OCR
Oxford Cambridge and RSA

Monday 12 January 2015 – 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	

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 **16** 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 uses a flame test on the mining waste to see if there are any metals present.

(i) Jenny concludes that the waste contains copper.

What colour is the flame if copper is present in the mining waste?

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

(ii) What should Jenny do to make sure her tests are **reproducible**?

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

(iii) How does Jenny check to see if her results are **repeatable**?

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

(b) Jenny makes a solution from the mining waste.

She tests the solution by adding dilute sodium hydroxide.

The result of this test confirms that the mining waste contains copper.

Describe what she sees.

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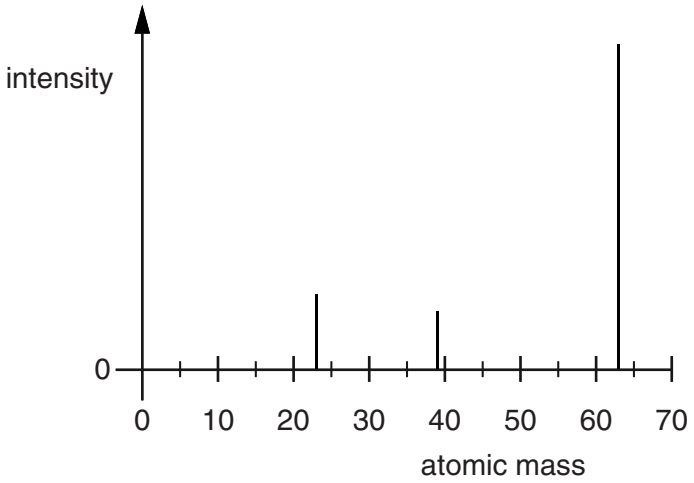
..... **[2]**

(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) Before using the mass spectrometer Jenny thought that the waste only contained copper.

Do the results from the mass spectrometer confirm this?

Explain your reasoning.

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

(ii) Give **two** reasons why the results from a mass spectrometer are more useful than those from a flame test or sodium hydroxide test.

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

[Total: 10]

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. The dyes are sent to a number of felt tip pen manufacturers.

Nikhil's job is to check the quality of each coloured dye before the containers leave the company.

(a) Describe how Nikhil should choose and collect samples of dye.

Explain the reasons for his actions.

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

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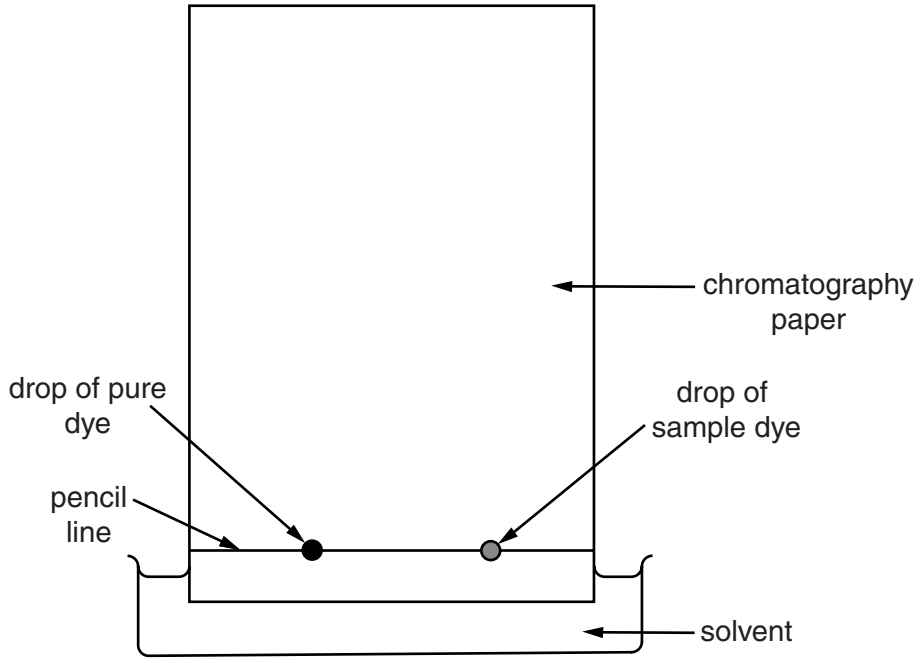
..... **[6]**

(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.



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 dye from sample 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]**

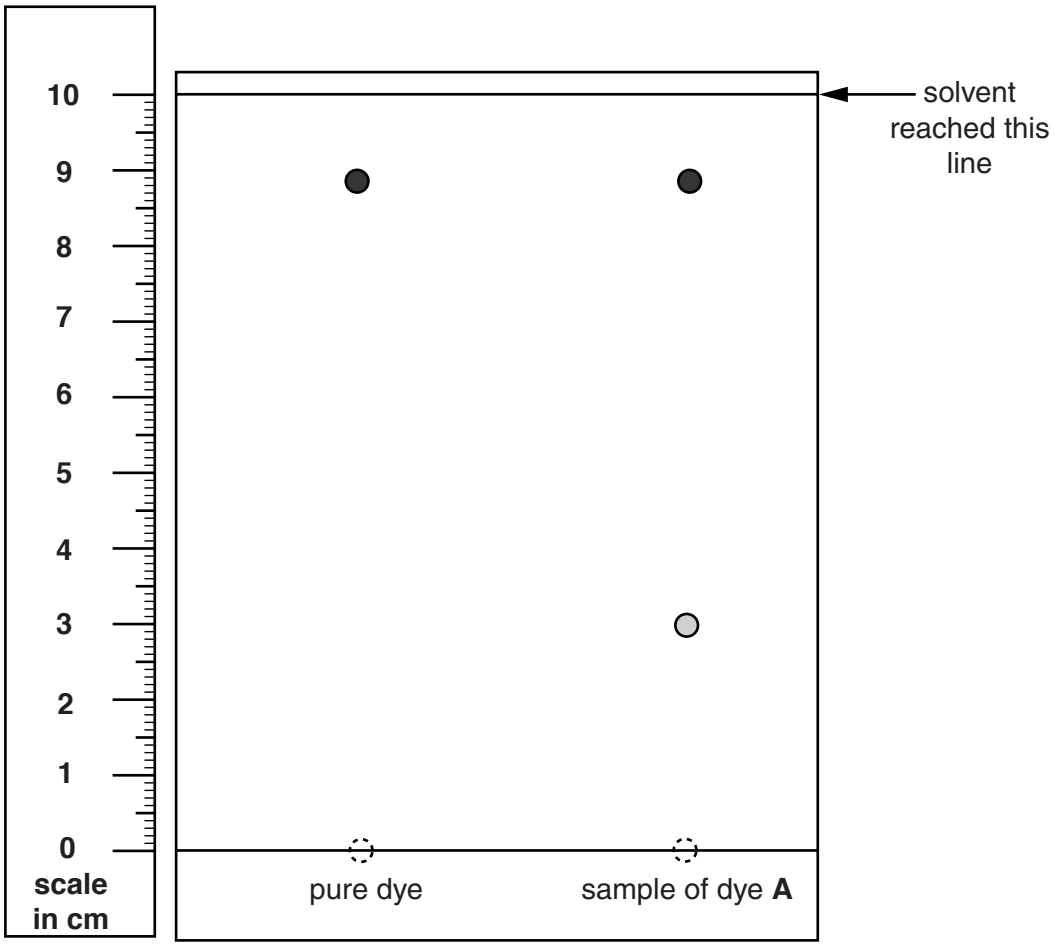
(iii) Why does he wait until the solvent has nearly soaked to the top of the paper (**Stage 4**)?

.....

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

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

This is the chromatogram Nikhil produces for one of the dyes, dye **A**.



(i) The R_f value for a spot can be calculated by using the formula

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

Use the scale next to the chromatogram to calculate the R_f value for the spot produced by the pure dye.

Show your working.

R_f value = ... **[2]**

(ii) The felt tip pen manufacturers only accept pure dyes.

Based on the chromatogram, should dye **A** be sent to the felt tip pen manufacturers?

Give evidence from the chromatogram to support your answer.

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

[Total: 13]

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

He needs to view a number of cells on the slide in order to estimate their mean size.

(a) He needs a large field of view to see enough cells.

Describe how he adjusts the microscope to give a large field of view.

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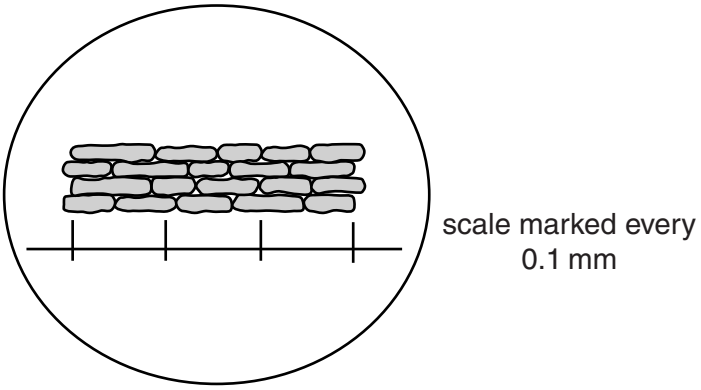
..... **[2]**

(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]**

[Total: 7]

Question 4 begins on the next page.

4 Miho works in a laboratory at the Environment Agency.

Part of Miho's job is to test the quality of water in rivers and lakes.

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

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

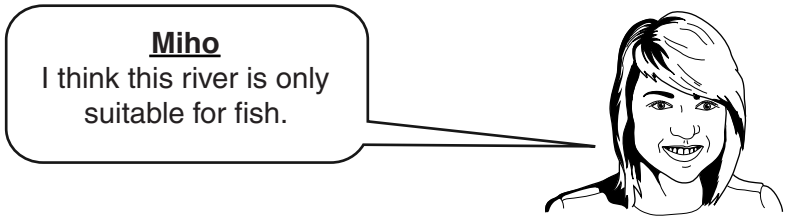
	pH range
plants	6.2 to 10.0
fish	6.0 to 9.0
snails	7.0 to 9.0

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

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

The indicator turns **yellow**.

Miho uses this result to make a conclusion.



Do you agree with her?

Give reasons for your answer.

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

(b) Miho also uses a pH meter to measure the acidity of the water.

Give one **advantage** and one **disadvantage** of using a pH meter compared with using universal indicator.

Advantage .....

.....

Disadvantage .....

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

(c) Miho tests the water from a lake.

She does a titration to find out how much acid is in the lake water.

She uses her titration to measure how much dilute sodium hydroxide reacts with a sample of lake water.

She repeats the procedure several times.

(i) Which variables should Miho control when she repeats the procedure?

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

(ii) Miho tests the pH of the lake water and the pH of the dilute sodium hydroxide.

She uses this information to choose the best indicator for the titration.

	pH
Lake water	5.5
Dilute sodium hydroxide	14.0

Type of titration	**Best indicator**
Strong acid/strong base	Bromothymol blue
Strong acid/weak base	Methyl orange
Weak acid/strong base	Phenolphthalein

Which indicator should she use for her titration?

Explain your reasoning.

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

(iii) These are Miho's results and calculated values for the mean and range:

	Rough trial	Test 1	Test 2	Test 3	Mean	Range
Volume of sodium hydroxide in cm^3	10.0	9.6	9.8	9.4	9.6	0.6

Toby and Miho work together.

He looks at her calculated values and notices that she has made a mistake.

What is the mistake and how can it be corrected?

.....

.....

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

(iv) Miho uses a burette which is accurate to the nearest 0.05 cm^3.

She takes a reading of 9.6 cm^3.

Calculate the percentage error in her reading.

Show your working.

Percentage error ..... % **[2]**

(d) 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.

Here are her results.

	Mean concentration in g/dm^3	**Range in g/dm^3**
Monday	0.55	0.05
Friday	0.48	0.04

Describe how Miho uses the colorimeter to obtain the concentration of the red coloured substance and whether her results show that the concentration has decreased during the week.

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

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

[Total: 20]

END OF QUESTION PAPER

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