



Accredited

COMBINED FEEDBACK ON THE JUNE 2014 EXAM PAPER

UNIT R075/02:
HOW SCIENTIFIC DATA
IS USED

SCIENCE IN THE WORKPLACE

Level 1
DECEMBER 2014

cambridgenationals.org.uk

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Oxford Cambridge and RSA

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This resource brings together the questions from the June 2014 examined unit (R075/02), the marking guidance, the examiner's comments and the exemplar answers into one place for easy reference.

The Question Paper and the Mark Scheme are available from Interchange.

The Report to Centre is available from: <http://www.ocr.org.uk/qualifications/cambridge-nationals-science-in-the-workplace-level-1-2-i816>

	
Thursday 12 June 2014 – Morning LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE IN THE WORKPLACE	
R075/02 How scientific data is used	
Candidates answer on the Question Paper. Calculators may be used for this paper. OCR supplied materials: None. Other materials required: Pencil Ruler (centimetre)	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 only 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 (C^M). • This document consists of 20 pages. Any blank pages are indicated.	
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**Cambridge National
Science**

Unit **R075/02: How Scientific Data is Used**
Level 2

Mark Scheme for June 2014

Oxford Cambridge and RSA Examinations

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**Cambridge National
Science**

Unit **R074 – R078:** Cambridge Nationals Science in the Workplace
Cambridge National Level 1/2 Certificate

OCR Report to Centres June 2014

Oxford Cambridge and RSA Examinations

GENERAL EXAMINER COMMENTS ON THE PAPER

This examination provides candidates with opportunities to demonstrate their knowledge and understanding of the ways scientists obtain, analyse and communicate information using the context of the analytical techniques they have experienced in unit R074.

Where questions were structured, candidates were able to demonstrate their knowledge and understanding and performed better than on those questions requiring an open response (eg 2bii, and 2c). It was clear that centres had appropriately entered candidates who were suited to the structured approach of this Level 1 paper. The language used in questions was appropriate and there was no evidence that candidates did not have sufficient time to complete the examination as most questions were attempted.

Most candidates seemed to have a calculator which they used for mathematical aspects of the paper where it was good practice to write down the steps carried out in a calculation to gain partial credit for correct data interpretation if the final answer was incorrect (eg Q4 biv).

Candidates read questions requiring more than one response carefully and most selected the correct number of responses required (eg Q4 cii).

OCR 	
Thursday 12 June 2014 – Morning	
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 

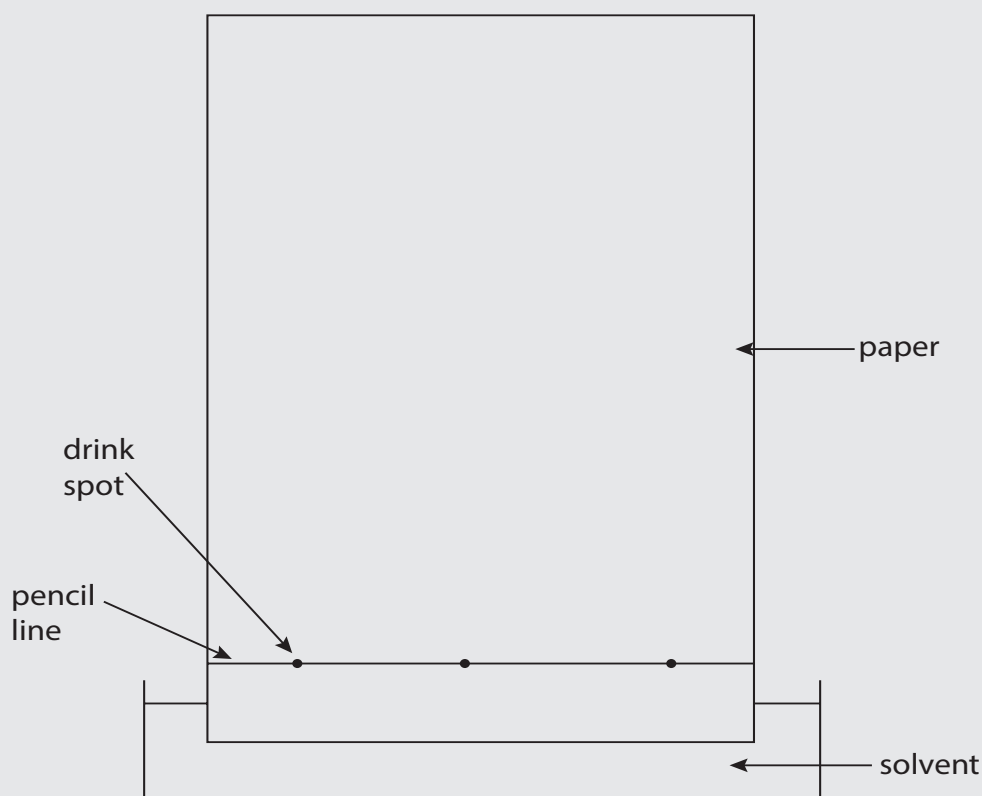
Question 1 (a)

Answer **all** questions.

- 1 Philip works in the laboratory of a company making fruit and vegetable drinks.

He is investigating the types of sugar in the drinks.

He uses chromatography to do this, as shown in the diagram.



- (a) Look at the diagram and identify the **stationary** and **mobile** phases.

Stationary phase paper

Mobile phase solvent

[2]

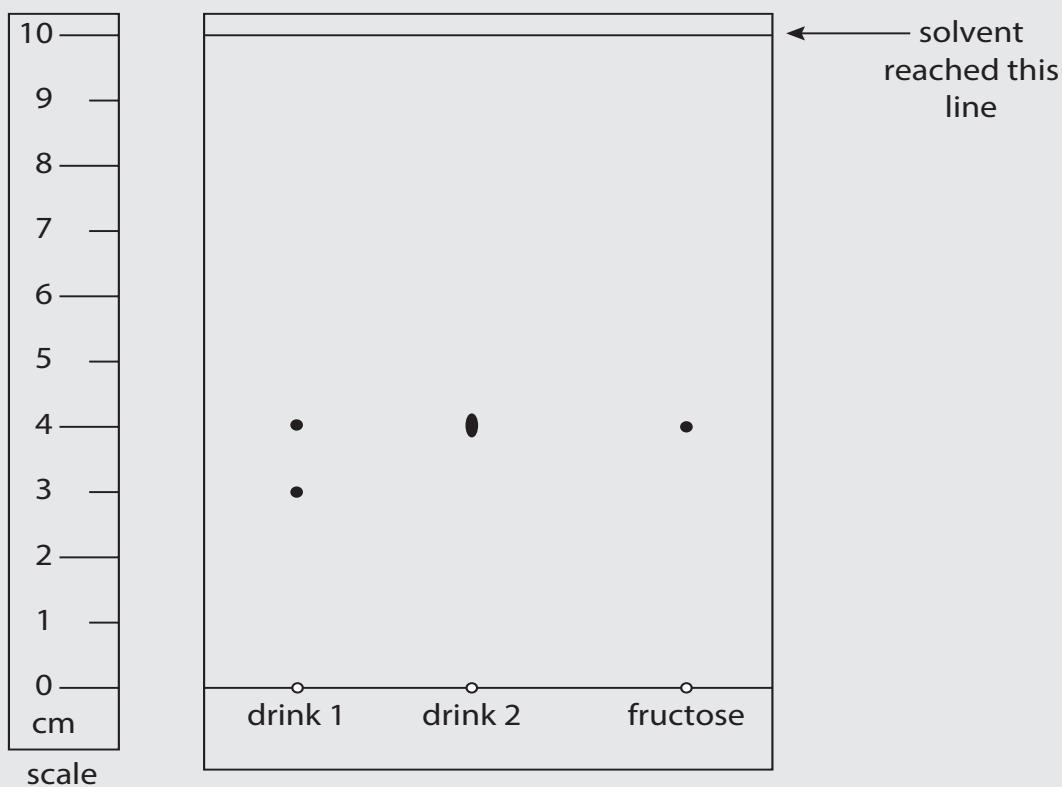
Examiner comments

This question allowed candidates to demonstrate their knowledge and understanding of the process of chromatography. Part (a) indicated that candidates might be familiar with the technique but are not very familiar with the terminology used. The mobile phase was most often correctly recognised while the pencil line was a common incorrect answer for the stationary phase. Many candidates drew lines to link up two components to each phase rather than just one.

Question 1 (bi)

He tests drink 1, drink 2 and fructose. He puts a drop of each on the pencil line.

Here is the chromatogram he produces.



Answer **all** questions.

(b) (i) Explain what the chromatogram tells you about drinks 1 and 2.

Drink 1 fructose

Another sugar

Drink 2 fructose

Other example answer:

Drink 2

• (maybe) another sugar

[3]

Mark Scheme Guidance

Allow another substance / two types of sugar.

Examiner comments

In part (bi) many candidates were able to correctly interpret a chromatogram.

Question 1 (bii, biii and biv)

(ii) Philip uses fructose as a **standard reference**.

Explain what is meant by standard reference.

Known sugar/value (1 mark) for comparison (1 mark)

[2]

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

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

Use the scale on the chromatogram diagram to calculate the R_f value for the **lower** spot of **drink 1**.

Show your working.

R_f value = 3.0/10 (1 mark) 0.3 (1 mark) [2]

(iv) Philip looks in a data book for R_f values of other types of sugar.

Type of sugar	R_f value
sucrose	0.36
glucose	0.32
galactose	0.30
maltose	0.25

Use your calculated value of R_f for the lower spot of drink 1 to identify which type of sugar it is likely to be.

Name of sugar Galactose (1 mark)

How certain can you be of your conclusion? Give reasons.

Matches exactly 0.3 (1 mark)

But could be glucose (1 mark)

As spot covers a range of values up to R_f 0.32 (1 mark)

[4]

Mark Scheme Guidance

1 (biii) Allow 0.28 to 0.32.

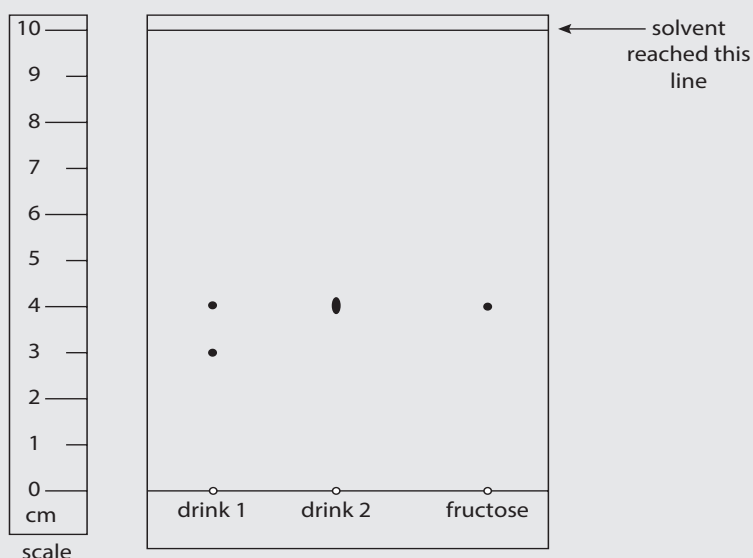
0.3 without working gets 2 marks.

Examiner comments

Parts (biii) and (biv) were answered well as many were able to calculate the R_f value, identify the sugar from a table and provide a correct explanation.

Question 1 (ci)

(c) (i) Philip, Edward and Ann, discuss the results for drink 2.



They say why they think there is a bigger spot for drink 2.

Philip

This shows that drink 2 contains more fructose than drink 1.



Edward

There may be another type of sugar in drink 2 as well as fructose.



Ann

You must have used a bigger drop of drink 2 on the pencil line than drink 1.



Who do you agree with? Put a ring around your choice.

Philip

Edward

Ann

Give a reason for your choice.

.....
 Another sugar present (with similar R_f / R_f of about 0.3) (1 mark)

[2]

Mark Scheme Guidance

Do **NOT** allow Philip or Ann.

Allow answer saying why Philip **AND** Ann are wrong.

Examiner comments

The statement made by Edward in (ci) was often correctly identified but few candidates were able to offer a clear explanation as to why they had made that choice.

Question 1 (cii)

(ii) Name another piece of apparatus Philip could use to identify the sugars in the drinks.

Gas chromatography/GC/HPLC/mass spectrometer (1 mark)

How would this apparatus improve the conclusion?

More sensitive (1 mark)

[2]

[Total: 17]

Mark Scheme Guidance

Allow clinisticks/clinistix.

Allow precise/accurate/gives more evidence / less human error.

Examiner comments

The statement made by Edward in (ci) was often correctly identified but few candidates were able to offer a clear explanation as to why they had made that choice.

Question 2 (a) and (bi)

2 Sunita is a science technician.

She finds two unlabelled bags of white powder.

(a) Sunita does three tests on each powder to identify its anion.

Here are her results for the anion in each bag.

Test	Results for Bag 1	Results for Bag 2
add dilute acid to the powder	fizzes and gives off a gas which turns limewater milky	no reaction
add dilute barium chloride to a solution of the powder	no reaction	no reaction
add dilute silver nitrate to a solution of the powder	no reaction	white precipitate

Complete this table to show which anion is present in each bag.

	Name of anion
bag 1	Carbonate (1 mark)
bag 2	Chloride (1 mark)

[2]

(b) Sunita does a flame test on each powder.

(i) The powder from both bags gives a lilac coloured flame.

Which cation is present in both bags?

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

Barium	
Calcium	
Potassium	✓
Sodium	

[1]

Examiner comments

None offered for this question.

Question 2 (bii and biii)

(ii) Sunita uses a platinum wire loop to do the flame tests.

She dips the loop in concentrated hydrochloric acid before putting it in the powder sample.

Explain why she does this.

Avoid contamination/make loop clean

[1]

(iii) She does the flame test again for each bag and gets the same results.

Complete each of these sentences.

Identifying a cation by observing the colour of a flame is an example of a qualitative technique.

Getting the same result each time the test is done means that it is repeatable [2]

Mark Scheme Guidance

2 (bii) Allow so powder will stick to loop.

2 (biii) Do **NOT** allow reproducible.

Examiner comments

This required an extended answer which provided candidates with an opportunity to describe fully the flame test procedure they would have carried out in the laboratory. The best answers were clearly ordered and included an explanation of how and why the wire loop was cleaned; others described the procedure but did not provide any explanation as required by the question.

Question 2 (c)

(c) Sunita suspects the powder in bag 2 may be contaminated.

She goes to a research laboratory and tests the powder in bag 2 with a mass spectrometer.

State the advantages and disadvantages of testing the powder with a flame test compared with a mass spectrometer.



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

Flame test advantage - quick Flame test disadvantage - qualitative only
 Mass Spectrometer advantage - very sensitive Mass Spectrometer disadvantage - expensive
 Further evidence to help make a conclusion

Other example answers:

Indicative scientific points:

- Use of more than one technique to obtain answer
- Colour may be masked by intense yellow

Flame test advantages:

- Readily available in the lab
- Easy to perform

Flame test disadvantages:

- Relies on eyesight - subjective
- Some colours masked by others
- Does not detect all cations

Mass Spectrometer advantages:

- Very accurate
- Detects all cations present
- Quantitative
- Not subjective

Mass Spectrometer disadvantages:

- Difficult to use – needs trained operator
- Takes time to get result.

[6]

[Total: 12]

Mark Scheme Guidance

This question is targeted at grades up to D*.

Level 3 (5 – 6 marks)

Gives most advantages **AND** disadvantages of mass spectrometry **AND** flame tests.

No significant errors in science or use of scientific terms.

Quality of written communication does not impede communication of the science at this level.

Level 2 (3 – 4 marks)

Gives some advantages **AND** disadvantages of mass spectrometry and flame tests.

There are some errors in the science.

Quality of written communication partly impedes communication of the science at this level.

Level 1 (1 – 2 marks)

Gives an advantage **OR** a disadvantage of mass spectrometry and flame tests.

Quality of written communication impedes communication of the science at this level.

Level 0 (0 marks)

Insufficient or irrelevant science.

Answer not worthy of credit.

Examiner comments

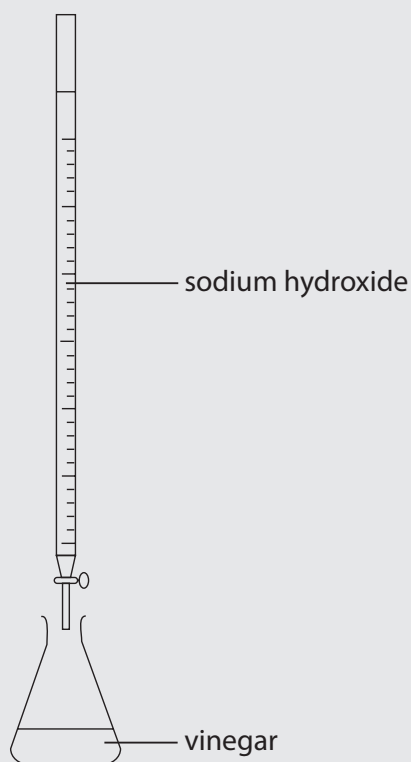
None offered for this question.

Question 3(ai and aii)

3. The Food Standards Agency suspects that some fast food outlets add more water to their vinegar than they should.

George tests some samples of vinegar in a laboratory.

He titrates vinegar with sodium hydroxide.



- (a) (i) The vinegar is a **weak acid** and the sodium hydroxide is a **strong base**.

What indicator should he use?

Phenolphthalein

[1]

- (ii) How does the indicator show that the end point of the titration has been reached?

Colour becomes pink

[1]

Mark Scheme Guidance

- 3 (aii) Allow colour change.
Allow ecf from part (i).

Examiner comments

Many candidates selected the correct indicator to use in a weak acid strong base titration but as in the January examination bromothymol blue was the usual incorrect choice in (a).

Question 3(b)

(b) Vinegar is a solution of ethanoic acid in water.

To get readings for his calibration graph George used the following procedure:

- dissolved 2.0g of ethanoic acid in 100ml of water to produce an acid solution
- took 25ml of this acid solution and put it in the beaker
- titrated the sodium hydroxide into the acid solution
- repeated the procedure using three 25ml samples from the same acid solution
- repeated the whole procedure for 4.0g, 6.0g and 8.0g of ethanoic acid.

Are each of the following a controlled variable, dependent variable, independent variable or not a variable?

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

	Controlled variable	Dependent variable	Independent variable	Not a variable
25ml of acid solution used in each titration	✓			
100ml of water used to make acid solution	✓			
mass of ethanoic acid dissolved in 100ml of water			✓	
repeating the titrations for the same acid solution				✓
volume of sodium hydroxide needed to neutralise the acid solution		✓		

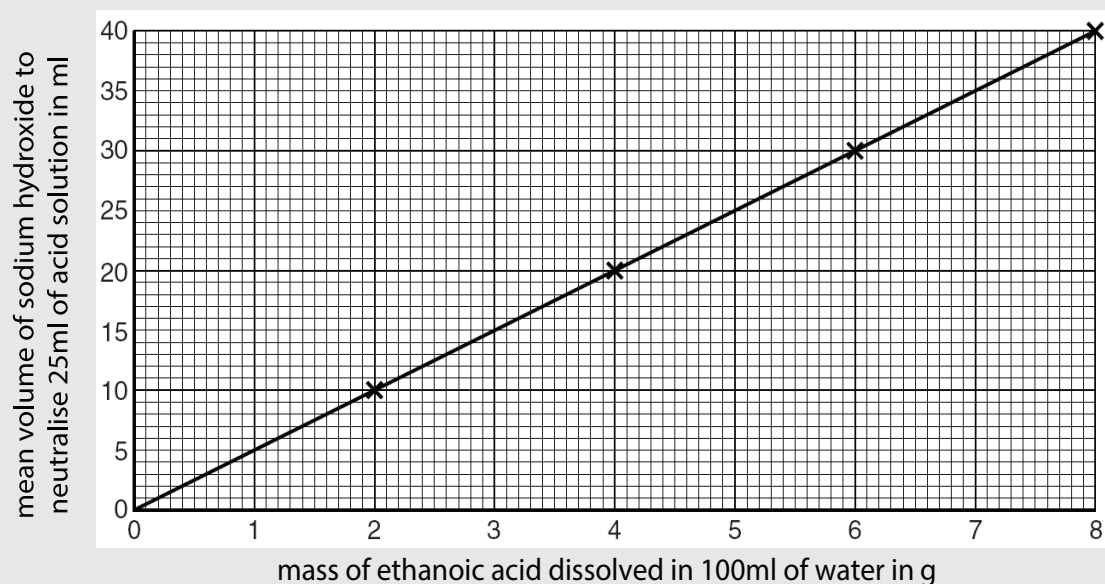
[5]

Examiner comments

None offered for this question.

Question 3 (c)

(c) This is the calibration graph George gets from his results of titrating ethanoic acid with sodium hydroxide.



He tested samples of vinegar from three food outlets.

Here are the results for his tests:

Outlet	Volume of sodium hydroxide to neutralise 25ml of vinegar in ml					
	Test 1	Test 2	Test 3	Test 4	Mean	Range
Allgoods	20.0	20.2	20.7	20.3	20.3	0.7
Bests	17.8	17.7	18.0	17.9		
Crinkles	25.0	15.0	25.2	25.1		

The quality of the data is judged by the range of the readings.

Range of readings in ml	Quality of data
up to 0.20	excellent
0.21 to 0.40	good
0.41 to 0.60	fair
greater than 0.60	poor

Vinegar with less than 4.0g of ethanoic acid in 100ml has too much water added.

Calculate the **means** and **ranges** of the data in the table and **decide** if the vinegar from each outlet has too much water in it, taking the quality of the data into account.



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

Mean and Range, quality:

- Allgoods: (20.3, 0.7), poor
- Bests: 17.9/17.85, 0.3, good
- Crinkles: All results: 22.6, 10.2 (very) poor
- Crinkles: Without test 2: 25.1, 0.2, excellent
- Test 2 for Crinkles outlier, not used.

Watered down:

- Allgoods above 4.0 but poor quality so not much confidence in result
- Bests: below 4.0, good quality, certainly too much water
- Crinkles not too much water, without outlier certain of result above 4.0

[6]

[Total: 13]

Mark Scheme Guidance

This question is targeted at grades up to D*.

Level 3 (5 – 6 marks)

Calculates means and ranges for other two outlets (**without** outlier for Crinkles), **AND** gives correctly reasoned conclusions for all outlets.

No significant errors in science.

Quality of written communication does not impede communication of the science at this level.

Level 2 (3 – 4 marks)

Calculates means and ranges for other two outlets (**with** outlier for Crinkles), **AND** gives correctly reasoned conclusions for some outlets.

Some errors in the use of scientific terms.

Quality of written communication partly impedes communication of the science at this level.

Level 1 (1 – 2 marks)

Either calculates means and ranges for other two outlets **OR** gives correctly reasoned conclusion for an outlet.

Quality of written communication impedes communication of the science at this level.

Level 0 (0 marks)

Insufficient or irrelevant science.

Answer not worthy of credit.

Examiner comments

None offered for this question.

Question 4 (a), (bi) and (bii)

4 Beatrice works in a forensics laboratory.

She looks at some hair on a piece of cloth.

She can use a magnifying glass (hand lens), a light microscope or an electron microscope.

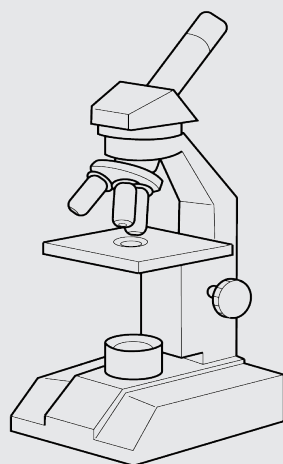
(a) Which of these pieces of apparatus would be best to do the following tasks?

Draw a straight line from each **Task** to the best **Apparatus** to use.

Task	Apparatus
count the number of hairs on the piece of cloth	electron microscope
measure the width of one hair	magnifying glass
view the internal structure of a hair	light microscope

[2]

(b) This is a diagram of a light microscope.



(i) Why is the stage moved up and down?

To focus (on specimen)

[1]

(ii) Why are there three objective lenses on the rotating mount?

(to provide) different magnification/size of image

[1]

Mark Scheme Guidance

- 4 (a) All correct 2 marks.
1 line correct 1 mark.

Examiner comments

None available for this question.

Question 4 (c) and (d)

(c) Beatrice finds a plant seed on the piece of cloth.

She looks at the seed with a light microscope. This is what she sees.



Measure the **longest** length of the image of the seed using your ruler.

Longest length of image = 28/1.4 (1 mark) mm

The seed's longest length is 1.4mm.

Using your measured length, calculate the magnification of the image of the seed.

Show your working,

Magnification of image = X 20 (1 mark) [2]

(d) Using a light microscope has advantages and disadvantages over using an electron microscope.

Write down one advantage and one disadvantage of using a light microscope rather than an electron microscope.

Advantage of light microscope quick

Disadvantage of light microscope Low magnification

Other example answers:

Disadvantage:

- Not 3D
- Low resolution
- Need light source

Other example answers:

Advantage:

- Easy to use
- Can look at living things
- Cheap
- In colour
- Portable

[2]

[Total: 8]

Mark Scheme Guidance

4 (c) Allow 26/14 to 30/14.

Allow 19 to 21.

Correct answer (19 to 21) without working gets 2 marks.

Allow any value/1.4 for 1 mark.

4 (d) Allow instant results, does not need electricity, doesn't take up much room.

Allow less detail.

Examiner comments

None offered for this question.

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