

Q1.

Why blue sweets are turning white

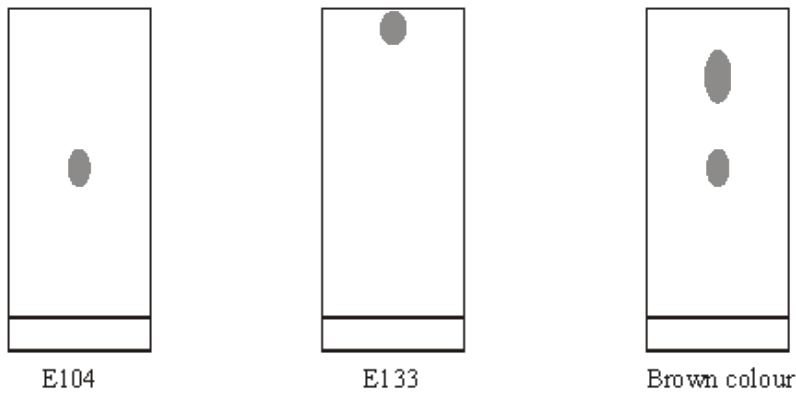
A recent study identified a possible harmful effect on children's nervous systems by some artificial colours. Two of these colours are Brilliant Blue (E133) and Quinoline Yellow (E104). Both are artificial colours because they are made from coal. The company is to stop producing the blue sweets because it is removing all artificial colours and there is no natural blue alternative.

- (a) Suggest why it is important to be able to identify the colour additives in food.

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(1)

- (b) A brown colour used in sweets was analysed using chromatography. The results were compared with those from E104 and E133.



What do the results tell you about the brown colour and its suitability for use in sweets?

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(3)

- (c) Once all the unsuitable colours are removed, the company claims that its sweets are now 'free from artificial colours'.

Does this mean that the sweets contain no additives? Explain your answer.

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(2)
(Total 6 marks)

- Q2.** Some farmed salmon have a coloured additive in the food that they are given. This is a permitted additive that improves the colour of the fish meat.

A sample of the colour is extracted from a salmon.

Explain how paper chromatography could be used to confirm that this is the permitted additive.

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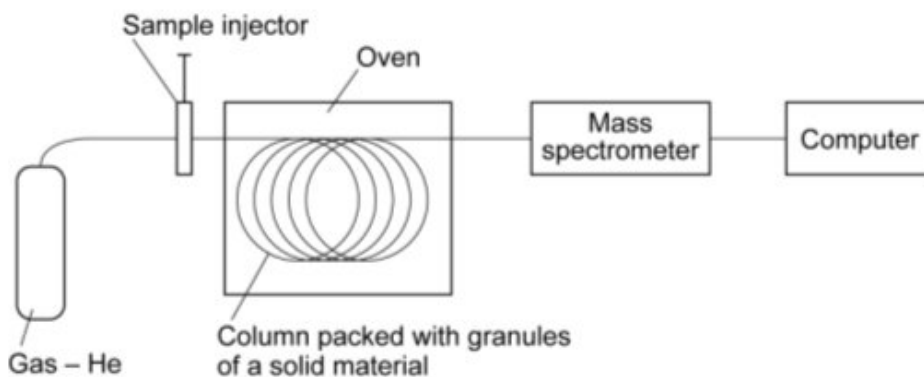
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(Total 3 marks)

- Q3.** The diagram shows the main parts of an instrumental method called gas chromatography linked to mass spectroscopy (GC-MS).



This method separates a mixture of compounds and then helps to identify each of the compounds in the mixture.

(a) In which part of the apparatus:

(i) is the mixture separated? (1)

(ii) is the relative molecular mass of each of the compounds in the mixture measured?
..... (1)

(b) (i) Athletes sometimes take drugs because the drugs improve their performance. One of these drugs is ephedrine.

Ephedrine has the formula:



What relative molecular mass (M_r) would be recorded by GC-MS if ephedrine was present in a blood sample taken from an athlete?

Show clearly how you work out your answer.

Relative atomic masses: H = 1; C = 12; N = 14; O = 16.

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Relative molecular mass = (2)

(ii) Another drug is amphetamine which has the formula:



The relative molecular mass (M_r) of amphetamine is 135.

Calculate the percentage by mass of nitrogen in amphetamine.

Relative atomic mass: N = 14

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Percentage of nitrogen = % (2)

- (c) Athletes are regularly tested for drugs at international athletics events.
An instrumental method such as GC-MS is better than methods such as titration.
Suggest **two** reasons why.

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(2)

- (d) When a blood sample is taken from an athlete the sample is often split into two portions.
Each portion is tested at a different laboratory.
Suggest why.

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(2)

(Total 10 marks)

Q4. Good quality water is essential for life.

- (a) In the United Kingdom, water is filtered and treated with chlorine to make it safe to drink.



Explain why the water is:

filtered

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treated with chlorine.

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(2)

- (b) Millions of people in Bangladesh drink water from wells that contain high levels of arsenic. Arsenic is poisonous.

The World Health Organisation recommends that there should be no more than 0.01 mg of arsenic per litre in drinking water.

The table gives some information about two instrumental methods of testing for arsenic.

Factor to consider	Laboratory Instrumental Method	Portable Instrumental Method
Cost of equipment	£10 000	£50
Skill level of technician	Highly skilled	where test is done
Little training needed	Laboratory only	Anywhere
Time to prepare the instrument for the test	5 minutes	10 seconds
Sensitivity of the instrument	0.000001 mg of arsenic per litre of water	0.1 mg of arsenic per litre of water

- (i) Use the information in the table to give **two** advantages and **one** disadvantage of using the Portable Instrumental Method compared with the Laboratory Instrumental Method.

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(3)

- (ii) The information about these two instrumental methods was provided by the Professional Institute of Water Engineers (PIWE). The Institute has no connection with the companies that make these instruments.

Suggest why many people would accept the views of PIWE rather than the views of the companies that make the instruments.

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(1)
(Total 6 marks)

Q5. Read the article.

Problem food colourings

Scientists say they have evidence that some food colourings cause hyperactive behaviour in young children.

These food colourings are added to some sweets.

W, X, Y and **Z** are food colourings that may cause hyperactive behaviour in young children.

A scientist used chromatography to see if these food colourings were used in two sweets, **S** and **P**.

The results are shown on the chromatogram.



(a) Food colourings, such as **W, X, Y** and **Z**, are added to some sweets.

Suggest **one** reason why.

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(1)

(b) In chromatography, the R_f value = $\frac{\text{distance moved by the colouring}}{\text{distance moved by the solvent}}$

Use the scale on the chromatogram to help you to answer this question.

Which food colouring, **W, X, Y** or **Z**, has an R_f value of 0.7?

(1)

- (c) From the chromatogram, what conclusions can the scientist make about the colourings in sweets **S** and **P**?

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(3)
(Total 5 marks)

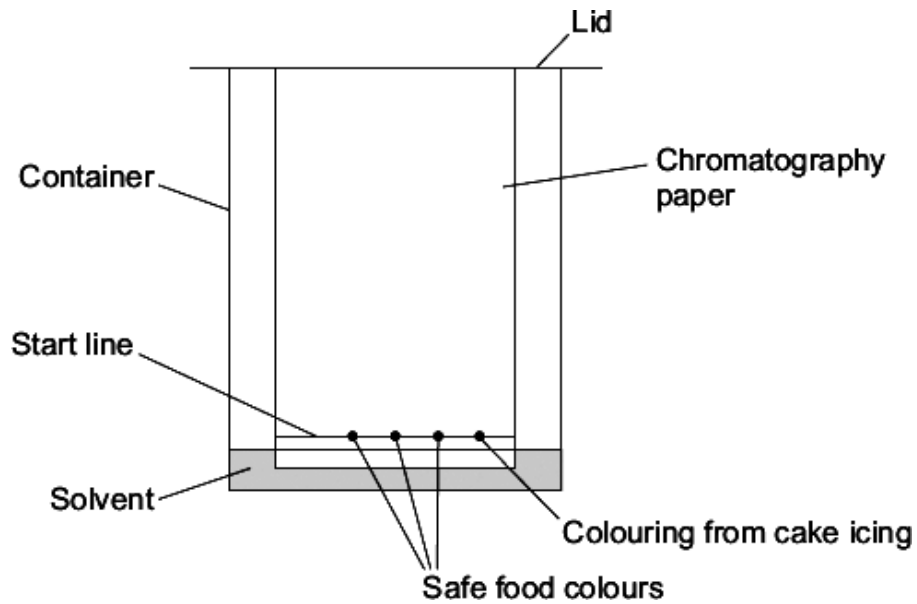
Q6. Icing on cakes is tested to check that safe colours were used when they were made.



By Megan Chromik [CC-BY-SA-2.0], via Wikimedia Commons

Paper chromatography is one method of testing which colours are in cake icing.

(a) The diagram shows an experiment a student did.



(i) Suggest why there is a lid on the container.

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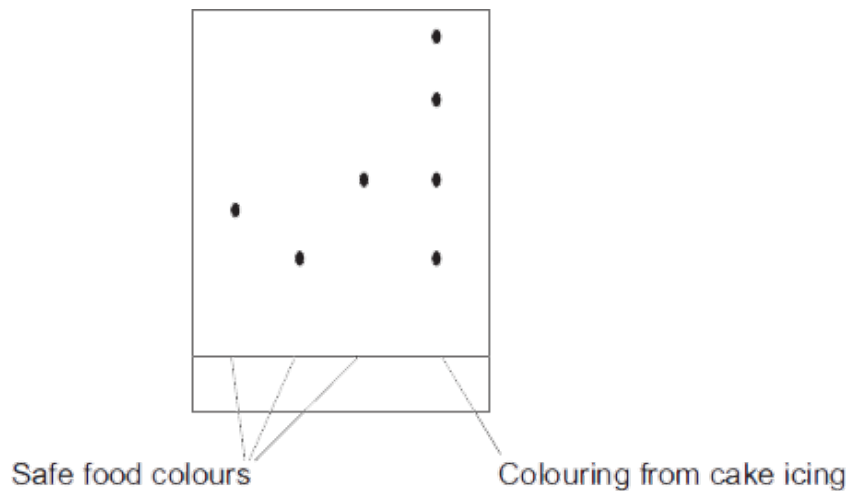
(1)

(ii) The start line should be drawn in pencil **not** in ink. Suggest why.

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(1)

(b) The diagram shows the results of the paper chromatography experiment.



(i) How many different food colours were used in the colouring from the cake icing?

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(1)

(ii) Is the cake icing safe to eat?

Give a reason for your answer.

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(1)

(c) Gas chromatography linked to mass spectroscopy is an example of an instrumental method. This method was used on a mixture of solvents.

(i) Give **two** advantages of gas chromatography compared with paper chromatography.

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(2)

(ii) What does gas chromatography do to the mixture of solvents?

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(1)

(iii) What information does mass spectroscopy give?

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(1)

(Total 8 marks)

