OCR
RECOGNISING ACHIEVEMENT

Wednesday 5 June 2013 – Afternoon

LEVEL 1 CAMBRIDGE NATIONAL IN SCIENCE IN THE WORKPLACE

R075/01 How scientific data is used

R03822061 3

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

R 0 7 5 0 1

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

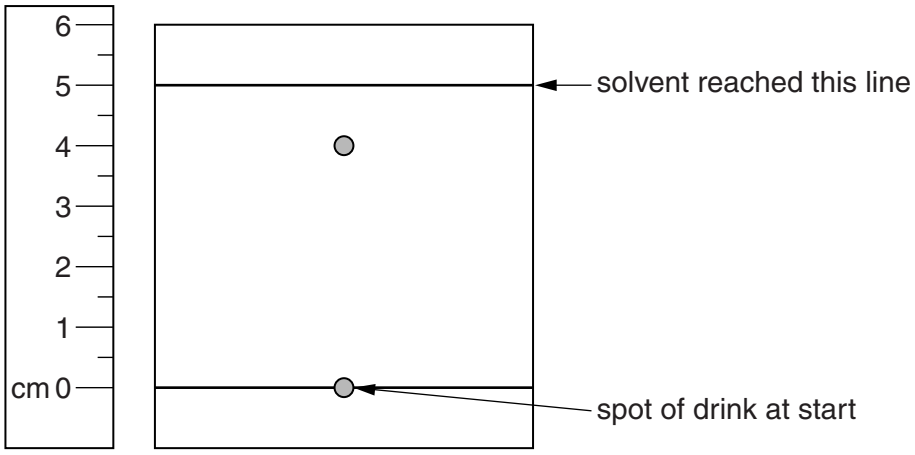
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **50**.
- Your quality of written communication is assessed in questions marked with a pencil (✎).
- This document consists of **20** pages. Any blank pages are indicated.

Answer **all** the questions.

1 Eve and Joe work in a food testing laboratory.

Eve uses chromatography to test some food colours used in drinks.

The diagram shows a chromatogram from one of the drinks she tests.



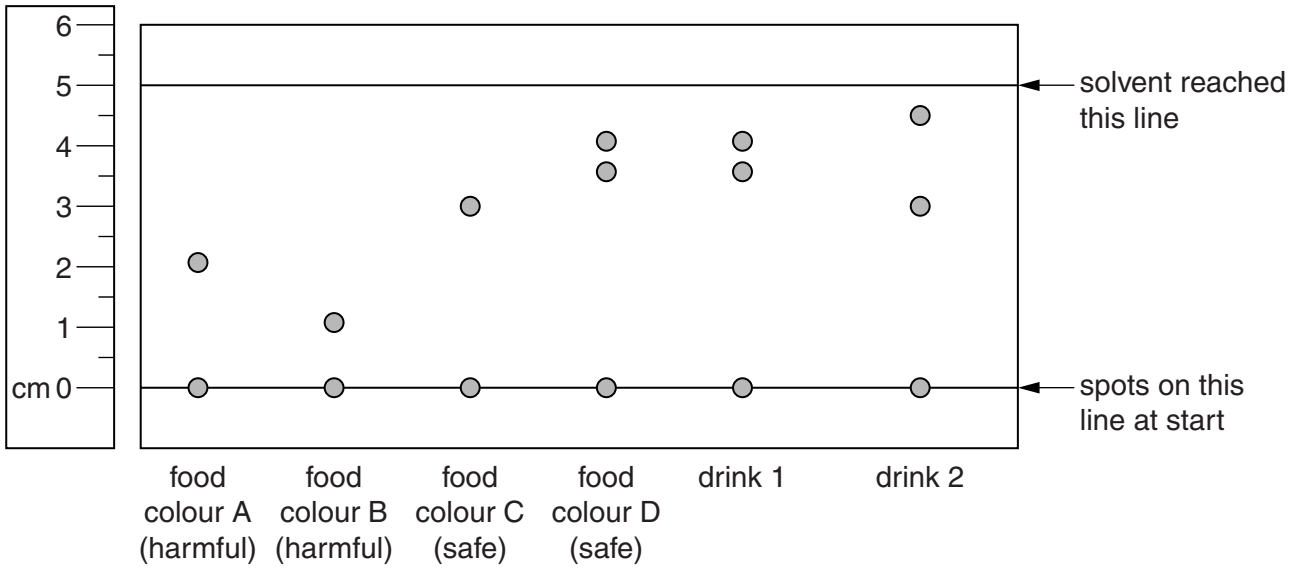
(a) Calculate the R_f of the food colour in the drink.

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

R_f = ... **[1]**

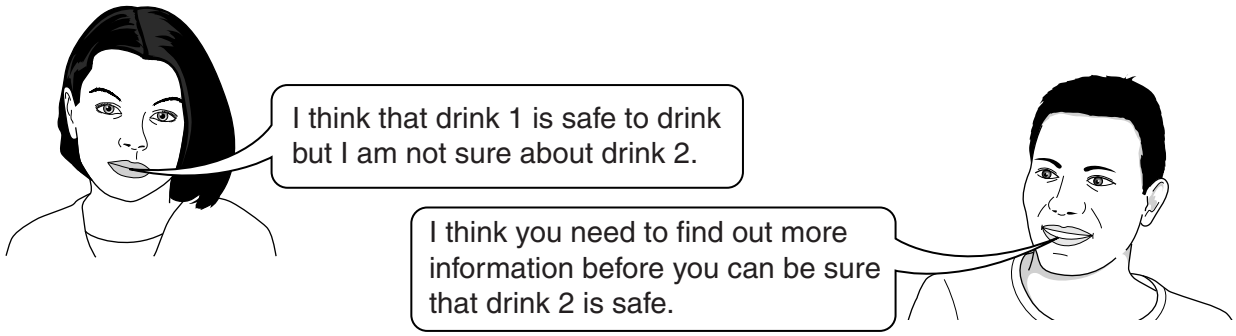
(b) Some food colours are harmful to humans. They must not be added to drinks.

Eve does a chromatogram using some food colours and some drinks.



3

Eve discusses the results of the chromatogram with Joe.



How does the chromatogram support Eve's ideas about drink 1 and drink 2? What further information does she need to find out to be sure about the safety of drink 2?

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

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

(c) Some parents have complained that a new soft drink causes behaviour problems in children.

The soft drink contains a new food colour.

How could Eve find out whether the new food colour causes behaviour problems in children?

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

Study the effect of the new food colour on many children.	☐
Compare the behaviour of children before and after having a drink containing the new food colour.	☐
Find out if the food colour affects adult behaviour.	☐
Test the effects of other food colours on the behaviour of children.	☐
Find out if children prefer drinks that contain the new food colour.	☐

[2]

[Total: 9]

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Question 2 begins on page 6

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2 Sue works for a museum. She researches ancient Egyptian mummies. Mummies are dead bodies that are wrapped in many layers of cloth. They are many thousands of years old.

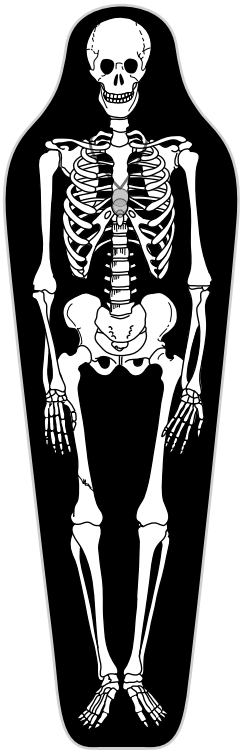
She has found that ancient Egyptian people had an average height of 1.7 m and lived an average of 35 years.

She uses X-rays to gather more data about the mummies.

Sue estimates the age of the person when they died:

- from the condition of the teeth
- by looking for evidence of arthritis, which causes bone growths in older people.

She records data from the X-ray of one of the mummies, **Man 1**.



Data from the X-ray of Man 1

height	• 1.6 m
teeth	• no children's teeth • all adult teeth • teeth in good condition
bones	• no bone growths • no evidence of arthritis
damage	• long bone of leg broken
other	• some gold jewellery is wrapped up with the body

From the X-ray I can tell that **Man 1** was a wealthy man of below average height. The state of his teeth and bones suggest he was a young man of about 20 years old.

He may have died from a broken leg caused by an accident, such as a fall.

Sue

(a) Sue X-rays another mummy, **Man 2**.

The table shows the data she collects.

Data from the X-ray of Man 2

height	• 1.8 m
teeth	• no children's teeth • all adult teeth • teeth very worn, some missing
damage	• some damage to skull • bone fragments inside skull • bone growths on backbone may indicate arthritis
other	• lots of gold jewellery is wrapped up with the body

What conclusions can Sue make from her data about **Man 2** and the cause of his death?

In your answer, explain what data and evidence she uses to make her conclusions.

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

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

(b) Sue looks at the X-rays of teeth from lots of mummies of ancient Egyptian people.

She finds that the teeth of these people were much more worn down and damaged than our teeth today.

Why are the teeth of the ancient Egyptian people more worn down and damaged?

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

The people lived in a desert and their food probably contained a lot of sand.	☐
People did not chew their food properly.	☐
People had no dental care.	☐
Many people probably had toothache.	☐
The people drank a lot of water.	☐ **[2]**

(c) Sue uses evidence from X-rays of the teeth to make conclusions about what the ancient Egyptian people used to eat.

She uses secondary data to support her conclusions.

Which of the following is an example of secondary data?

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

ridges and marks left by food on the teeth	☐
amount of tooth enamel that has worn away	☐
difference in wear and tear on different types of teeth	☐
paintings of food on the walls where the mummies were found	☐ **[1]**

[Total: 9]

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Question 3 begins on page 10

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3 Ben is a geologist. He studies the minerals in some rocks. He uses a hammer to break off and collect some samples of different minerals from the rocks.

He is going to take the mineral samples back to his laboratory to identify the elements in them.

(a) Ben follows this procedure when he collects his samples:

1. He keeps the hammer clean.
2. He places each sample in a separate plastic bag and seals it.
3. He labels each bag immediately with the time, date and place of collection.

Why does Ben follow this procedure?

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

(b) Ben collects samples of three minerals. He does some tests to identify the metal in each mineral.

First, Ben does flame tests on some known metal compounds. The table shows his results.

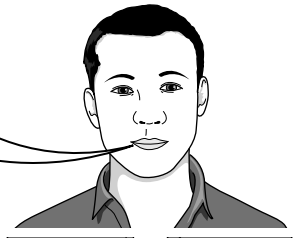
Compound tested	Colour of flame
copper compound	pale green
sodium compound	bright, strong yellow
iron compound	pale yellow
lead compound	pale blue

Then he does a flame test on each mineral.

Mineral tested	Colour of flame
mineral 1	pale green
mineral 2	bright, strong yellow
mineral 3	bright, strong yellow

Ben is unhappy with the results of the flame test on each mineral.

I don't think these are reliable results. I collected my samples near the sea. I think some of my samples contain sodium compounds from the sea salt. I can't tell what other metals are in the minerals from these results.



(i) Explain why Ben cannot tell what metals are in all three of the minerals using the flame test results.

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

(ii) Ben does the mineral tests again. He holds a glass filter in front of the flame.

The filter absorbs yellow light but allows other colours of light through.

How does this help Ben to identify the metals in all the minerals?

Explain your answer.

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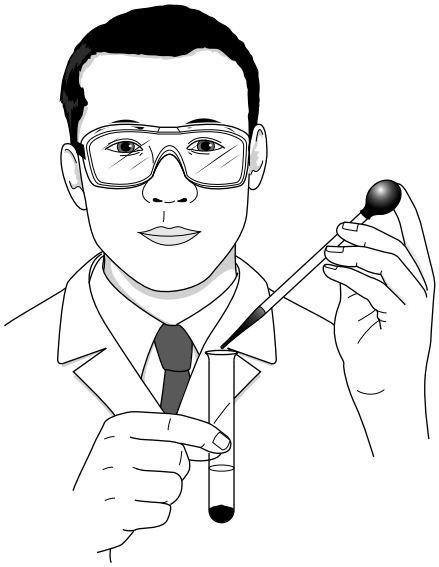
..... **[2]**

(c) Ben does some further tests to identify the metal ions in each mineral. He makes a solution of each mineral by dissolving it in dilute acid. He then adds dilute sodium hydroxide to each solution.



These are his results for the three minerals.

Test	Result for mineral 1	Result for mineral 2	Result for mineral 3
add **dilute sodium hydroxide**	blue precipitate	green precipitate	white precipitate

He finds out the names of some minerals and the metal compounds that they contain.

Name of mineral	Metal compound in the mineral
siderite	iron(II) carbonate
malachite	copper carbonate
cerussite	lead carbonate

Draw **three** straight lines to connect each **name of the mineral** with the correct **metal ion**.

Draw **three** straight lines to connect each **metal ion** with the correct **mineral tested**.

Name of mineral	Metal ion	Mineral tested
siderite	iron Fe^{2+}	mineral 1
malachite	lead Pb^{2+}	mineral 2
cerussite	copper Cu^{2+}	mineral 3

[3]

(d) Ben uses the results from the sodium hydroxide tests as well as the results from the flame tests to identify the metals in the minerals.

Why does Ben use two techniques?

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

Flame tests involve using very high temperatures.	☐
Tests using sodium hydroxide only work for solutions.	☐
Using two techniques makes the results of the analysis more reliable.	☐
Both techniques can be used to find out the pH of the minerals.	☐

[1]

[Total: 11]

Question 4 begins on page 14

4 Anya works for a large chemical factory that makes medicines.

The factory makes aspirin tablets.

The factory operates 24 hours a day. Many batches of tablets are made every day. Each batch contains thousands of tablets.

Anya's job is to check the amount of aspirin in the finished tablets before they are put into boxes.

(a) Anya chooses sample tablets and checks them.

How should Anya choose sample tablets to make sure that her sampling is as reliable as possible?

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

Choose all the sample tablets from the same batch. ☐

Choose one sample tablet every day. ☐

Choose sample tablets from all batches throughout the day. ☐

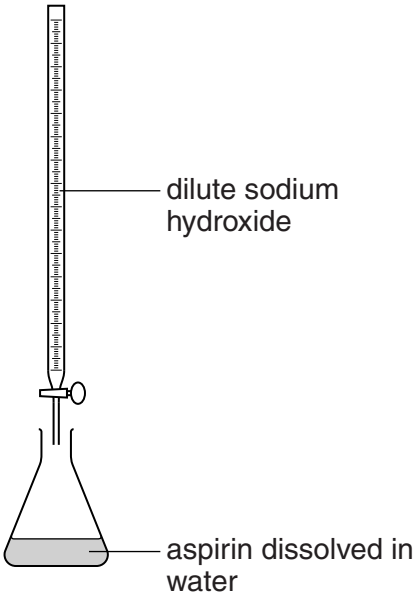
Choose sample tablets only from the last batch each day. ☐

Choose as many sample tablets as possible. ☐ **[2]**

(b) Anya uses a titration to check the amount of aspirin in each sample tablet.

She dissolves the aspirin in water.

She adds dilute sodium hydroxide from a burette.



Aspirin is a weak acid. Sodium hydroxide is a strong alkali.

Anya chooses to use phenolphthalein indicator in the titration.

Why is it important that she chooses the indicator for this titration carefully?

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

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

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

The rate of this reaction is different with different indicators. ☐

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

(c) Anya tested 5 sample tablets from a batch (batch A).

The table shows her results.

	Tablet 1	**Tablet 2**	**Tablet 3**	**Tablet 4**	**Tablet 5**
burette reading at end in cm^3	20.30	40.70	20.50	40.90	41.75
burette reading at start in cm^3	0.00	20.30	0.00	20.50	0.00
volume of sodium hydroxide used in cm^3	20.30	20.40	20.50	20.40	

(i) Anya started with a full burette.

She refilled the burette before testing some of the tablets.

When did she refill the burette?

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

only before testing **Tablet 4** ☐

before testing **Tablet 3** and **Tablet 5** ☐

before testing every tablet ☐

only at the end ☐ **[1]**

(ii) Use the results for **Tablets 1**, **2**, **3** and **4** to calculate a mean for the volume of sodium hydroxide used.

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

(iii) Anya crossed out the result for **Tablet 5**.

What volume of sodium hydroxide was used in the titration for **Tablet 5**?

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

(iv) Why do you think Anya crossed out the result for **Tablet 5**?

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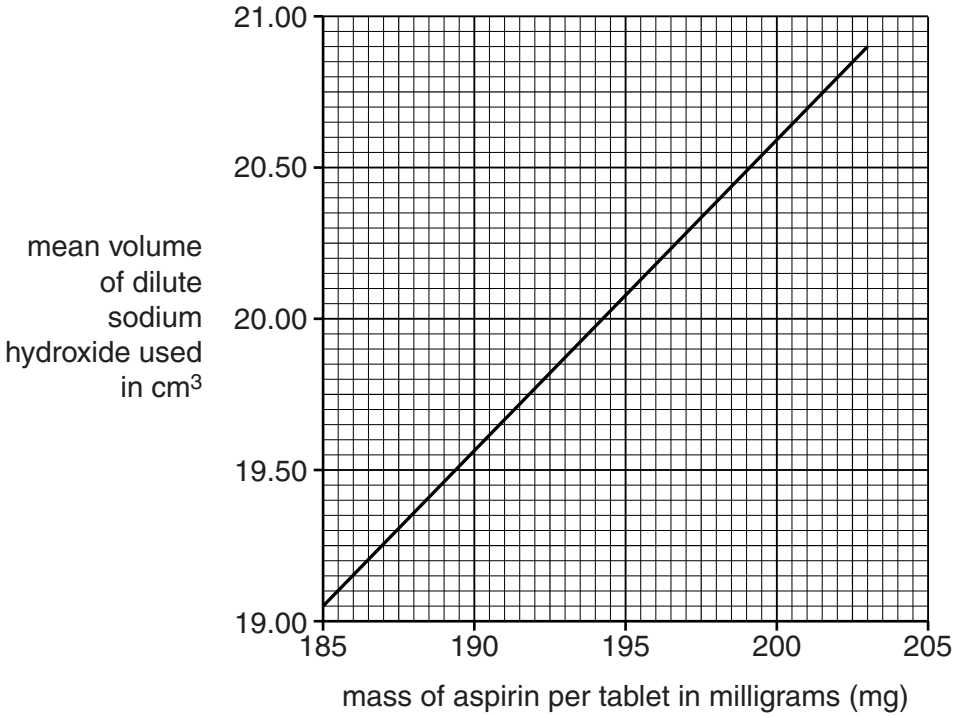
..... **[2]**

(d) Anya tests sample tablets from another batch (batch B).

She uses a calibration graph to work out the mass of aspirin in each tablet.



(i) The mean volume of dilute sodium hydroxide used in the titration was 20.50 cm^3.

What is the mass of aspirin per tablet?

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

(ii) Each tablet should contain 200 mg of aspirin.

However, tablets may be sold if the mass of aspirin per tablet is within 4 mg of this value.

Look at your answer to **(i)**.

May the tablets from batch B be sold? Explain your answer.

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

(e) Anya wants to buy some new computer controlled equipment to do the titrations.

Give **two** advantages of using computer controlled equipment for doing the titrations.

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

[Total: 14]

5 Jake works for a company that grows rose bushes to sell in garden centres.

Greenfly are insects that live on rose bushes. Many greenfly can live on one bush. They damage the bushes.

Jake researches the numbers of greenfly that live on the bushes.

(a) The company has a thousand rose bushes.

Describe how Jake could use sampling techniques to estimate the total number of greenfly on **all** of the bushes.

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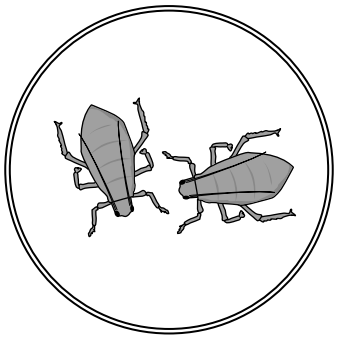
..... **[3]**

(b) Jake looks at the greenfly he collects.

He uses three different instruments …

- a hand lens
- a light microscope
- an electron microscope.



What are the advantages of each type of instrument?

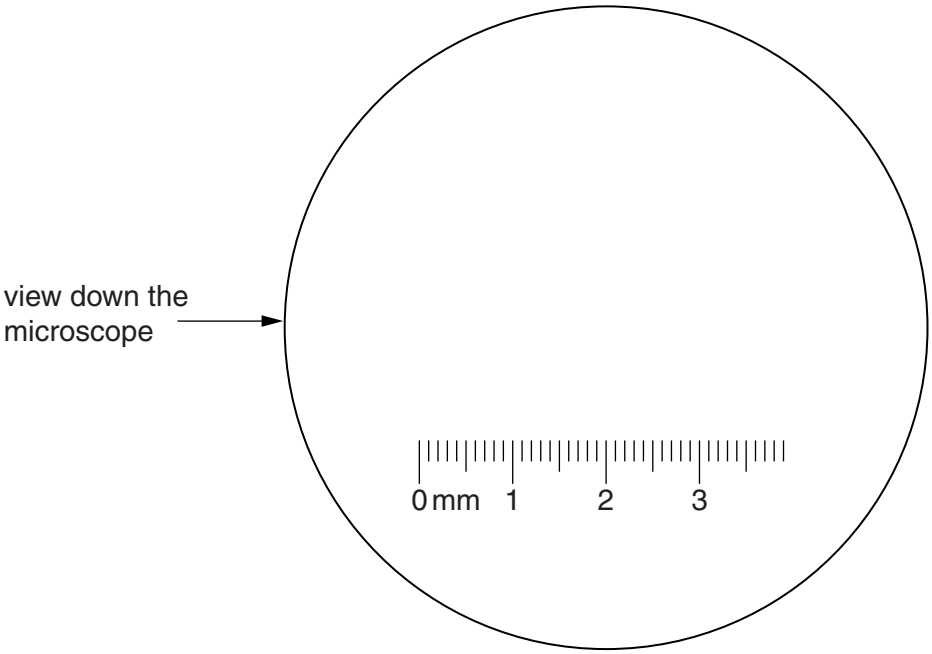
Put a tick (✓) in one box in each row.

Advantage	Hand lens	Light microscope	Electron microscope
best for looking at different bushes quickly	☐	☐	☐
good quality image at x10000 magnification	☐	☐	☐
good quality image at x500 magnification and fast to use in the lab	☐	☐	☐
easiest to carry to the bushes	☐	☐	☐
highest quality digital image	☐	☐	☐

[3]

(c) Jake is thinking about buying a new light microscope for the lab.

He looks at one with a scale built into it.



What could Jake use the scale for?

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

[Total: 7]

END OF QUESTION PAPER