OCR
Oxford Cambridge and RSA

Monday 12 January 2015 – 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

R075 01

4539077162

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**.
- The quality of written communication is assessed in questions marked with a pencil (✎).
- This document consists of **20** pages. Any blank pages are indicated.

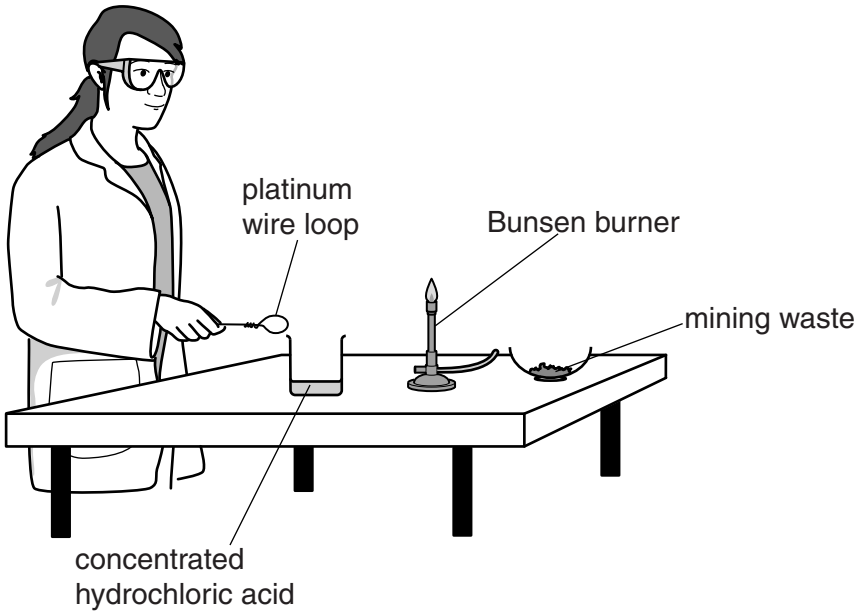
Answer **all** the questions.

1 Jenny works for a mining company.

Mining produces a lot of waste. This waste contains metals.

Jenny tests the mining waste to find out whether there are any useful metals left.

(a) She does a flame test on the mining waste.



For the flame test she uses a platinum wire loop, a Bunsen burner and a beaker of concentrated hydrochloric acid.

(i) Here is the procedure she follows for each flame test, but the steps are in the wrong order.

A	Put the wire loop into the flame of the Bunsen burner.
B	Dip the wire loop into the mining waste.
C	Observe the colour of the flame.
D	Dip the wire loop into the concentrated hydrochloric acid.

Fill in the boxes to show the correct order of the steps she follows.

Step **A** has been filled in for you.

	A		**A**	

[2]

(ii) Why does she dip the wire loop into the concentrated hydrochloric acid?

.....

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

(iii) Jenny concludes from the flame test that there is copper in the mining waste.

What colour is the flame?

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

green-blue	
purple	
yellow	

[1]

(b) Jenny can check her conclusion by using different techniques to test the mining waste.

Explain why it is a good idea to use more than one technique.

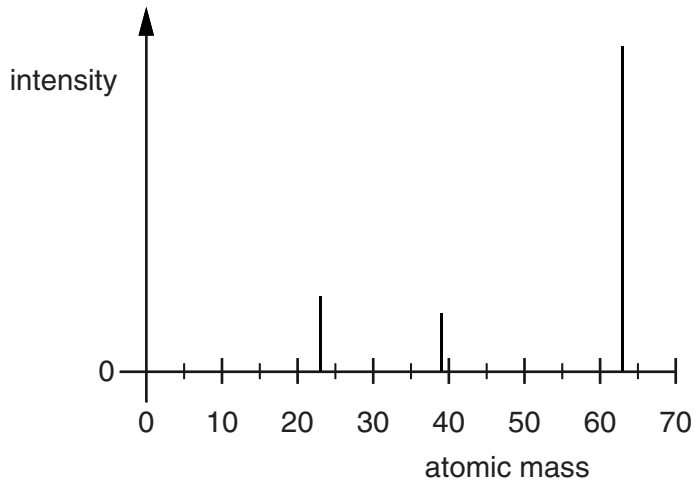
.....

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

Question 1 continues on the next page.

(c) Jenny uses a mass spectrometer to test the mining waste.

The graph shows her results.



She uses this table to interpret her graph.

Metal	Atomic mass
lithium	7
sodium	23
potassium	39
calcium	56
copper	63

(i) Jenny concludes that the waste contains copper.

How do her results from the mass spectrometer show this?

.....

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

(ii) Which **two** other metals are in the waste?

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

calcium	
lithium	
potassium	
sodium	

[2]

(d) Jenny identified only one metal in the mining waste by using the flame test. She identified three metals by using the mass spectrometer.

Suggest a reason why the flame test did not detect the other two metals.

.....

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

(e) Compare the flame test and mass spectrometer.

Give **one** advantage of using each technique.

Advantage of **flame test** .....

.....

Advantage of **mass spectrometer** .....

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

[Total: 11]

Question 2 begins on page 7.

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2 Nikhil works in the laboratory of a company that makes large amounts of coloured dyes for use in felt tip pens.

Every day the company makes dyes in a number of different colours.

Once made, the dyes are stored in containers.

Nikhil's job is to check the quality of each coloured dye.

(a) Describe how he **samples** the dyes and explain how his procedures avoid **contamination**.

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

.....

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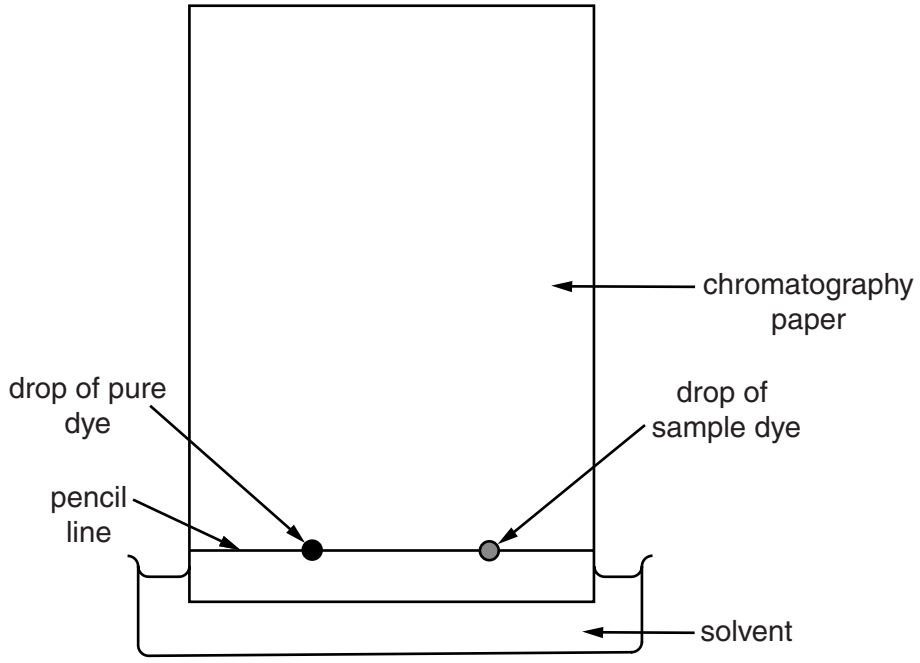
..... **[6]**

(b) Nikhil needs to find out whether each coloured dye is pure.

Nikhil uses chromatography to test a sample of a dye and he also uses a pure dye as a reference.

The diagram shows the apparatus he uses.



Which component is the **stationary phase**?

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

Component	
chromatography paper	☐
drop of pure dye	☐
pencil line	☐
solvent	☐

[1]

(c) Nikhil uses the following procedure to test every sample of dye.

Stage 1	Put a drop of pure dye on the pencil line.
Stage 2	Put a drop of sample dye on the pencil line.
Stage 3	Place the chromatography paper in the solvent so the pencil line is above the surface of the solvent.
Stage 4	Leave until the solvent has soaked nearly to the top of the paper.
Stage 5	Remove the paper and dry it.

(i) Why does Nikhil use a drop of **pure dye** (**Stage 1**) as a reference?

.....

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

(ii) Why does Nikhil place the paper so that the pencil line is **above** the surface of the solvent (**Stage 3**)?

.....

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

(iii) Why does he wait until the solvent has nearly soaked to the top of the paper (**Stage 4**)?

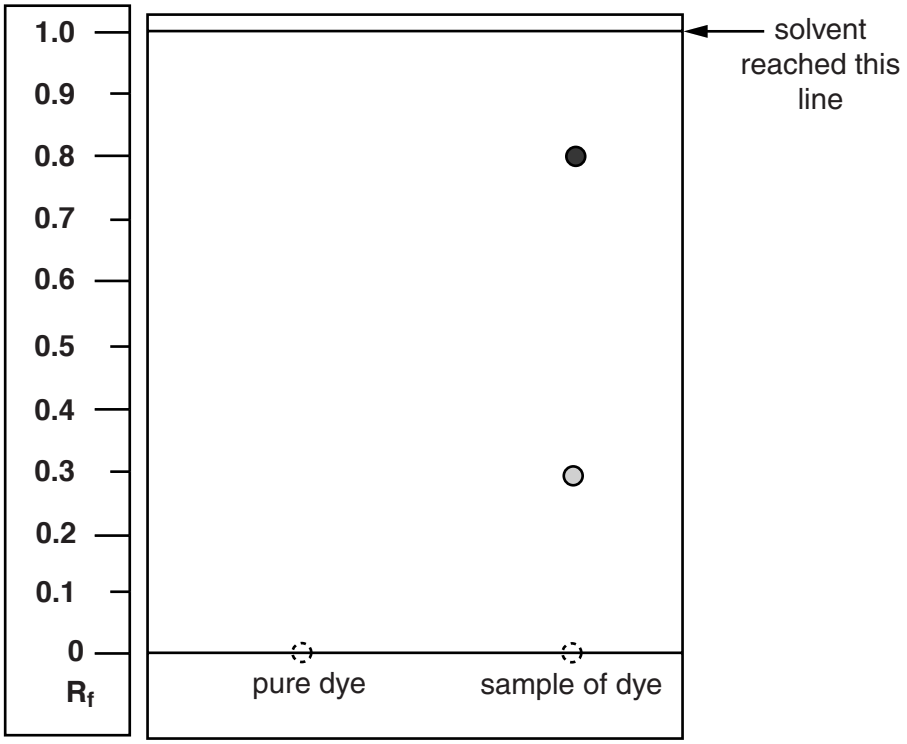
.....

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

Question 2 continues on the next page.

(d) The chromatogram of each dye shows coloured spots.

This is one of the chromatograms Nikhil produces.



The scale is used to find the R_f value of the coloured spots.

(i) One spot with an R_f value of 0.8 is produced by the pure dye.

On the chromatogram, draw the spot from the pure dye in its correct position. **[1]**

(ii) Nikhil concludes that the sample of dye contains the pure dye and one impurity.

What is the evidence for his conclusions?

.....

.....

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

(iii) What is the R_f value of the impurity in the sample of dye?

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

(iv) Nikhil uses a chromatography data sheet to identify the impurity.

How would he do this?

.....

.....

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

[Total: 16]

Question 3 begins on the next page.

3 David uses a light microscope to examine slides in a hospital laboratory.

(a) He follows a standard procedure to set up the light microscope.

Draw a straight line from each **step** to the correct **reason** for doing that step.

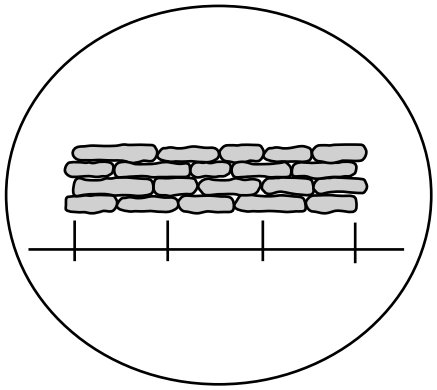
Step	Reason
places slide on stage under clips	to hold the slide in place
selects the objective lens	to avoid damaging the lens and slide
lowers objective lens close to the slide	to focus the image
looks through eyepiece lens and raises objective lens slowly	to choose the magnification

[3]

(b) David uses the light microscope to look at some cells on a slide.

He uses a slide that has a scale on it. The scale is marked every 0.1 mm.

This is what he sees.



(i) Use the scale to estimate the **mean** length of a cell.

Show your working.

Mean length of a cell = ... mm **[3]**

(ii) Explain why this is an **estimated** value and why it is the **mean** length.

estimated .....

.....

mean .....

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

(c) David then uses an electron microscope to look at the same cells.

State **one** way in which an electron microscope produces a better image than a light microscope.

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

[Total: 9]

Question 4 begins on the next page.

4 The Environment Agency monitors the quality of water in rivers and lakes.

(a) Miho tests the acidity of a sample of water from a river.

She uses universal indicator and this chart to find the pH of the water.

9	8	7	6	5	4
blue	green-blue	green	yellow	orange	red

(i) The indicator goes **yellow**.

What is the pH of the water?

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

(ii) To find the effect of the water on the plant and animal life in the river, she uses the information in the table below.

The table shows the pH range that best suits some plants and animals.

	pH range
plants	6.2 to 10.0
fish	6.0 to 9.0
snails	7.0 to 9.0

Miho makes a conclusion and discusses it with Dominic.

Miho
I think the water that makes the universal indicator go yellow is **only** suitable for fish. It is not suitable for plants and snails.

Dominic
I agree about the water being suitable for fish and not suitable for snails. However, I think it will be ok for plants.

Do you agree with Dominic?

Give reasons for your answers.

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

(b) Miho also does a titration to find out how much acid is in the river water.

(i) She takes samples of the river water to use in her titrations.

Name a variable that she needs to control.

.....

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

(ii) How can Miho make sure that the results from her titrations are **reproducible**?

.....

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

(c) In her titrations Miho measures the volume of sodium hydroxide that reacts with the acid in the samples of river water.

Here are her results.

	Volume of sodium hydroxide in cm^3
Trial	42.0
Repeat 1	41.5
Repeat 2	41.4
Repeat 3	41.6

(i) Why does Miho do a trial?

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

(ii) Why does Miho decide not to do any further repeats?

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

(d) Miho also tests the water in a local lake. The land around the lake contains a natural red substance. During heavy rain on Sunday some of the red substance gets washed into the lake.

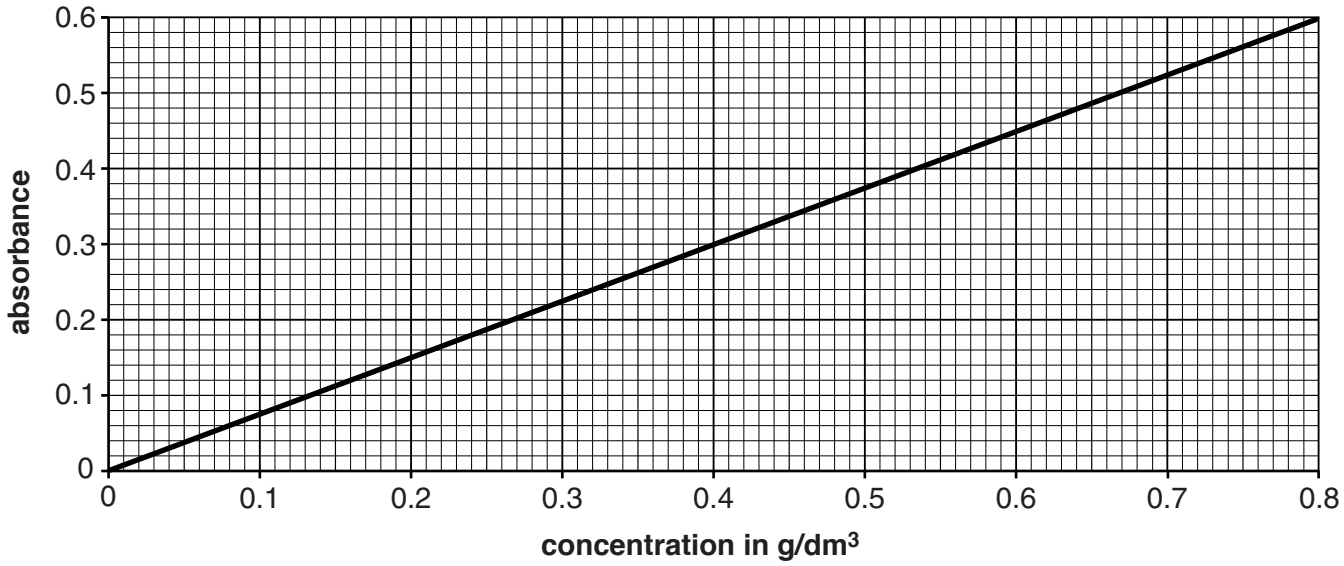
The next day Miho uses a colorimeter to find out the concentration of the red substance in the water.

Miho tests samples of water from the lake on Monday and the following Friday.

She takes four readings on each day.

	Absorbance	
	Monday	**Friday**
	0.44	0.45
	0.48	0.39
	0.45	0.14
	0.43	0.42
Mean absorbance	0.45	
Range	0.43 to 0.48	
Concentration g/dm^3	0.60	

This is the calibration graph she uses for the colorimeter.



Use the data to calculate the **mean absorbance**, the **range** and the **concentration** of the red substance on Friday.

Decide whether there is enough data to judge if the water quality is improving during the week.

Explain your answer.

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

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

[Total: 14]

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