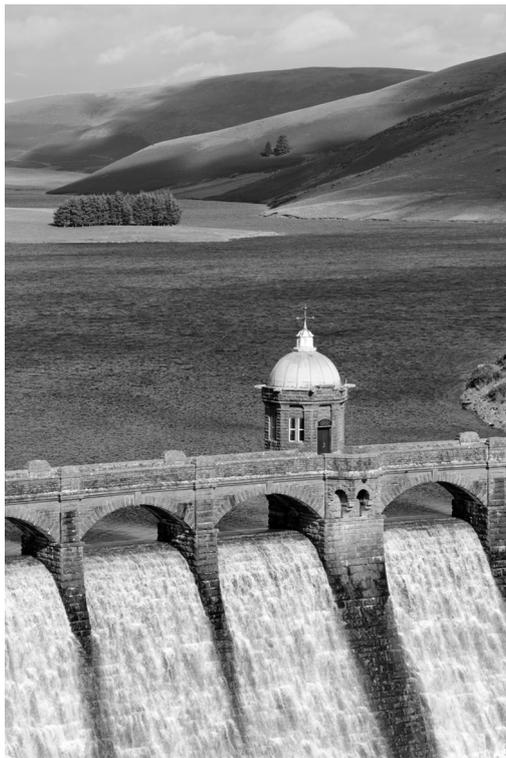
It is Pat's job to do tests to check the quality of the water in one of these reservoirs.

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

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

....

....

.... **[2]**

(b) Pat collects her samples from 10 different places at different times of the day.

Explain why.

....

....

.... **[2]**

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

When she collects the samples of water, she needs to avoid contaminating them. She also needs to know where each sample of water came from.

Describe the procedures that Pat should follow when collecting the samples of water.

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

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.... **[6]**

Turn over

(d) Pat tests the samples of water.

One of the tests turns the samples of water 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 each day.

(i) Why does she calibrate the colorimeter each day?

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

To avoid any systematic error in her measurements. ☐

To avoid contamination of the samples. ☐

To make her measurements accurate. ☐

To make her measurements qualitative. ☐

To speed up taking her measurements. ☐ **[2]**

(ii) Put a ⬭ring around the word that correctly completes the sentence below.

To calibrate the colorimeter, Pat puts in a sample of water containing phosphates with

known ... **concentration** / **mass** / **volume** . **[1]**

(e) Pat does the test three times on each sample of water from the reservoir.

Table 1 shows the results for one of the samples on Monday.

Table 1

	Test 1	Test 2	Test 3
Concentration of phosphates in ppm	0.41	0.46	0.43

(i) Calculate the range.

range = ... ppm **[1]**

(ii) Table 2 shows the mean concentrations for Tuesday, Wednesday and Thursday.

Table 2

	Tuesday	**Wednesday**	**Thursday**
Mean concentration of phosphates in ppm	0.46	0.44	0.43

Pat's colleague, Joe, comments on these results.

These results show that the concentration of phosphates is getting less.
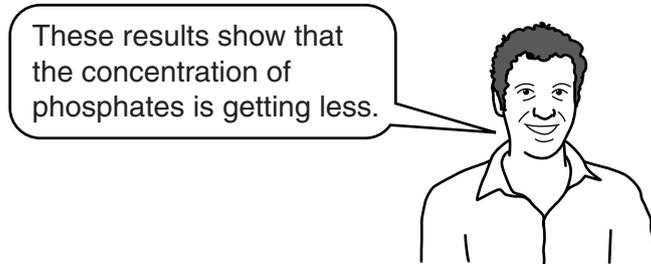
Pat says Joe is wrong.

Use your answer to **(e)(i)** to explain why Pat is correct.

....

.... **[1]**

[Total: 15]

3 Jane is an archaeologist.

She finds this arrowhead in the ground.
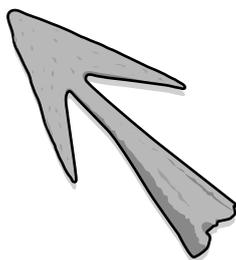
Jane does some tests to find out if the arrowhead contains copper.

(a) First she does a simple flame test.

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

       Put a ⟨ring⟩ around the correct colour.

              green   **red**   **violet**   **yellow**

                                                                                                   [1]

    (ii) Here is the procedure she follows.

       The steps are in the **wrong order**.

       A   She dips the platinum wire in hydrochloric acid.

       B   She holds the wire in a bunsen flame.

       C   She dips the platinum wire in the solution.

       D   She reacts a sample of the arrowhead in acid to form a solution.

       Put the steps in the **correct order** in the table below.

       The first one has been done for you.

D			

                                                                                                       [1]

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

Jane thinks another metal may be present in the arrowhead. However, she can't use the flame test to detect it.

Why can't she detect the other metal with a flame test?

Put ticks (✓) in the boxes next to the **two** best reasons.

It reacts with the platinum wire. ☐

It glows too brightly in the flame. ☐

Its colour is similar to the colour for copper. ☐

It produces too many different colours in the flame. ☐

It is present in a much smaller amount than the copper. ☐ **[2]**

Question 3 continues on page 12

(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.
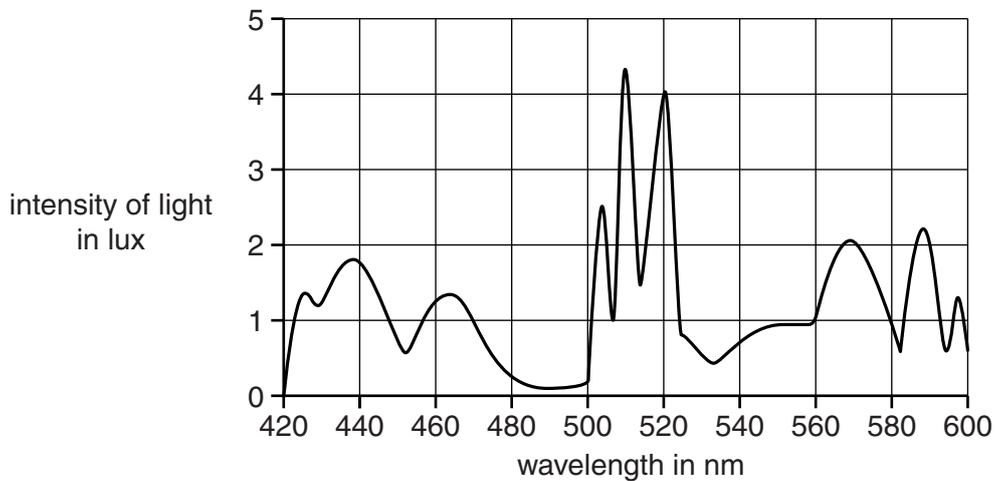
(i) The spectrophotometer produces this graph for a sample of pure copper.
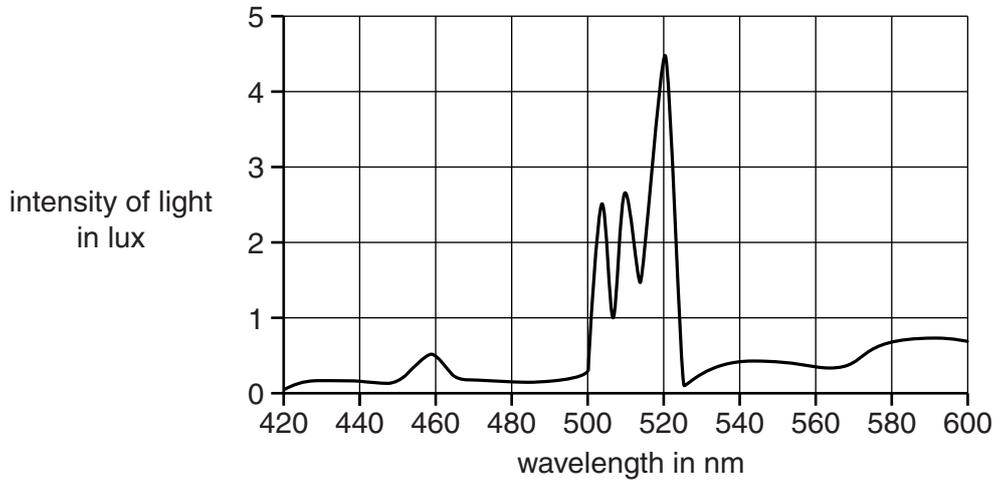
Write down the wavelength of light from copper which has the maximum intensity.

wavelength = ... nm **[1]**

(ii) The spectrophotometer produces this graph for a sample from the arrowhead.

The graph shows that the arrowhead is made of copper, but may also contain another metal.

Jane

Use data from both graphs to explain why Jane has come to this conclusion.

✎ *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 to measure its conductivity.
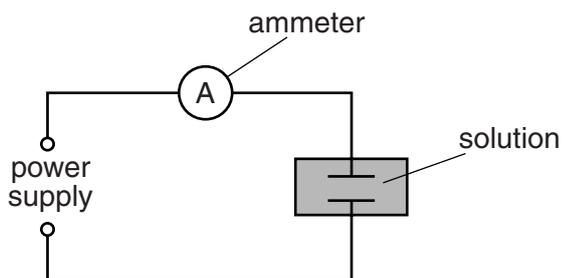
(i) He tests a sample of fertiliser taken from a bag. It is dissolved in water and is used in the electric circuit. It gives a current of 60 μA.

Leon thinks this bag of fertiliser may be contaminated with sodium carbonate.

Use the calibration curve and the table of data below to decide if he is correct.
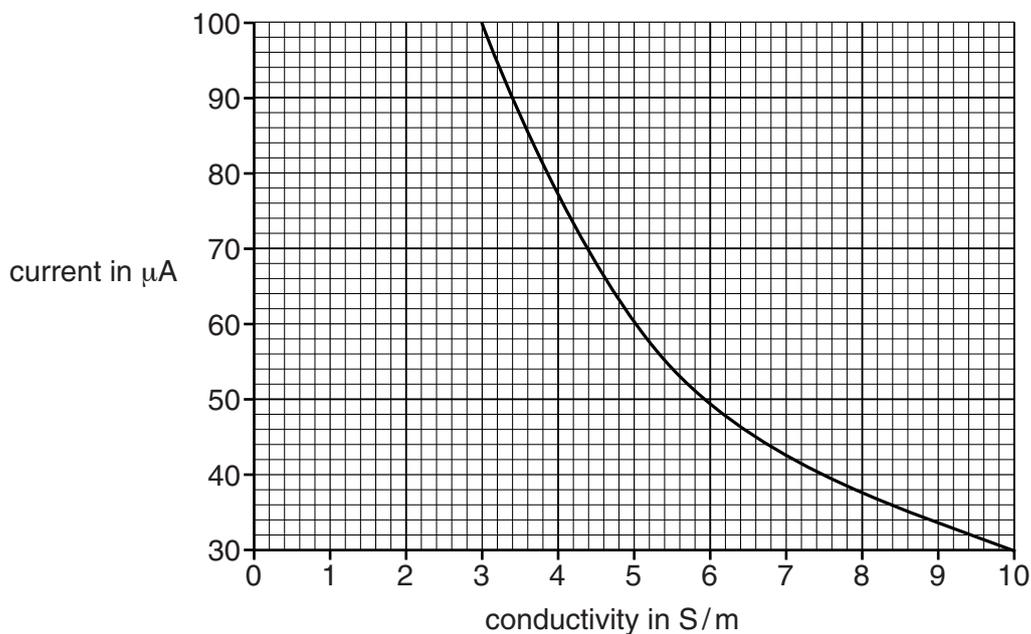
Substance at concentration of 50 g/l	Conductivity in S/m
ammonium sulfate	5.5
sodium carbonate	4.5
sodium chloride	6.7

Is he correct? Give reasons for your answer.

....

....

....

.... **[2]**

 (ii) What should Leon do to confirm his conclusion about this bag?

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

Test samples from five different bags. ☐

Test the same sample five more times. ☐

Test five more samples from the same bag. ☐ **[1]**

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

Describe a suitable procedure for checking the calibration.

....

....

....

.... **[2]**

Turn over

(b) Leon does some more tests on four different bags of fertiliser.

Here are his results.

	Results of tests on fertiliser	
Bag	**Adds hydrochloric acid to fertiliser**	**Adds silver nitrate solution to fertiliser solution**
A	no reaction	goes cloudy
B	bubbles appear	goes cloudy
C	no reaction	no reaction
D	bubbles appear	no reaction

  (i) Which bag, **A**, **B**, **C** or **D**, could be pure ammonium sulfate?

.... **[1]**

  (ii) Which bag, **A**, **B**, **C** or **D**, could be ammonium sulfate contaminated with sodium chloride?

.... **[1]**

(c) Leon does a different test. He takes a sample from each bag.

He adds barium chloride solution to a solution of each sample. They all turn cloudy.

He concludes that each bag must contain ammonium sulfate.

Is he **completely** correct? Give reasons for your answer.

....

....

....

.... **[2]**

[Total: 9]

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Question 5 begins on page 18

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5 Sam works in a forensics laboratory.

She studies a piece of clothing from a crime scene.

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

She uses a magnifying glass to get a better look.

What else could she use to identify the spot?
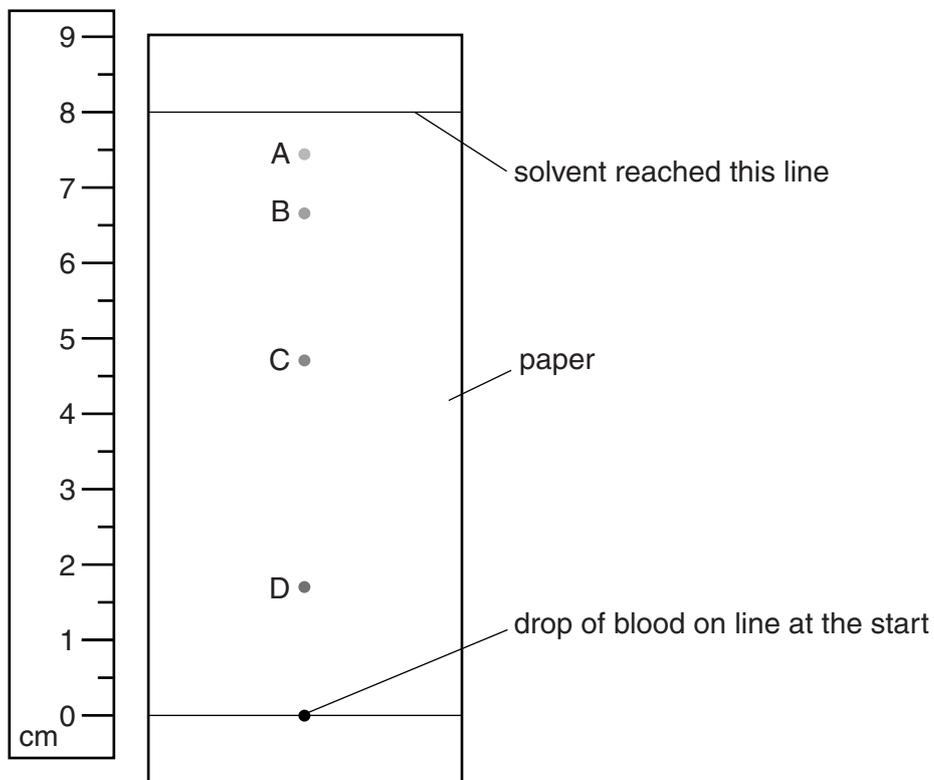
Put a (ring) around the correct instrument.

colorimeter   **microscope**   **pH meter**

[1]

(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.

Sam thinks spot **C** is methionine. Use the table to decide if she is correct.

....

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.... **[2]**

[Total: 5]

END OF QUESTION PAPER

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