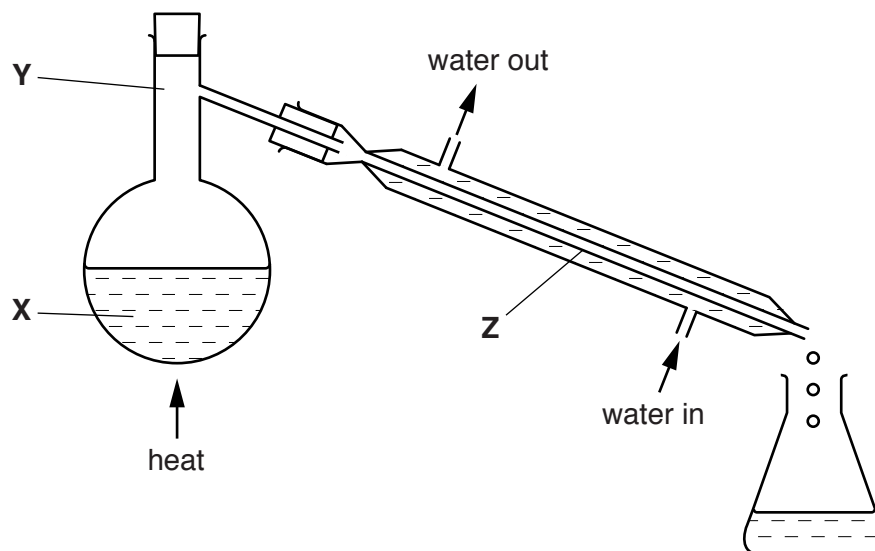


## Methods of Purification and Analysis

Q6/41/M/J/16

1 The diagram shows the apparatus used to distil seawater.



While water is being collected, at which point(s) is the temperature  $100^{\circ}\text{C}$ ?

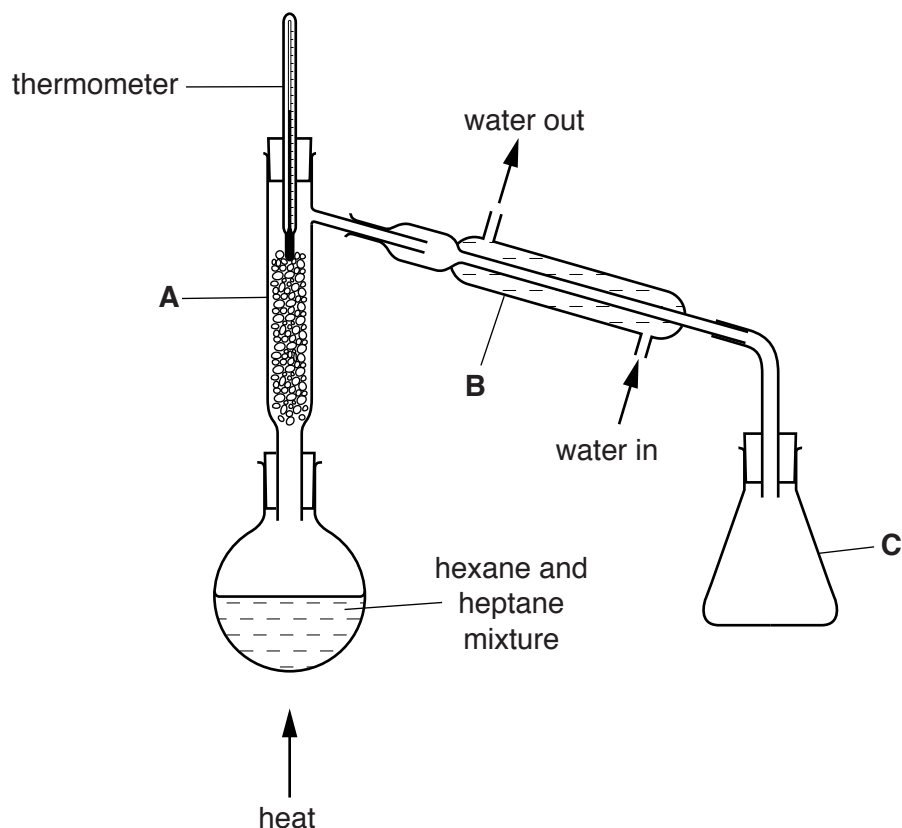
- (a) X only
- (b) Y only
- (c) X and Y only
- (d) Y and Z only
- (e) X and Y and Z

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

[Total: 1]

Q1/42/M/J/16

- 2 A student separates hexane,  $C_6H_{14}$ , (b.p.  $69^\circ C$ ) and heptane,  $C_7H_{16}$ , (b.p.  $98^\circ C$ ) using the apparatus shown.



- (a) Identify two errors in the student's apparatus.

1. ....
  2. ....
- [2]

The errors were then corrected and the separation started.

- (b) (i) Name apparatus **A**.

..... [1]

- (ii) What is the purpose of apparatus **A**?

.....[1]

- (iii) Name apparatus **B**.

..... [1]

- (iv) What is the purpose of apparatus **B**?

.....[1]

- (c) (i) What is the reading on the thermometer when the first few drops of liquid appear in **C**?

.....

[1]

- (ii) Name this liquid.

.....

[1]

- (d) Suggest which method should be used to heat the mixture and explain your choice.

method .....

explanation .....

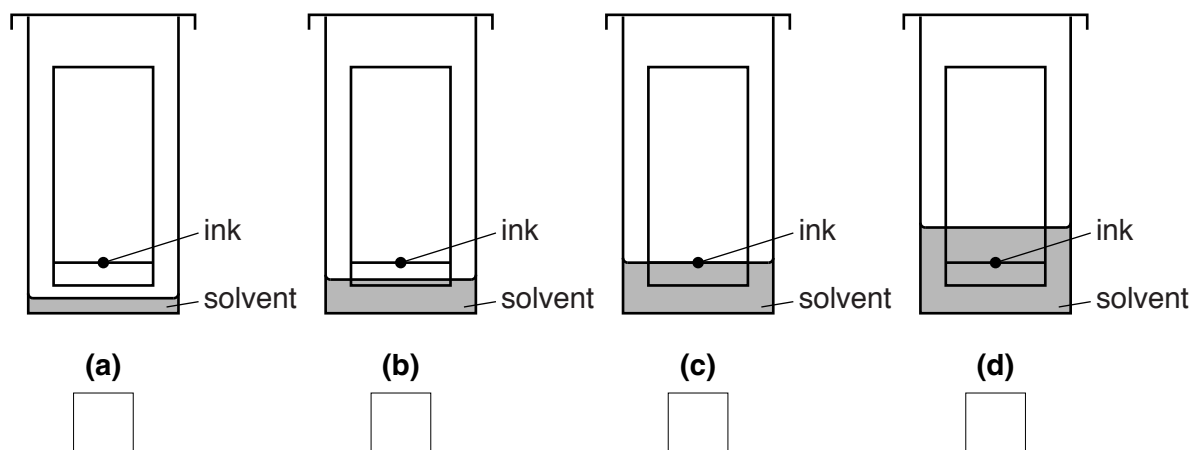
.....

[2]

[Total: 10]

Q4/42/M/J/16

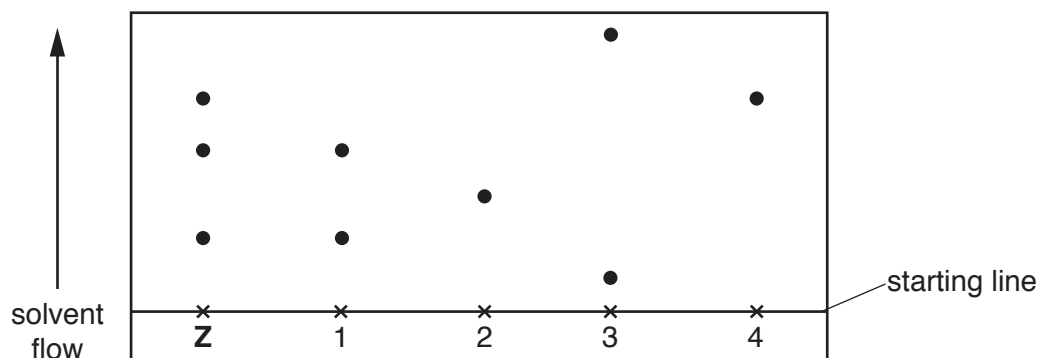
- 3 Chromatography can be used to separate the dyes present in black ink.  
Which diagram shows the correct arrangement at the beginning of the experiment?



[Total: 1]

Q4/42/O/N/16

- 4 The chromatogram shows the results of chromatography using mixture **Z** as well as individual dyes labelled 1, 2, 3 and 4.



Which of the dyes does **Z** contain?

(a) 1 only

☐

(b) 2 and 3

☐

(c) 1 and 4

☐

(d) 4 only

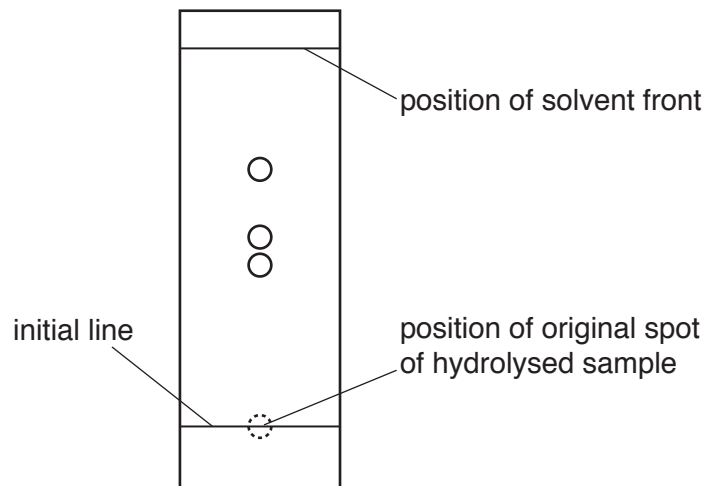
☐

[Total: 1]

Q3/41/M/J/18

- 5 A molecule contains four amino acid units. These amino acid units are linked in the same way as in a protein.

A sample of this molecule is hydrolysed. The resulting colourless solution is spotted onto chromatography paper. The paper is placed into a suitable solvent. A diagram of the final chromatogram is shown.



- (a) Suggest why the initial line is drawn in pencil and not ink.

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

- (b) Draw a line on the diagram of the chromatogram to show the depth of solvent into which the paper is placed. [1]

- (c) Suggest how the chromatogram needs to be treated to make the spots visible.

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

- (d) What effect does hydrolysis have on the sample of the molecule?

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

- (e) Suggest a reason why only three spots are detected on the final chromatogram.

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

- (f) The  $R_f$  values of some amino acids, in the solvent used for this experiment, are shown.

amino acid	$R_f$ value
alanine	0.38
leucine	0.73
phenylalanine	0.68
arginine	0.20
valine	0.61

- (i) State how an  $R_f$  value is calculated.

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

- (ii) State which one of the amino acids, listed in the table, is present on the chromatogram.

Your answer should include measurements from the diagram and a calculation to justify your decision.

.....[2]

[Total: 9]

**6** Mixtures can be separated in various ways depending on the physical properties of their components.

For each mixture, describe a method to obtain a pure sample of each substance in the mixture. In your description you should include the names of any techniques and apparatus used.

..... [5]

.....[5]

Q4(a)/42/M/J/18

**L** is soluble in water. **M** is insoluble in water.

..... [2]

Q2/42/M/J/19

**8** E150a and E155 are both brown food colourings.

Plan an investigation to find whether the brown food colouring in a soft drink is E150a or E155. The food colourings are both soluble in water.

You are provided with solutions of E150a, E155 and the brown food colouring from the soft drink. You also have access to the apparatus normally found in a chemistry laboratory.

You should draw a labelled diagram with your plan and include essential practical details.

.....

.....

.....

.....

.....

.....

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.....

.....



Q3/41/O/N/19

- 9 Carbon and copper(II) oxide are both black solids. Copper(II) oxide reacts with dilute sulfuric acid to form an aqueous solution. Carbon does not react with or dissolve in dilute sulfuric acid. Neither carbon nor copper(II) oxide dissolve in water.

A mixture contains carbon and copper(II) oxide only.

Plan an experiment to produce **a sample of pure carbon** from the mixture.

You may use:

- dilute sulfuric acid
- distilled water
- any of the apparatus usually found in a chemistry laboratory.

No other chemicals are available.

Your plan should include details of:

- how to dissolve the copper(II) oxide in the dilute sulfuric acid
- how to separate the carbon
- how to purify the carbon
- observations occurring at each stage of the process.

Chemical equations are not required.

.....

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.....

.....

Q5/41/M/J/20

**10** Leaves of plants contain a number of different coloured pigments.

Four students want to extract and analyse some of these coloured pigments.

The leaves are chopped up and ground using a mortar and pestle and then mixed with ethanol.



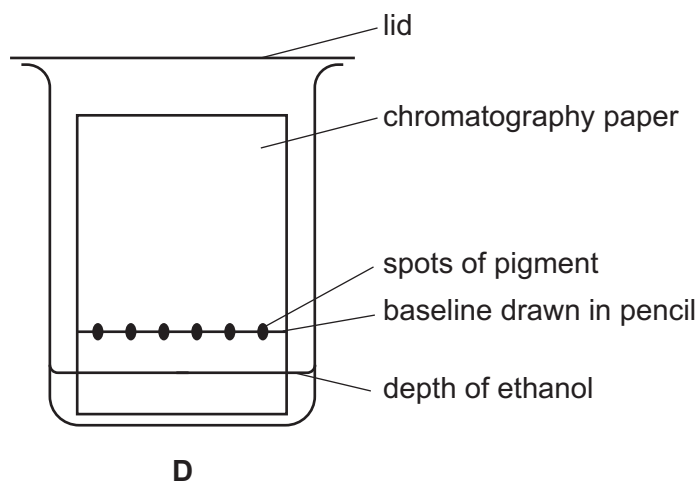
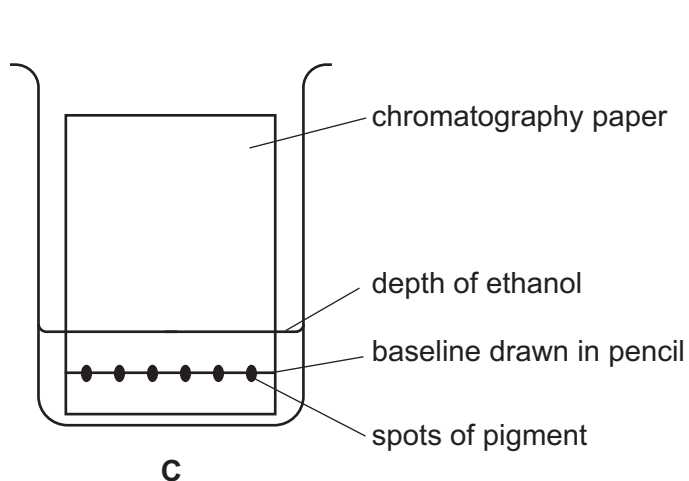
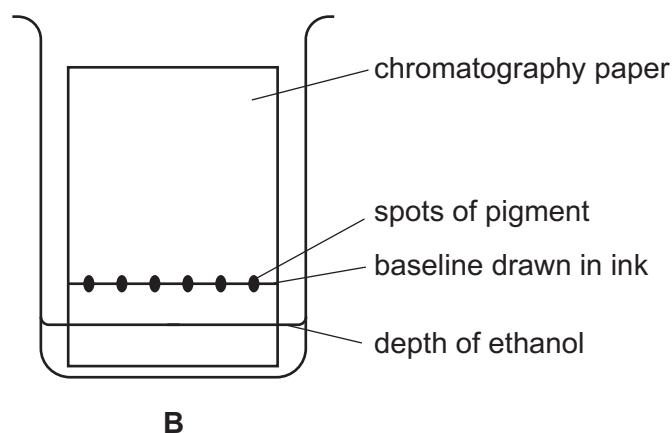
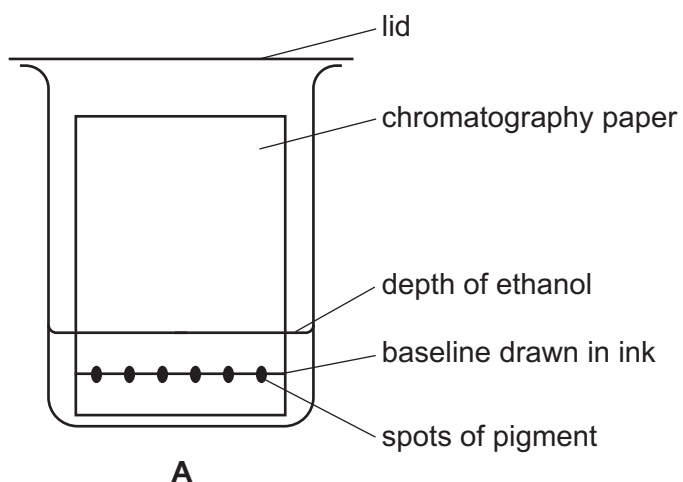
The pigments are separated using paper chromatography.

**(a) (i)** Suggest a reason for cutting and grinding the leaves.

..... [1]

**(ii)** Four students do the paper chromatography separation.

The diagrams show four sets of apparatus used by the students. Three of the students make mistakes in setting up the apparatus.



Which diagram, **A**, **B**, **C**, or **D**, shows the correct set-up of the apparatus?

..... [1]

(iii) Describe **two** mistakes made by the students shown in the diagrams.

Explain why each mistake will prevent the chromatography from working correctly.

mistake 1:

.....  
.....

explanation:

.....  
.....

mistake 2:

.....  
.....

explanation:

.....  
.....

[4]

(iv) Chromatography often uses water in the beaker.

Suggest why ethanol is used instead of water in this experiment.

..... [1]

(v) What property of ethanol makes it hazardous to use in the laboratory?

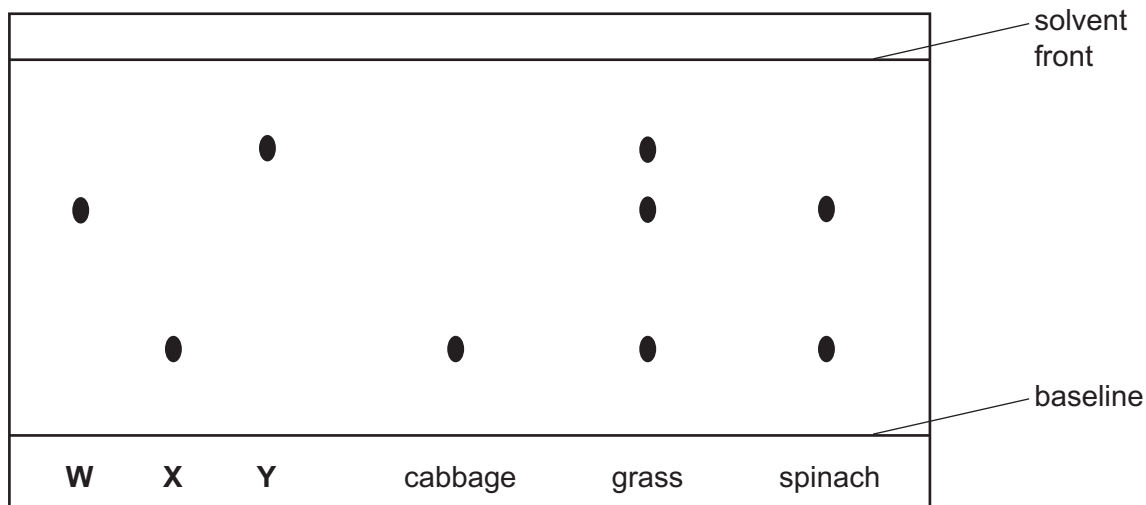
What safety precaution needs to be taken to avoid this hazard?

property: .....

precaution: .....

[2]

- (b) The diagram shows the results for three known pigments, **W**, **X** and **Y**, and pigments from three plants.



- (i) How many pigments are there in grass? Explain your answer.

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

- (ii) Which pigment is in all of the plants?

..... [1]

- (iii) Calculate the  $R_f$  value for pigment **W**.

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

- (iv) Which of the plants contain pigment **W**?

..... [1]

[Total: 14]

Q3/42/M/J/20

- 11 (a) Name the process used to separate ethanol from a mixture of ethanol and water.

State why this process is suitable.

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

- (b) Describe a suitable method in each case to separate the named substance from the mixture.

Explain your choice in each case.

- (i) pure, dry sodium chloride from a mixture of sodium chloride and sand

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

- (ii) a food colouring from a mixture of three food colourings

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

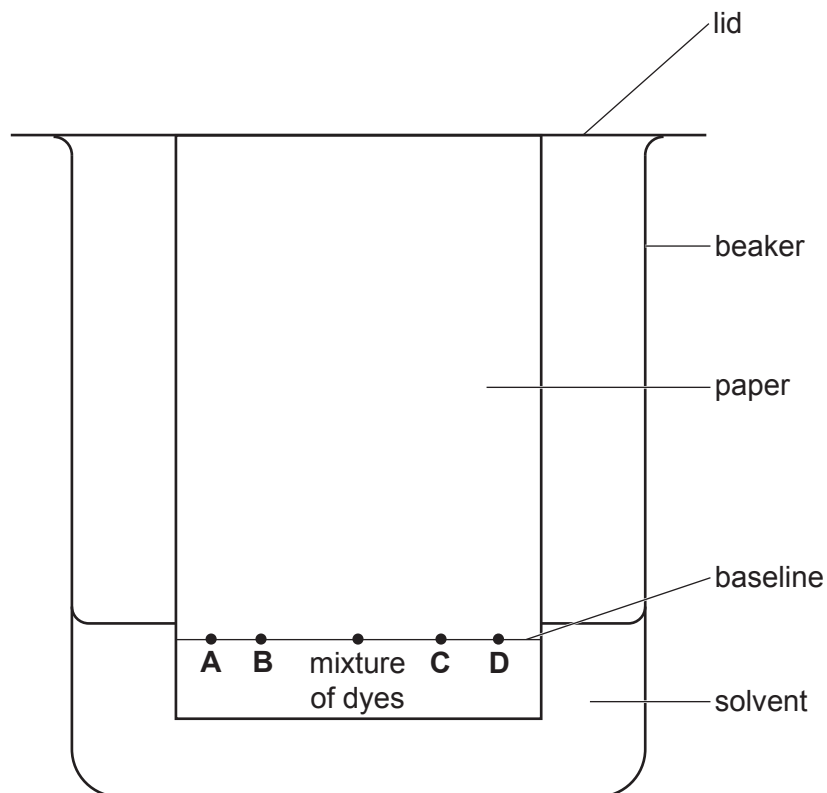
[Total: 8]

Q1/41/O/N/20

**12** A student wants to separate a mixture of dyes so that the dyes in the mixture can be identified.

The apparatus the student uses is shown.

The student also tests dyes **A**, **B**, **C** and **D**.



**(a)** Name the process the student uses to separate the mixture of dyes.

..... [1]

**(b)** The apparatus shown in the diagram is set up incorrectly. Explain why.

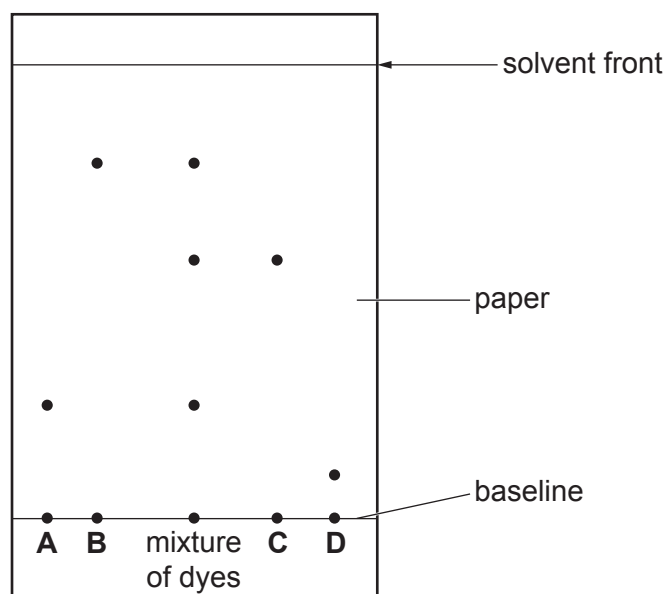
..... [1]

The apparatus is then set up correctly.

The solvent travels up the paper.

The paper is removed and then dried.

The result is shown in the diagram.



(c) Which of the dyes **A**, **B**, **C** and **D** are present in the mixture of dyes?

..... [1]

(d) The student identifies the dyes in the mixture of dyes using  $R_f$  values.

(i) Measure the distance between:

- the baseline and the solvent front ..... cm
- the baseline and the position of **A** ..... cm.

[1]

(ii) Calculate the  $R_f$  value of **A**.

$R_f$  value of **A** ..... [1]

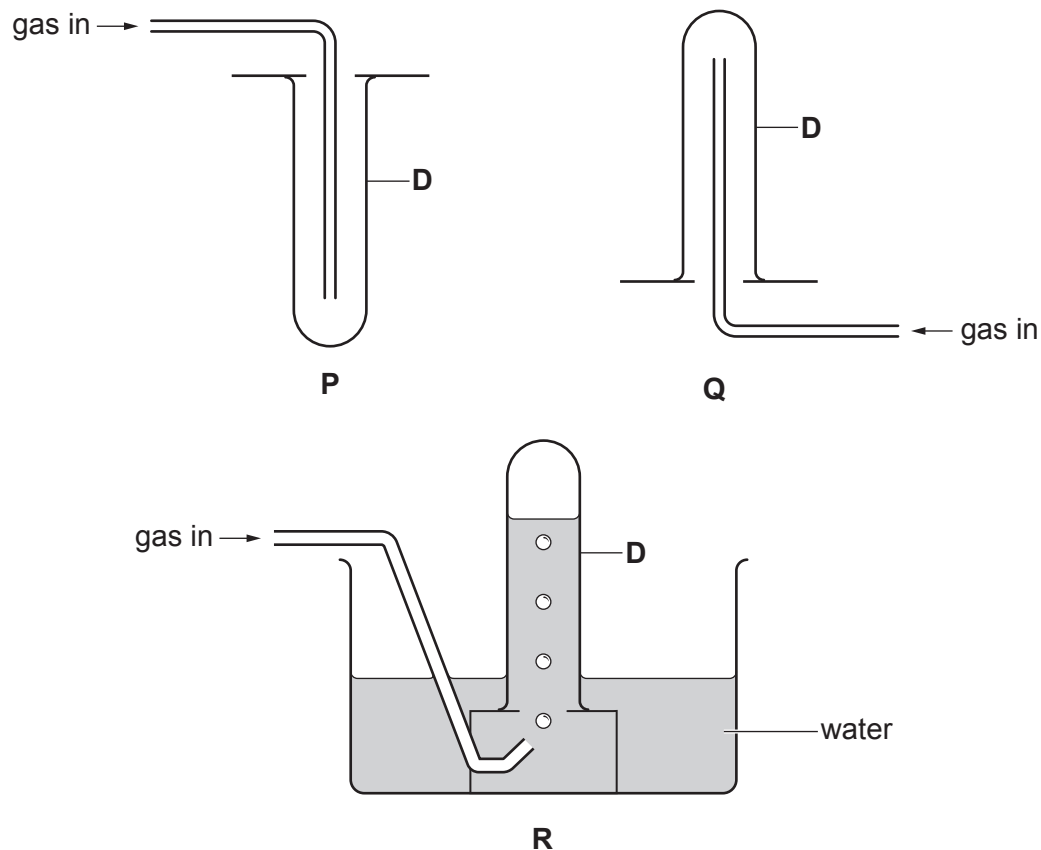
[Total: 5]

Q1/41/O/N/22

13 Two gases **A** and **B** have the properties shown.

gas	density	solubility in water	appearance
<b>A</b>	less dense than air	insoluble	colourless
<b>B</b>	less dense than air	soluble	brown

Some sets of apparatus, **P**, **Q** and **R**, used to collect gases are shown.



(a) Name apparatus **D**.

..... [1]

(b) **Q** is used to collect gas **B**.

(i) State why **R** is **not** used to collect gas **B**.

..... [1]

(ii) State why **P** is **not** used to collect gas **B**.

..... [1]

(c) State why **R** is more suitable than **Q** to collect gas **A**.

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

[Total: 4]



Q1/41/M/J/23

14 A student uses chromatography to separate the dyes in a food colouring.

Fig. 1.1 shows the apparatus the student uses.

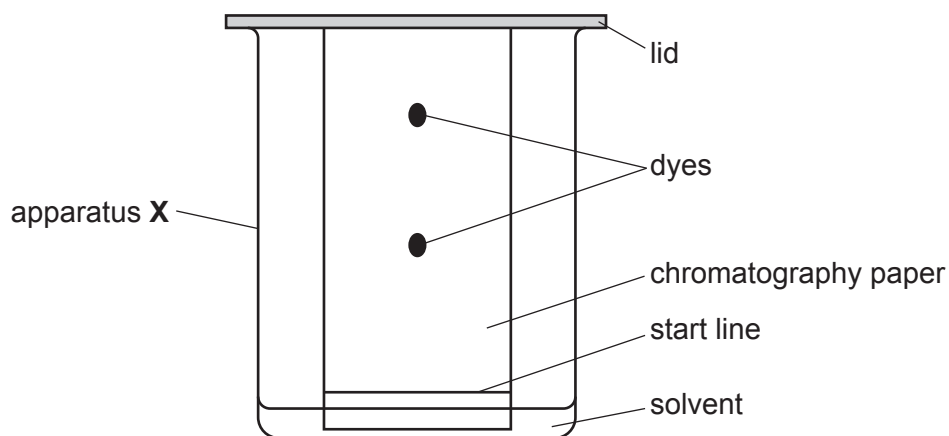


Fig. 1.1

(a) Name apparatus X.

..... [1]

(b) State why it is important to have a lid on X.

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

(c) State why the start line is:

- above the level of the solvent
- drawn in pencil.

above the level of the solvent .....

.....

drawn in pencil .....

.....

[2]

(d) The  $R_f$  value of one of the dyes in the food colouring is 0.60.

In the separation this dye travels 5.7 cm.

Calculate the distance travelled by the solvent during the separation.

distance travelled by solvent ..... cm [2]

[Total: 6]