GCSE Chemistry

Separating Mixtures

Question Paper

Time available: 45 minutes
Marks available: 38 marks

1. This question is about mixtures.

(a) Substances are separated from a mixture using different methods.

Draw **one** line from each substance and mixture to the best method of separation.

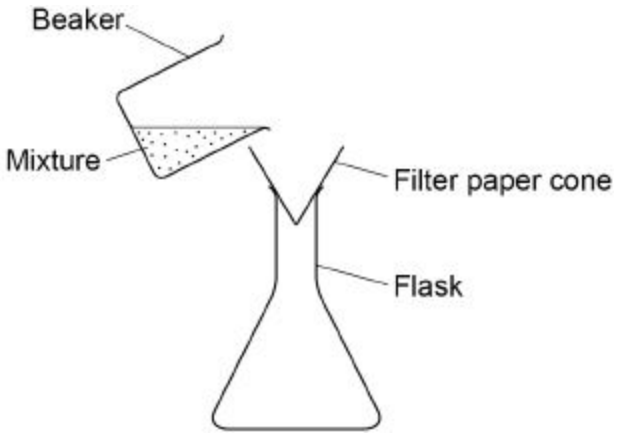
Substance and mixture	Method of separation
	Chromatography
Ethanol from ethanol and water	Crystallisation
Salt from sea water	Electrolysis
The different colours in black ink	Filtration
	Fractional distillation

(3)

(b) A student filters a mixture.

Figure 1 shows the apparatus.

Figure 1



Suggest **one** improvement to the apparatus.

_____

_____

(1)

(c) Complete the sentences.

Choose answers from the box.

condense	**evaporate**	**freeze**	**melt**	**solidify**

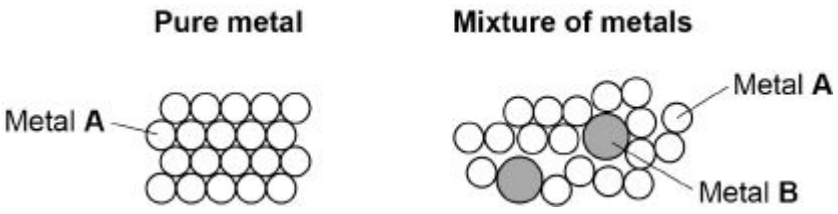
In simple distillation, the mixture is heated to make the liquid _____ .

The vapour is then cooled to make it _____ .

(2)

Figure 2 shows the arrangement of atoms in a pure metal and in a mixture of metals.

Figure 2



(d) Calculate the percentage of metal B atoms in the mixture of metals shown in **Figure 2**.

_____

_____

_____

Percentage of metal **B** atoms = _____ %

(2)

(e) What is a mixture of metals called?

Tick **one** box.

An alloy ☐

A compound ☐

A molecule ☐

A polymer ☐

(1)

(f) Why is the mixture of metals in **Figure 2** harder than the pure metal?

Tick **one** box.

The atoms in the mixture are different shapes. ☐

The layers in the mixture are distorted. ☐

The layers in the mixture slide more easily. ☐

The mixture has a giant structure. ☐

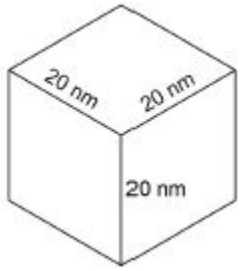
(1)

(g) A nanoparticle of pure metal **A** is a cube.

Each side of the cube has a length of 20 nm.

Figure 3 shows the cube.

Figure 3



What is the volume of the nanoparticle?

Tick **one** box.

20 nm^3 ☐

60 nm^3 ☐

400 nm^3 ☐

8000 nm^3 ☐

(1)

(Total 11 marks)

2. Rock salt is a mixture of sand and salt.

Salt dissolves in water. Sand does **not** dissolve in water.

Some students separated rock salt.

This is the method used.

1. Place the rock salt in a beaker.
2. Add 100 cm^3 of cold water.
3. Allow the sand to settle to the bottom of the beaker.
4. Carefully pour the salty water into an evaporating dish.
5. Heat the contents of the evaporating dish with a Bunsen burner until salt crystals start to form.

(a) Suggest **one** improvement to step 2 to make sure all the salt is dissolved in the water.

_____

_____

(1)

(b) The salty water in step 4 still contained very small grains of sand.

Suggest **one** improvement to step 4 to remove all the sand.

_____

_____

(1)

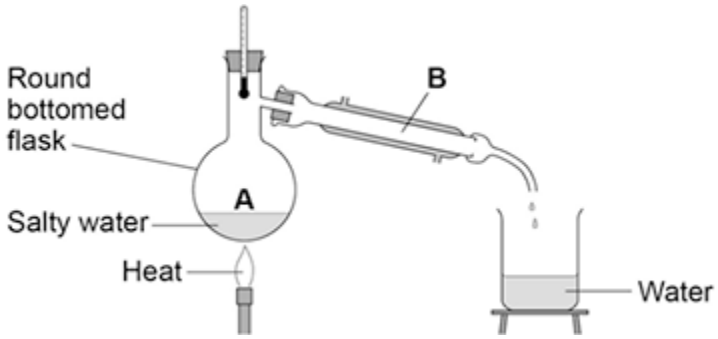
(c) Suggest **one** safety precaution the students should take in step 5.

_____

_____

(1)

(d) Another student removed water from salty water using the apparatus in the figure below.



Describe how this technique works by referring to the processes at **A** and **B**.

_____

_____

_____

_____

(2)

(e) What is the reading on the thermometer during this process?

_____ °C

(1)

(Total 6 marks)

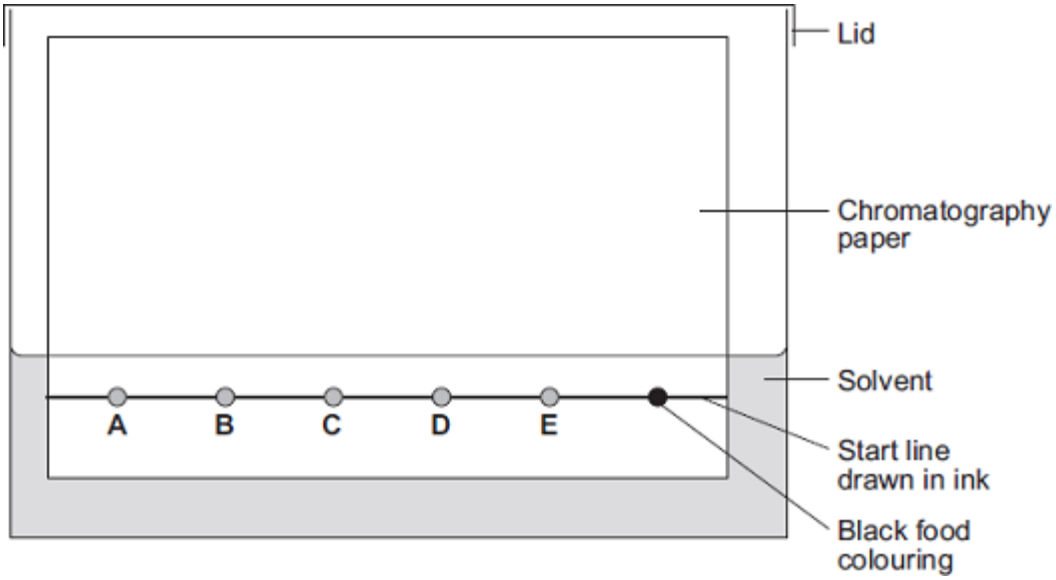
3. Chromatography can be used to separate components of a mixture.

(a) A student used paper chromatography to analyse a black food colouring.

The student placed spots of known food colours, **A**, **B**, **C**, **D** and **E**, and the black food colouring on a sheet of chromatography paper.

The student set up the apparatus as shown in **Diagram 1**.

Diagram 1



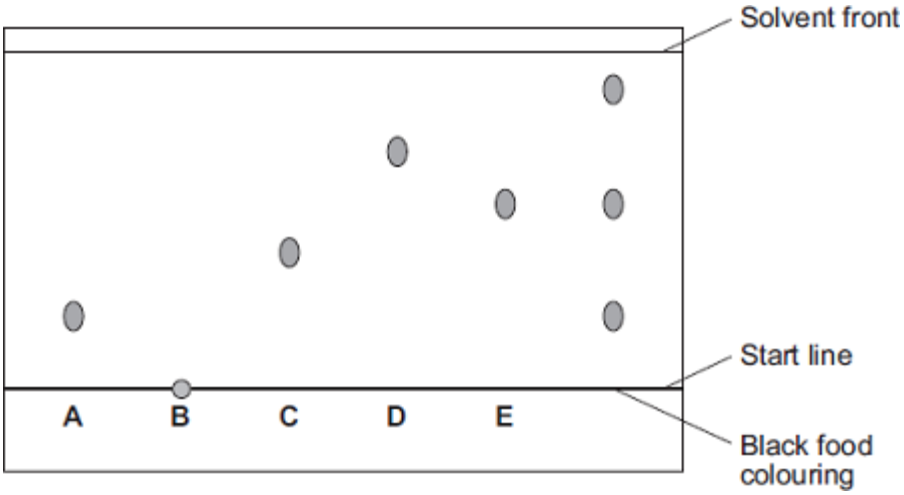
The student made **two** errors in setting up the apparatus.
Identify the **two** errors and describe the problem each error would cause.

(4)

(b) A different student set up the apparatus without making any errors.

The chromatogram in **Diagram 2** shows the student's results.

Diagram 2



(i) What do the results tell you about the composition of the black food colouring?

_____

_____

_____

(2)

(ii) Use **Diagram 2** to complete **Table 1**.

Table 1

	Distance in mm
Distance from start line to solvent front	_____
Distance moved by food colour **C**	_____

(2)

(iii) Use your answers in part **(b) (ii)** to calculate the R_f value for food colour **C**.

_____

_____

R_f value = _____

(1)

(c) **Table 2** gives the results of chromatography experiments that were carried out on some known food colours, using the same solvent as the students.

Table 2

Name of food colour	Distance from start line to solvent front in mm	Distance moved by food colour in mm	R_f value
Ponceau 4R	62	59	0.95
Carmoisine	74	45	0.61
Fast red	67	27	0.40
Erythrosine	58	17	0.29

Which of the food colours in **Table 2** could be food colour **C** from the chromatogram?

Give the reason for your answer.

_____

_____

_____

(2)

(d) Two types of chromatography are gas chromatography and paper chromatography.

Give **one** advantage of gas chromatography compared with paper chromatography.

_____

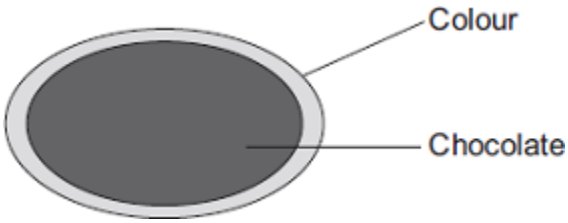
_____

(1)

(Total 12 marks)

4. Colours are used to coat some chocolate sweets.

Some of these colours are given E-numbers.



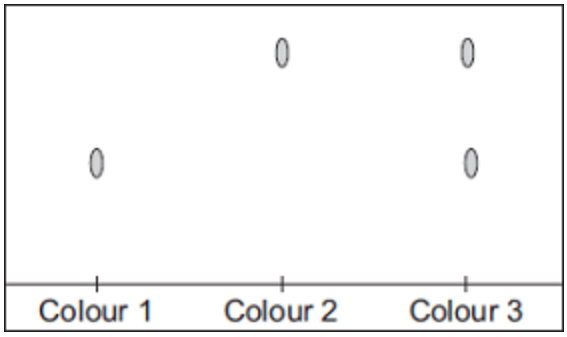
(a) Use the correct word from the box to complete the sentence.

additive	element	fuel

An E-number is used to identify a permitted food _____

(1)

(b) Chromatography was used to compare three of the colours used to coat the chocolate sweets.



What do these results tell you about these three colours?

_____

_____

_____

_____

_____

_____

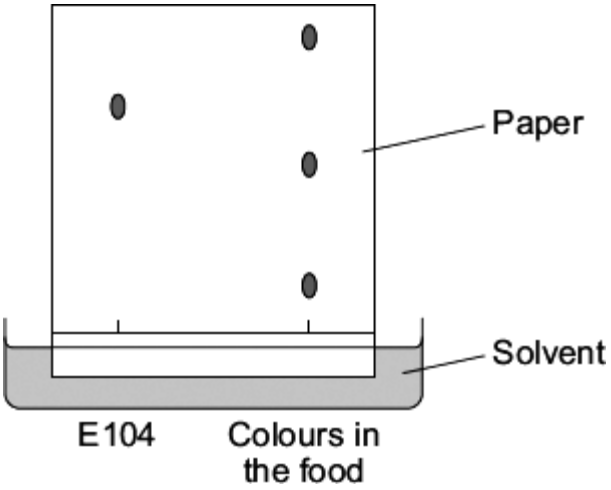
(3)

(Total 4 marks)

5. An article began:

> # Ban yellow additives
>
> Quinoline yellow (E104) is suspected of causing hyperactivity, asthma and rashes in children.

(a) A student tested a food to find out if it contained quinoline yellow (E104).
The student's results are shown below.



(i) Draw a ring around the correct answer to complete the sentence.

This method of detecting and identifying colours is called

chromatography.

distillation.

electrolysis.

(1)

(ii) Using the student's results, how many different colours are in the food? ___

(1)

(iii) Using the student's results, how can you tell that the food does **not** contain quinoline yellow (E104)?

_____

_____

(1)

(b) Quinoline yellow (E104) is used in foods such as sweets, drinks and ice cream.

(i) Give **one** reason why quinoline yellow (E104) is added to foods.

_____

_____

(1)

(ii) Suggest what should be done to decide if quinoline yellow (E104) should be banned.

_____

_____

(1)

(Total 5 marks)