OCR
RECOGNISING ACHIEVEMENT

Wednesday 5 June 2013 – Afternoon

LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE IN THE WORKPLACE

R075/02 How scientific data is used

R038230613

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

R075021

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.

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Answer **all** the questions.

1 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 them.

(a) Ben wants to make sure that the samples do not become contaminated during collection or transport.

(i) What does **contaminated** mean?

.....

.....

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

(ii) What should Ben do when he is collecting and transporting the samples to make sure that they do not become contaminated?

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

(b) Ben thinks that two of the minerals in the samples are malachite and bluestone. He finds out what chemical compounds are in malachite and bluestone.

Name of mineral	Compound in the mineral
malachite	copper carbonate
bluestone	copper sulfate

Ben tests the minerals to see if he is correct.

For one of the tests he uses powdered mineral. For the other tests he makes a solution of the mineral by dissolving the mineral in dilute acid.

These are his results.

Test	Result for mineral 1	Result for mineral 2
add **dilute sodium hydroxide** to the mineral solution	blue precipitate	blue precipitate
add **dilute acid** to the mineral powder	fizzes and gives off a gas that turns lime water milky	no reaction
add **dilute barium chloride** to the mineral solution	no reaction	white precipitate
add **dilute silver nitrate** to the mineral solution	no reaction	no reaction

(i) How do the tests show that **both** minerals contain copper ions?

.....

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

(ii) How do the tests show that **neither** mineral contains any chloride ions?

.....

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

(iii) Ben uses the results of the tests to identify the compounds and the names of the minerals.

Use the information in **both** tables to give the name of each mineral.

Explain your reasons.

name of mineral 1 .....

reason .....

.....

name of mineral 2 .....

reason .....

.....

[3]

(c) After the sodium hydroxide tests, Ben does some flame tests to confirm the identity of 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: 10]

2 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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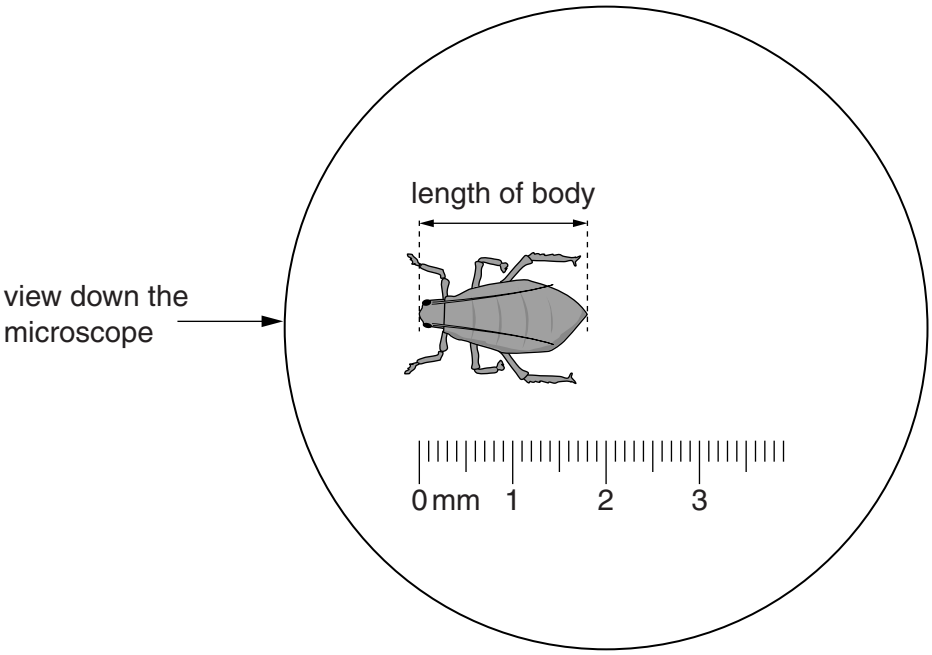
..... **[3]**

(b) Jake looks at one of the greenfly under a microscope. The microscope has a scale built into it.

Jake uses the scale to measure the length of the body. The scale measures in mm.



The scale has a magnification of **x2**.

What is the actual length of the greenfly?

Show your working.

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

(c) Jake investigates a pesticide that is designed to kill greenfly.

He wants to find out how well the pesticide works.

He chooses 10 rose bushes that all have a similar number of greenfly.

He sprays the bushes with the pesticide.

(i) What should Jake use as a control?

.....

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

(ii) What measurements should he make to find out how well the pesticide works?

.....

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

[Total: 8]

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Question 3 begins on page 10

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3 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.

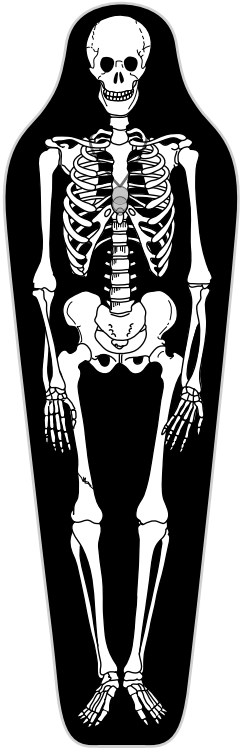
She uses X-rays to gather some data about the mummies of two men, **Man 1** and **Man 2**.

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.

Data from X-rays

Man 1



	Man 1	Man 2
height	• 1.9 m	• 2.0 m
teeth	• no children's teeth • all adult teeth but wisdom teeth had not come through gums • teeth not worn down and in very good condition • front teeth out of shape and turn inward	• no children's teeth • all adult teeth • teeth very worn, some missing • front teeth out of shape and turn inward
bones	• no extra bone growths	• bones in spine and joints have some extra growths
damage	• long bone of leg broken	• none visible
other	• unusual shape of lower jaw • some gold jewellery is wrapped up with the body	• unusual shape of lower jaw • very large amount of gold jewellery is wrapped up with the body

Sue makes some conclusions based on the data and evidence from the X-rays.

Using the data from the X-rays, I think that **Man 1** was a wealthy man of above average height. I think 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.

I think that **Man 2** was even more wealthy. He was a lot older when he died. He was above average height and may have spent his last years in some pain from toothache and arthritis. He may have died naturally of old age.

I think the two men may have been closely related to each other and may even have been father and son.

Sue

(a) How does the evidence from the X-rays support the conclusions that Sue has made?

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

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

(b) Sue looks at the hair of the mummies, **Man 1** and **Man 2**.

She finds some insects she thinks are headlice.

She looks at the insects using a **hand lens** and an **electron microscope**.

Give an advantage of using each piece of equipment.

Advantage of using a **hand lens** .....

.....

Advantage of using an **electron microscope** .....

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

[Total: 8]

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?

.....

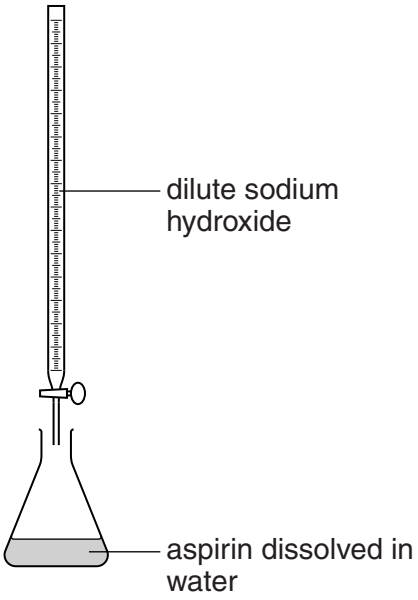
.....

..... **[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 tests 5 tablets from the same batch (batch A).

Table 1 shows her results.

Table 1

	Rough trial	Accurate readings				
		Tablet 1	Tablet 2	Tablet 3	Tablet 4	Tablet 5
volume of sodium hydroxide used in cm^3	21.00	20.30	20.40	20.45	20.25	20.30

Anya explains why she repeats the test.

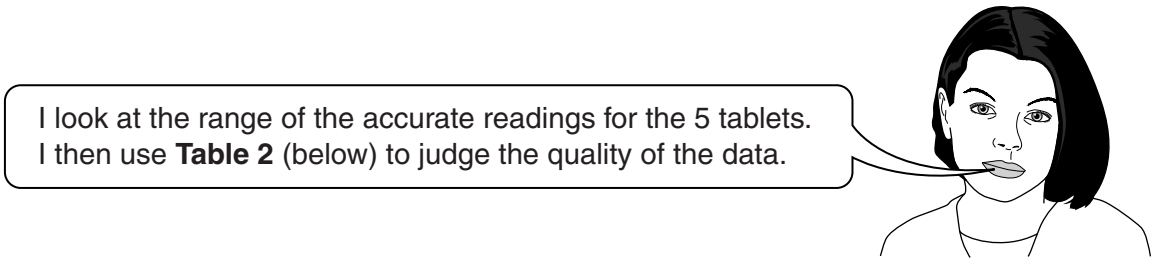


Table 2

Range of accurate readings in cm^3	Quality of the data
up to 0.10	excellent
0.11–0.30	good
0.31–0.50	fair
greater than 0.50	poor

(i) Why is the range of accurate readings a reliable method of judging the quality of the data?

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

The range shows the repeatability of the data. ☐

Repeating readings gives secondary data. ☐

A broad range shows uncertainty in the results. ☐

The range shows whether the mean is accurately calculated. ☐

If the range is larger the data is more reproducible. ☐ **[2]**

(ii) Use **Table 1** and **Table 2** to judge the quality of Anya's data.

Put a (ring) around the correct answer.

excellent **good** **fair** **poor** **[1]**

(iii) Explain your reasoning.

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

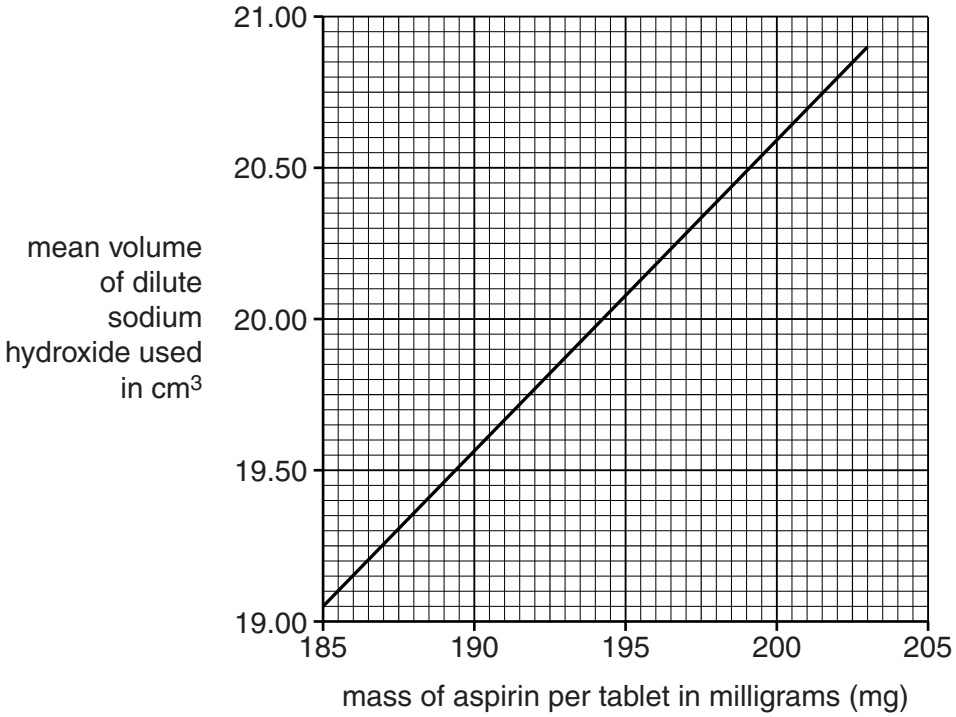
(iv) Use the results in **Table 1** to calculate the mean of the **accurate readings**.

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

Question 4 continues on page 16

(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 2% 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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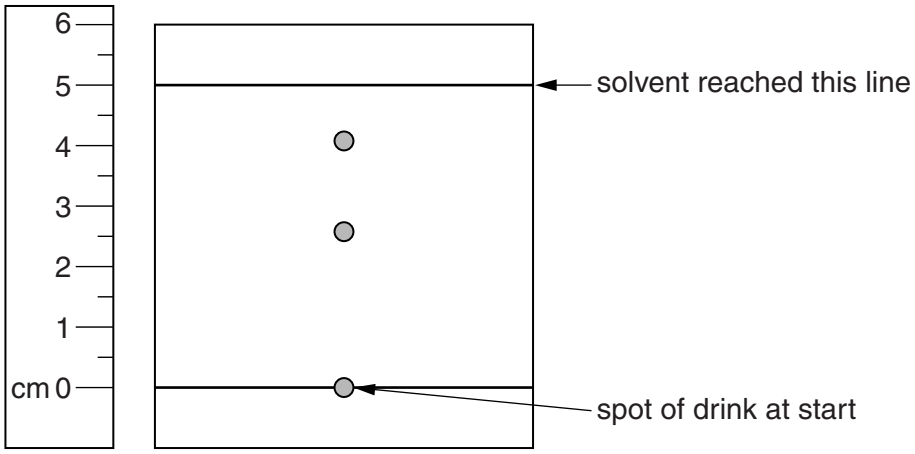
..... **[2]**

[Total: 14]

5 Eve works for 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.



The R_f value for each spot can be calculated by using the formula

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

(a) Which of the statements about this chromatogram are **true** and which are **false**?

Put a tick in **one** box in **each** row.

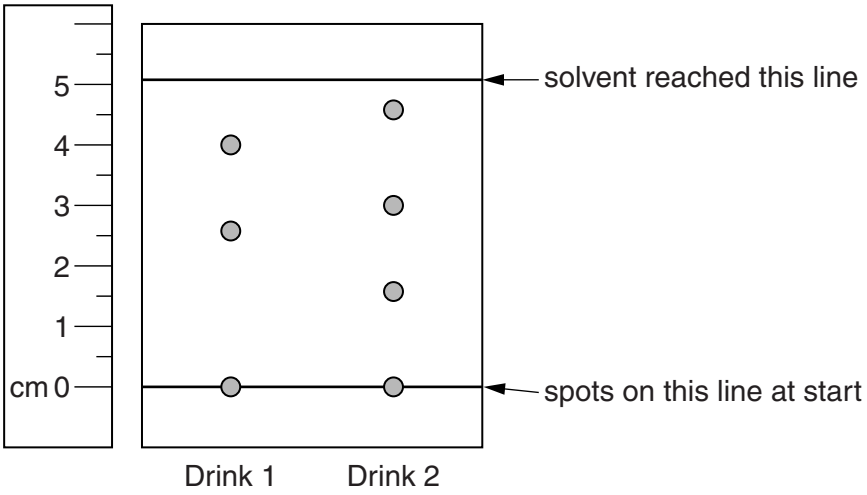
	True	**False**
The R_f for the highest spot is 0.8.		
The R_f for the lower spot is 0.5.		
The stationary phase is the solvent.		
The drink contains a mixture of food colours.		

[2]

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

Eve investigates whether two drinks, Drink 1 and Drink 2, contain any harmful food colours. She separates the food colours in the drinks by using a chromatogram.

Eve's chromatogram



She compares the R_f values for the food colours in Drink 1 and Drink 2 to the food colours in the table.

Food colour	R_f	Harmful or safe?
A	0.4	harmful
B	0.2	harmful
C	0.6	safe
D	0.8	safe
E	0.5	safe

Explain how the information shows that Drink 1 contains only safe food colours, but why there is not enough evidence to judge whether Drink 2 is safe.

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

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

(c) Eve also uses secondary data to support her work on the safety of the food colours used in the drinks.

What secondary data about the drinks could be used to support her work?

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

data about how harmful food colours affect health	☐
information about the prices of the drinks	☐
labels from the bottles to show what food colours have been used	☐
information about what food colours are used in other drinks	☐
information about which of the two drinks people prefer	☐

[2]

[Total: 10]

END OF QUESTION PAPER

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