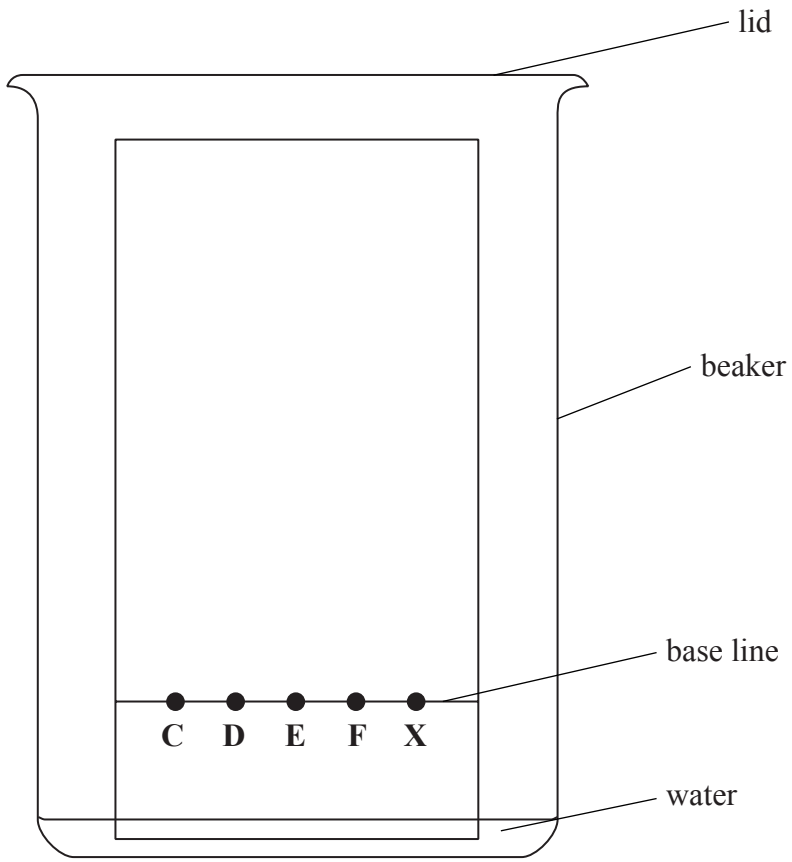
1 Four separate food dyes (**C**, **D**, **E** and **F**) and a mixture of food dyes (**X**) were investigated using paper chromatography. The diagram shows the apparatus used.

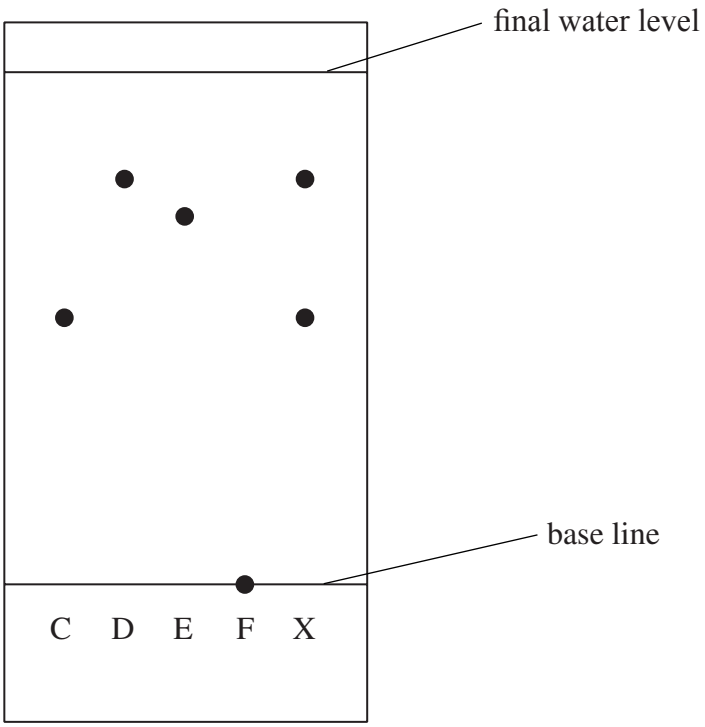


(a) Why should the water level be below the food dyes?

(1)

(b) During the experiment the water rises up the paper. The experiment is stopped just before the water reaches the top of the paper.

The diagram shows the paper after it has been removed from the beaker and dried.



(i) Which of the food dyes C, D, E and F does X contain?

(1)

(ii) Suggest why food dye F did not move up the paper during the experiment.

(1)

(c) Each food dye has an R_f value that can be calculated using this expression:

$$R_f = \frac{\text{distance moved by food dye from base line}}{\text{distance moved by solvent from base line}}$$

Record the distances for food dye **D** in the table below and calculate its R_f value.

(3)

Distance moved by food dye **D** from base line in mm	
Distance moved by solvent from base line in mm	
R_f value	

(Total for Question 1 = 6 marks)

2 This question is about the separation of mixtures.

(a) The table shows some methods used to separate mixtures.

(i) Place a tick (✓) in one box in each row of the table to show the best method of separation for each mixture.

(4)

Separation		Method of separation			
		Chromatography	**Simple distillation**	**Filtration**	**Fractional distillation**
P	red ink from a mixture of coloured inks				
Q	ethanol from a mixture of ethanol and water				
R	sand from a mixture of sand and water				
S	water from copper(II) sulfate solution				

(ii) Which of the mixtures P, Q, R or S contains an undissolved solid?

(1)

.....

(b) Pure dry crystals of magnesium nitrate can be obtained from magnesium nitrate solution by crystallisation.

These steps describe the method, but the steps are in the wrong order.

A allow the solution to cool to room temperature

B heat the solution to evaporate some of the water

C pour the mixture of crystals and solution through filter paper

D put the crystals in a warm place to dry

E dip a glass rod into the solution to see if crystals form

Write a letter in each box to show the correct order.

One has been done for you.

(2)

	E			

(Total for Question 2 = 7 marks)

3 Rock salt is a mixture of salt and sand. Crystals of pure salt can be obtained from rock salt by using the method below.

Use words from the box to complete the sentences.

You may use each word once, more than once or not at all.

(5)

crystals	dissolve	evaporate	filter	solution	solvent

- Grind the rock salt into a fine powder.
- Add the powder to hot water and stir to ..... the salt.
- Filter the mixture. The salt ..... passes through the filter paper leaving behind the sand.
- Boil the filtrate to ..... some of the water.
- Leave the saturated solution to cool so that ..... of salt form.
- Finally, ... the cold mixture to separate the crystals from the remaining solution.

(Total for Question 3 = 5 marks)

4 This is a description of how the orange colouring can be extracted from rose petals.

- crush the petals using a pestle and mortar
- add the crushed petals to some ethanol in a beaker
- heat to about 60 °C and stir to produce an orange solution
- separate the orange solution from the petals

(a) (i) Suggest why ethanol is used instead of water.

(1)

.....

.....

(ii) Ethanol is a flammable liquid.

Suggest how it could be heated safely.

(1)

.....

.....

(iii) How could the orange solution be separated from the petals?

(1)

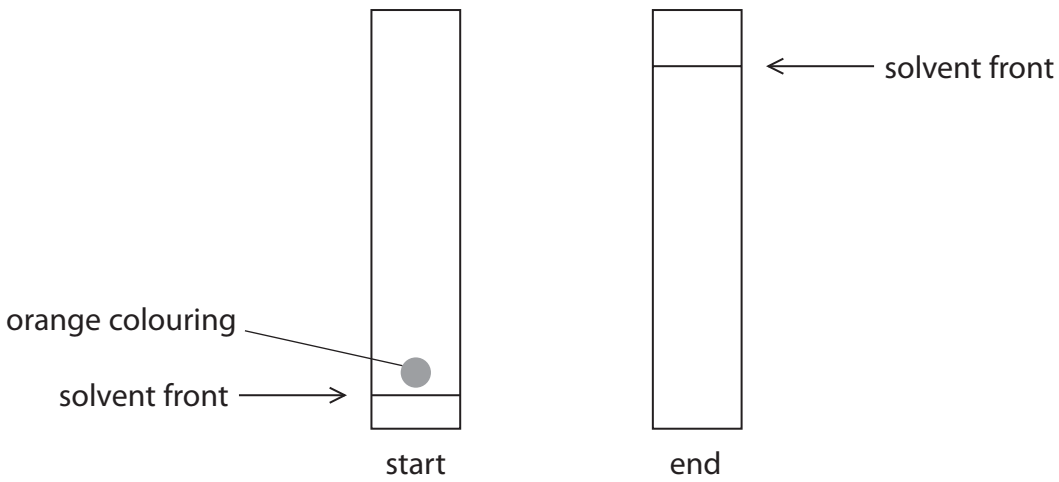
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(b) The orange colouring is analysed using chromatography and is found to consist of two different colours, red and yellow.

The diagram shows the chromatography paper at the start of the experiment.

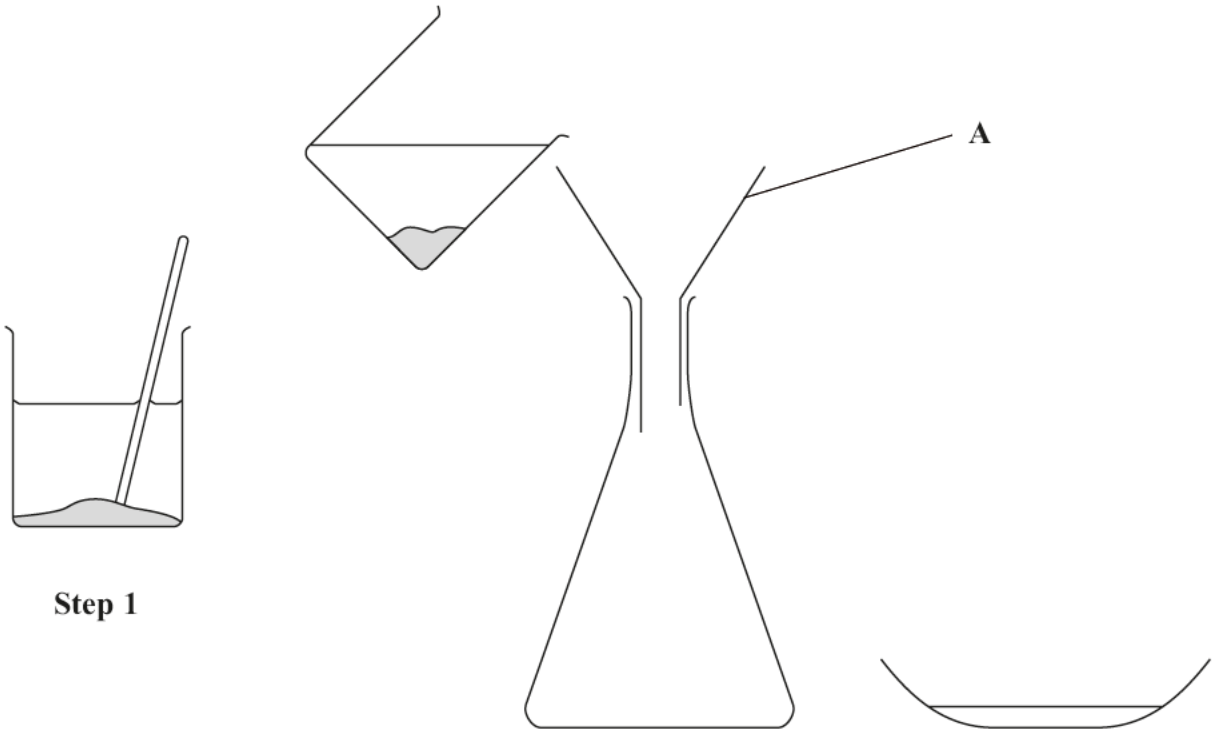
Complete the diagram to show a possible result at the end of the experiment.

(2)



(Total for Question 4 = 5 marks)

5 Salt is soluble in water, but sand is insoluble in water. This difference allows a mixture of salt and sand to be separated using this apparatus.



(a) Use words from the box to complete the sentences. Each word may be used once, more than once or not at all.

(6)

beaker	**Bunsen burner**	**burette**	**conical flask**
funnel	**glass rod**	**thermometer**	**water**

In **Step 1**, the mixture of salt and sand is placed in a .....

containing ..... and stirred with a .....

In **Step 2**, the mixture from **Step 1** is poured through a .....

into a .....

In **Step 3**, the liquid is transferred to a basin to allow the.....

to be removed.

(b) (i) What should be placed in **A** before the mixture from **Step 1** is poured through it?

(1)

.....

(ii) What is the solid removed in **Step 2**?

(1)

.....

(c) Place crosses (☒) in **two** boxes to show the names of two processes used in this separation.

(2)

- ☐ chromatography
- ☐ condensation
- ☐ distillation
- ☐ evaporation
- ☐ filtration
- ☐ sublimation

(Total for Question 5 10 marks)