Chapter 12 Chemical Analysis

Name: _____

Class: _____

Date: _____

Time: **104 minutes**

Marks: **104 marks**

Comments:

1 This question is about chemical tests.

(a) Solutions of copper(II) ions and iron(III) ions produce coloured precipitates with sodium hydroxide solution.

Draw **one** line from each metal ion to the colour of the precipitate it produces.

Metal ion	Colour of precipitate
Copper(II) (Cu^{2+})	Blue
	Brown
	Green
Iron(III) (Fe^{3+})	White

(2)

(b) Sodium hydroxide solution was added to a solution containing ions of a metal.

A white precipitate was produced. The white precipitate dissolved in excess sodium hydroxide solution.

Use the correct answer from the box to complete the sentence.

aluminium	**magnesium**	**potassium**

The ions in the solution were ions of ..... .

(1)

(c) Low sodium salt contains sodium chloride and potassium chloride.

A student used a flame test on low sodium salt.

(i) What is the colour produced by sodium ions in a flame test?

.....

(1)

(ii) What is the colour produced by potassium ions in a flame test?

.....

(1)

(iii) Why is it **not** possible to tell from the flame test that both ions are present in low sodium salt?

.....

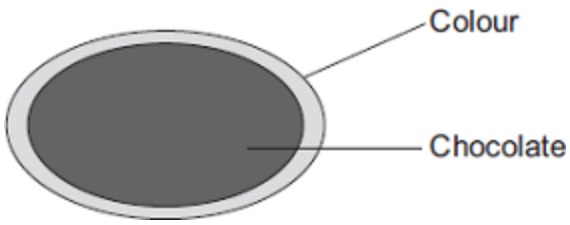
.....

(1)

(Total 6 marks)

2 Colours are used to coat some chocolate sweets.

Some of these colours are given E-numbers.



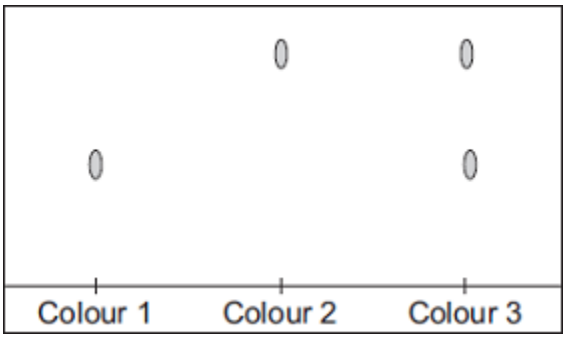
Use the correct word from the box to complete the sentence.

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)

3 Chemical tests can be used to identify ions in solutions.

(a) List **A** gives the names of two sulfates in solution.
List **B** gives the results of adding sodium hydroxide solution.

Draw a straight line from each sulfate in List **A** to its correct test result in List **B**.

List A **Name of sulfate in solution**	**List B** **Result of adding sodium hydroxide solution**
	A blue precipitate formed
Copper sulfate	
	A white precipitate formed
Iron(II) sulfate	
	A green precipitate formed

(2)

(b) Suggest why clean test tubes were used for each test.

.....

.....

(1)

(c) Draw a ring around the correct colour to complete this sentence.

Sulfate solutions react with barium chloride solution to give a

blue
green
white

precipitate.

(1)

(Total 4 marks)

4 (a) The colours of fireworks are produced by chemicals.

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Three of these chemicals are lithium sulfate, potassium chloride and sodium nitrate.

(i) A student wants to carry out flame tests on these three chemicals.

Describe how to carry out a flame test.

.....

.....

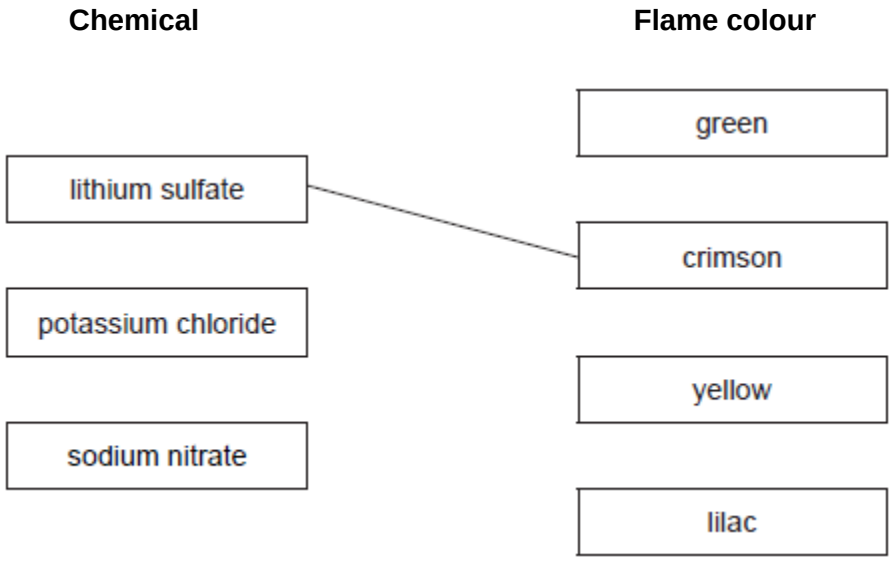
.....

.....

(2)

(ii) Draw **one** line from each chemical to the correct flame colour.

The first one has been done for you.



(2)

(iii) Dilute nitric acid and silver nitrate solution are added to solutions of the three chemicals.

A white precipitate forms in one of the solutions.

Which chemical produces the white precipitate?

.....

(1)

(b) The student tests a fourth chemical, **X**.

(i) The student adds sodium hydroxide solution to a solution of chemical **X**.

A blue precipitate is formed.

Which metal ion is in chemical **X**?

.....

(1)

(ii) The student adds dilute hydrochloric acid to a solution of chemical **X** and then adds barium chloride solution.

A white precipitate is formed.

Which negative ion is in chemical **X**?

Draw a ring around the correct answer.

chloride **nitrate** **sulfate**

(1)

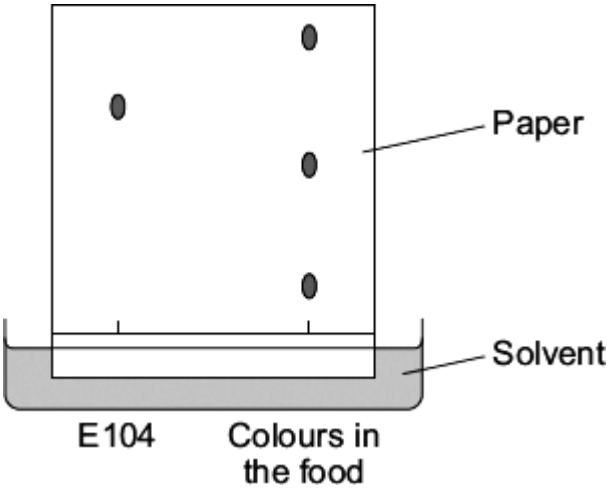
(Total 7 marks)

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)

6 The label shows the ingredients in a drink called Cola.

Cola

Ingredients:

Carbonated water
Sugar
Colouring
Phosphoric acid
Flavouring
Caffeine

(a) (i) The pH of carbonated water is 4.5.

The pH of Cola is 2.9.

Name the ingredient on the label that lowers the pH of Cola to 2.9.

.....

(1)

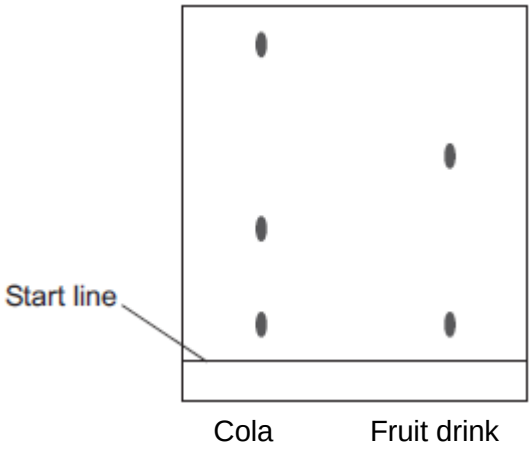
(ii) Which ion causes the pH to be 2.9?

.....

(1)

(b) A student investigated the food colouring in Cola and in a fruit drink using paper chromatography.

The chromatogram in the figure below shows the student's results.



(i) Complete the sentence.

The start line should be drawn with a ruler and ..... .

Give a reason for your answer.

.....

.....

(2)

(ii) Suggest **three** conclusions you can make from the student's results.

.....

.....

.....

.....

.....

.....

(3)

(c) Caffeine can be separated from the other compounds in the drink by gas chromatography.

Why do different compounds separate in a gas chromatography column?

.....

.....

(1)

(d) Caffeine is a stimulant.

Large amounts of caffeine can be harmful.

(i) Only **one** of the questions in the table **can** be answered by science alone.

Tick (✓) **one** question.

Question	**Tick** (✓)
Should caffeine be an ingredient in drinks?	
Is there caffeine in a certain brand of drink?	
How much caffeine should people drink?	

(1)

(ii) Give **two** reasons why the other questions **cannot** be answered by science alone.

Reason 1 .....

.....

Reason 2 .....

.....

(2)

(Total 11 marks)

7 Read the article.

Problem food colourings

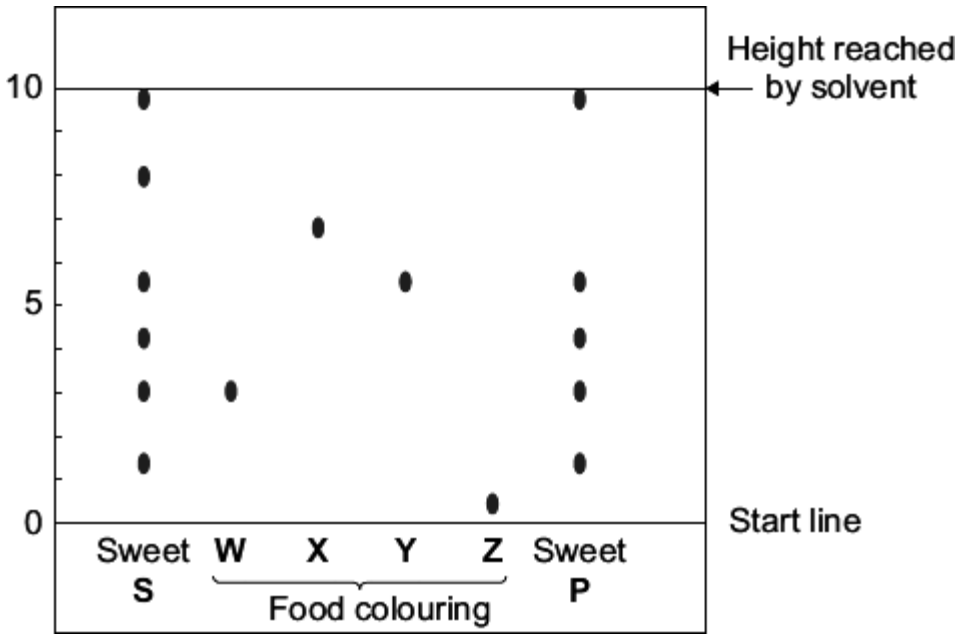
Scientists say they have evidence that some food colourings cause hyperactive behaviour in young children.

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.

.....

.....

(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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.....

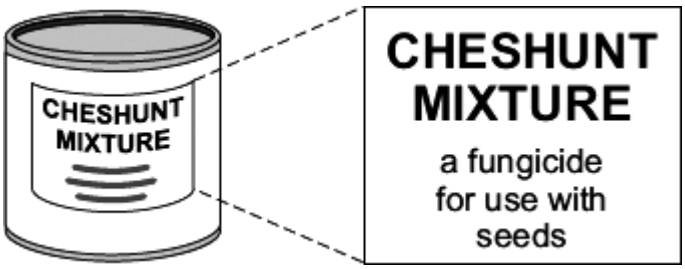
.....

.....

(3)

(Total 5 marks)

8 Cheshunt mixture is a powder containing copper sulfate, $CuSO_4$, and ammonium carbonate, $(NH_4)_2CO_3$



(a) A student tested the Cheshunt mixture.

(i) Hydrochloric acid was added.
A gas was produced that turned limewater milky.

Complete the sentence.

The gas was ..... which shows

that ..... ions are in the mixture.

(2)

(ii) Sodium hydroxide solution was added.
A gas was produced that indicates that ammonium ions are in the mixture.

Complete the sentence.

The gas was ..... which turns

damp red ..... blue.

(2)

(b) Cheshunt mixture is dissolved in water before it is used.
When the student dissolved the Cheshunt mixture in water it formed a blue solution.

(i) Suggest how the student knew that copper ions are in this solution.

.....

.....

(1)

(ii) The student tested the Cheshunt solution and the result of the test indicated that sulfate ions are in the solution.

Complete the sentence.

The student added a solution of ..... in the presence of

dilute hydrochloric acid and a ..... precipitate was produced.

(2)

(Total 7 marks)

9 The colours of fireworks are produced by chemicals.

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(a) Information about four chemicals is given in the table.

Complete the table below.

Chemical	Colour produced in firework
barium chloride	green
..... carbonate	crimson
sodium nitrate	.....
calcium sulfate	red

(2)

(b) Describe a test to show that barium chloride solution contains chloride ions.

Give the result of the test.

.....

.....

.....

.....

(2)

(c) A student did two tests on a solution of compound **X**.

Test 1
Sodium hydroxide solution was added.
A blue precipitate was formed.

Test 2
Dilute hydrochloric acid was added.
Barium chloride solution was then added.
A white precipitate was formed.

The student concluded that compound **X** is iron(II) sulfate.

Is the student's conclusion correct?

Explain your answer.

.....

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(3)

(Total 7 marks)

10 This is part of an article about food additives.

> **THE PERIL OF FOOD ADDITIVES**
>
> Some orange drinks contain the additives E102 (Tartrazine), E104 (Quinoline Yellow) and E110 (Sunset Yellow).These three coloured additives are thought to cause hyperactivity in children.

(a) State **two** reasons that a manufacturer might give to justify the use of these additives.

1 .....

.....

2 .....

.....

(2)

(b) Some scientists asked 4000 twelve-year-old children to help them investigate if there is a link between these three coloured additives and hyperactivity.

How would the scientists use these 4000 children to investigate if there is a link between these three coloured additives and hyperactivity in children?

.....

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(4)

(c) A manufacturer used an independent scientist to show that their orange drink did not contain these three coloured additives.

(i) Suggest why the manufacturer would use a scientist who was independent instead of using their own scientist.

.....

.....

(1)

(ii) The scientist had samples of E102, E104 and E110 and the orange drink. The scientist used paper chromatography for the test.

Describe how the scientist could use the results to show if the orange drink contained any of these three coloured additives.

You may include a diagram of the paper chromatography results.

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(2)

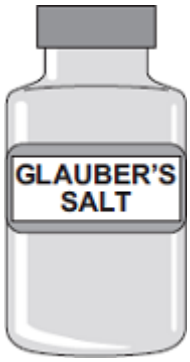
(Total 9 marks)

11 Four bottles of chemicals made in the 1880s were found recently in a cupboard during a Health and Safety inspection at Lovell Laboratories.

Sodium carbonate

Sodium chloride

Sodium nitrate



Sodium sulfate

The chemical names are shown below each bottle.

(a) You are provided with the following reagents:

- aluminium powder
- barium chloride solution acidified with dilute hydrochloric acid
- dilute hydrochloric acid
- silver nitrate solution acidified with dilute nitric acid
- sodium hydroxide solution.
- limewater
- red litmus paper

(i) Describe tests that you could use to show that these chemicals are correctly named.

In each case give the reagent(s) you would use **and** state the result.

Test and result for carbonate ions:

.....

.....

.....

Test and result for chloride ions:

.....

.....

.....

Test and result for nitrate ions:

.....

.....

.....

Test and result for sulfate ions:

.....

.....

.....

(4)

(ii) Suggest why a flame test would **not** distinguish between these four chemicals.

.....

(1)

(b) Instrumental methods of analysis linked to computers can be used to identify chemicals.

Give **two** advantages of using instrumental methods of analysis.

.....

.....

.....

.....

(2)

(Total 7 marks)

12 Four labels have come off four bottles.

Aluminium sulphate solution $Al_2(SO_4)_3$ (aq)	Ammonium sulphate solution $(NH_4)_2SO_4$ (aq)
Magnesium sulphate solution $MgSO_4$ (aq)	Sodium sulphate solution Na_2SO_4 (aq)

Describe and give the results of the **chemical** tests that you would do to identify which bottle contained which substance.

.....

.....

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.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total 5 marks)

13 This question is about chemical analysis.

(a) A student has solutions of three compounds, **X, Y** and **Z**.

The student uses tests to identify the ions in the three compounds.

The student records the results of the tests in the table.

	Test			
Compound	**Flame test**	**Add sodium hydroxide solution**	**Add hydrochloric acid and barium chloride solution**	**Add nitric acid and silver nitrate solution**
X	no colour	green precipitate	white precipitate	no reaction
Y	yellow flame	no reaction	no reaction	yellow precipitate
Z	no colour	brown precipitate	no reaction	cream precipitate

Identify the **two** ions present in each compound, **X, Y** and **Z**.

X .....

Y .....

Z .....

(3)

(b) A chemist needs to find the concentration of a solution of barium hydroxide.
Barium hydroxide solution is an alkali.

The chemist could find the concentration of the barium hydroxide solution using two different methods.

Method 1

- An excess of sodium sulfate solution is added to 25 cm^3 of the barium hydroxide solution. A precipitate of barium sulfate is formed.
- The precipitate of barium sulfate is filtered, dried and weighed.
- The concentration of the barium hydroxide solution is calculated from the mass of barium sulfate produced.

Method 2

- 25 cm^3 of the barium hydroxide solution is titrated with hydrochloric acid of known concentration.
- The concentration of the barium hydroxide solution is calculated from the result of the titration.

Compare the advantages and disadvantages of the two methods.

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(5)

(Total 8 marks)

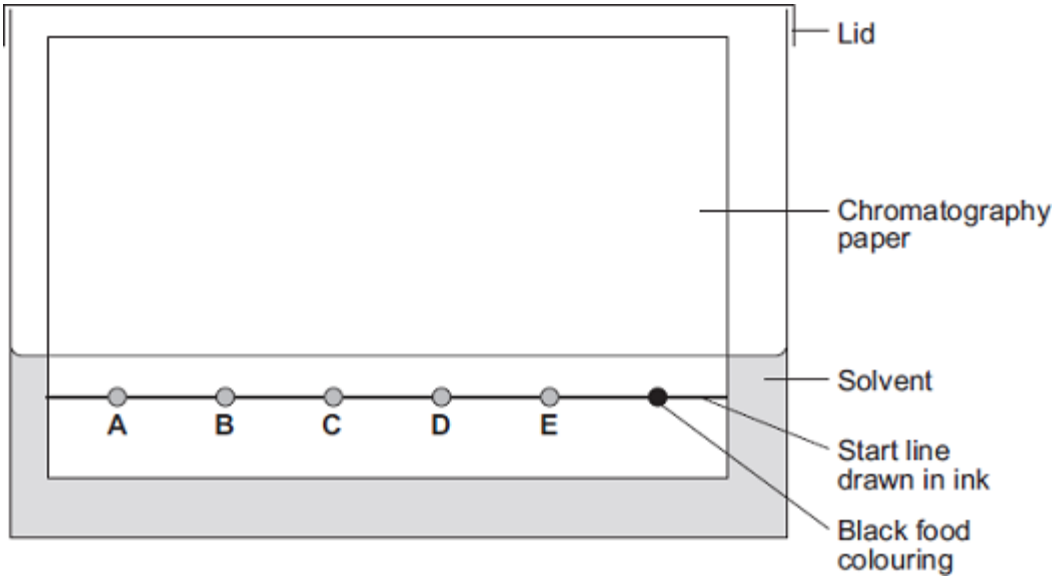
14 Chromatography can be used to separate components of a mixture.

(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.

.....

.....

.....

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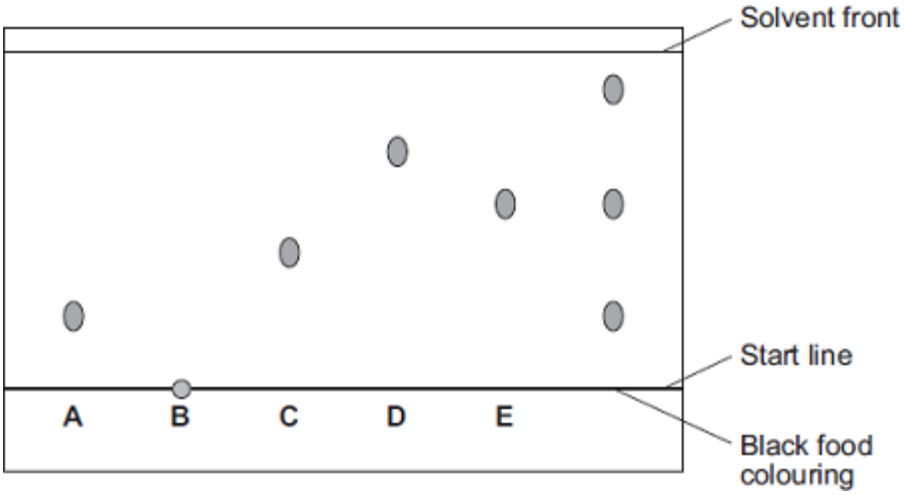
.....

(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.

.....

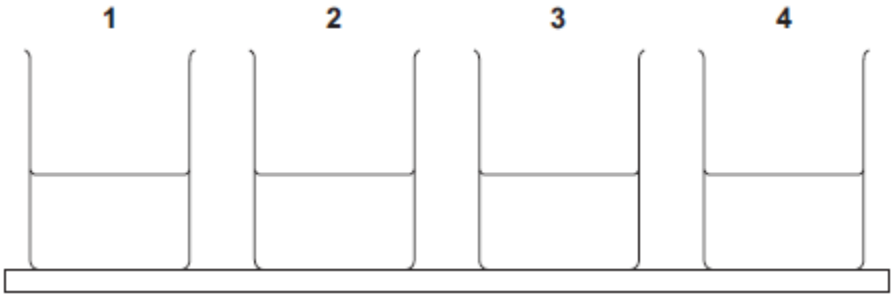
.....

(1)

(Total 12 marks)

15 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

A group of students had four different colourless solutions in beakers **1, 2, 3** and **4**, shown in the figure below.



The students knew that the solutions were

- sodium chloride
- sodium iodide
- sodium carbonate
- potassium carbonate

but did **not** know which solution was in each beaker.

The teacher asked the class to plan a method that could be used to identify each solution.

She gave the students the following reagents to use:

- dilute nitric acid
- silver nitrate solution.

The teacher suggested using a flame test to identify the positive ions.

Outline a method the students could use to identify the four solutions.

You should include the results of the tests you describe.

.....

.....

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.....

Extra space .....

.....

.....

.....

.....

.....

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.....

.....

(Total 6 marks)

1

(a) copper (II) → blue

iron (III) → brown

more than one line from any box negates the mark

1
1

(b) aluminium

allow correct answer shown in box if answer line blank

1

(c) (i) yellow

allow orange

1

(ii) lilac

allow purple

1

(iii) one colour masks the other

allow colours mixed

1

[6]

2

(a) additive

1

(b) colour 3 is a mixture of colours 1 and 2

any **two** from:

accept E-number or additive instead of colour

ignore comments about height / level

1

- colour 1 is made up of only one colour / dye
- colour 2 is made up of only one colour / dye
- colour 3 is made up of two colours / dyes
  or
  more colours (than colours 1 and 2)

2

[4]

3

(a) copper sulfate → blue precipitate

1

iron(II) sulfate → green precipitate

1

(b) eg some idea of contamination

allow so you can see the colour change clearly / easily

or

give misleading / incorrect results / lead to wrong conclusion

allow to get accurate / reliable results
ignore fair test

1

(c) white

1

[4]

4

(a) (i) *method of introducing sample into flame*

e.g. wire / splint / spray

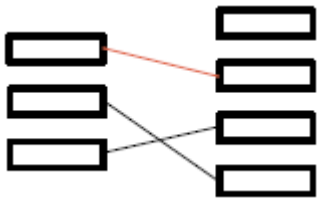
1

clean wire or colourless flame

allow blue / roaring flame

1

(ii)



1
1

(iii) (potassium) chloride

allow KCl ***or*** *Cl^-*

1

(b) (i) copper

allow Cu^{2+}

1

(ii) sulfate

1

[7]

5

(a) (i) chromatography

1

(ii) 3 / three

1

(iii) the colour / E104 is not on the same level as any of the colours in the food

accept E104 does not match

1

(b) (i) to improve the appearance of the food

ignore adds yellow / colour

ignore taste / flavour

1

(ii) further / or different tests (for harmful effects) **or** obtain more evidence (that it is harmful)

allow do a survey / study

1

[5]

6 (a) (i) (phosphoric) acid

allow phosphoric

1

(ii) H^+ / hydrogen (ion)

if ion symbol given, charge must be correct

1

(b) (i) pencil

1

so it will not run / smudge / *dissolve*

ignore pencil will not interfere with / affect the results

or

because ink would run / smudge / *dissolve*

ignore ink will interfere with / affect the results

1

(ii) any **three** from:

*reference to spots / dots = max **2***

allow colouring for colour

- *3* colours in Cola

*allow more colours in cola **or** fewer colours in fruit drink*

- *2* colours in Fruit drink
- one of the colours is the same
- two of the colours in Cola are different
- one of the colours in Fruit drink is different

allow some of the colours in the drinks are different

- *one of the colours in Cola is the most soluble*

accept one of the colours in Cola has the highest R_f value

3

(c) different substances travel at different speeds **or** have different retention times

accept different attraction to solid

ignore properties of compounds

1

(d) (i) Is there caffeine in a certain brand of drink?

1

(ii) any **two** from:

- cannot be done by experiment
- based on opinion / *lifestyle choice*
- ethical, *social* or economic issue

accept caffeine has different effects on different people

2

[11]

7 (a) (improve) appearance

allow add colour

allow these food colourings have not been proven to cause hyperactive behaviour in young children

*do **not** accept taste / flavour / preservatives*

ignore reference to E-numbers

1

(b) X

1

(c) any **three** from:

- S contains six / 6 colourings
- P contains five / 5 colourings

  *if neither of first 2 bullet points given allow **1** mark for S contains more colours than P **or** converse*
- both S and P contain the same

  five / 5 colourings
- both contain W **and** Y
- both sweets (may) cause hyperactivity

  ignore unsafe
- neither contain X **and** Z

3

[5]

8 (a) (i) carbon dioxide / CO_2

1

carbonate / CO_3^{2-}

answers must be in the order shown

marks are independent

1

(ii) ammonia / NH_3

1

litmus

answers must be in the order shown

marks are independent

1

(b) (i) solution is blue

accept blue precipitate only if sodium hydroxide added

allow blue liquid

allow copper sulfate / copper ions are blue

1

(ii) barium chloride / $BaCl_2$

allow barium nitrate / barium ions / Ba^{2+}

1

white

answers must be in the order shown

marks are independent

1

[7]

9 (a) lithium

allow Li^+ / Li

1

yellow

allow orange

1

(b) silver nitrate (solution)

*incorrect test = **0** marks*

ignore (nitric) acid

*do **not** allow other named acids*

1

white precipitate

1

(c) blue precipitate (with sodium hydroxide) indicates copper ions

allow Cu^{2+}

1

and white precipitate (with barium chloride) indicates sulfate ions

allow SO_4^{2-}

*accept compound X is copper sulfate / $CuSO_4$ for **1** mark*

1

but iron(II) ions produce a green precipitate (with sodium hydroxide)

1

[7]

10 (a) any **two** from:

ignore reference to taste / shelf-life / sales etc

- improve the colour / appearance
- additives are permitted / not banned / listed on the label
- link between additives and hyperactivity not proved
- maintain the low cost of the drink **or** natural colours would make the drink cost more

allow cheaper if qualified

2

(b) have a control group / placebo **or** test children before any drink given

1

give a drink to at least 3 groups **or** give a drink at least 3 times

1

give each additive to different group / children / at different times

1

observe / monitor / compare behaviour of group / children

1

(c) (i) so that there would be trust / respect / no bias

1

(ii) compare the colours / spots from the orange drink with those of the (three) additives

accept diagram of chromatogram(s) with spots for E102, 104, 110 and sample from the orange drink

1

there should be no matching colours / spots

1

[9]

11 (a) (i) Na_2CO_3: HCl → gas / effervescence / bubbles (1)
CO_2 / carbon dioxide / turns lime water milky (1)

1

NaCl: $AgNO_3$ → white ppt (1)
silver chloride (1)

1

$NaNO_3$: Al + NaOH → pungent / sharp smell / choking gas (1)
NH_3 / ammonia / turns (red) litmus blue(1)

1

Na_2SO_4: $BaCl_2$ → white ppt (1)
barium sulfate (1)

1

*each correct test and one result = **1** mark*

***one** other result for any test = **1** mark this mark can only be awarded <u>once</u>*

(ii) all would give a yellow / yellow-orange (flame) / same coloured (flame) / same results

allow <u>orange</u> (flame) 1

or

they all contain sodium

1

(b) any **two** from:

ignore cost/errors

- fast / quick or comment about speed
  allow precise
- small amounts/sensitive
  allow can be left to run/continuous analysis
- accurate
- ease of automation
  accept operators do not need chemical skills
- sample not used up
- reliable / efficient

2

[7]

12 any series of chemical tests that work should be given credit

each mark is for test + result + inference

identifying all 4 substances unambiguously with no errors gains **5** marks

e.g.

- Flame test: yellow / orange
  ⇒ Na^+ ⇒ sodium sulphate
  ignore incorrect flame test colours for other compounds

1

- Add NaOH to remaining 3 samples:
  no (white) ppt / ammonia ⇒
  no need to test for ammonia

1

NH_4^+ ⇒ ammonium sulphate (white) ppt ⇒ magnesium ions or aluminium ions

1

- add excess NaOH to the 2 samples which gave a (white) ppt:
  ppt dissolves ⇒ aluminium sulphate
  ppt insoluble ⇒ magnesium sulphate

2

or

- Add NaOH:

  no ppt: ammonia ⇒NH_4^+ ⇒ (1)
  ammonium sulphate
  the other one is sodium sulphate (1)
  (damp red) litmus goes blue*
  ⇒ *NH_3* ⇒ *ammonium sulphate*
  the other one is sodium sulphate

- Add excess NaOH to the 2 samples
  which gave the white ppt (1)
  ppt dissolves ⇒ aluminium sulphate (1)
  ppt insoluble ⇒ magnesium sulphate (1)
  (*) or UI/pH indicator goes blue/purple

[5]

13 (a) **X:**
Fe^{2+} / iron(II), SO_4^{2-} / sulfate
allow iron(II) sulfate
or *$FeSO_4$*

1

Y:

Na^+ / sodium, I^- / iodide

allow sodium iodide

or *NaI*

1

Z:

Fe^{3+} / iron(III), Br^- / bromide

allow iron(III) bromide

or *$FeBr_3$*

correct identification of any two ions = one mark

correct identification of any four ions = two marks

1

(b) any **five** from:

allow converse arguments

method 1

- weighing is accurate
- not all barium sulfate may be precipitated
- precipitate may be lost
- precipitate may not be dry
- takes longer
- requires energy

allow not all the barium hydroxide has reacted

method 2

- accurate
- works for low concentrations

allow reliable / precise

5

[8]

14 (a) start line drawn in ink

1

so it will run / dissolve in the solvent / split up

allow mixes with the spots

1

spots under solvent **or** solvent above spots / start line

1

so they will mix with solvent **or** wash off paper **or** colour the solvent **or** dissolve in the solvent

1

(b) (i) contains **A** and **E**

1

and one other (unknown substance)

*if no other marks awarded, an answer saying it is made up of three colours gains **1** mark*

1

(ii) 45 or 46

allow any value from 45 to 46

1

18

allow any value from 16 to 20

*award **1** mark if numbers correct but in cm*

1

(iii) 0.40

*allow ecf from **(b)(ii)***

ignore units

1

(c) fast red

*allow ecf from **(b)(iii)***

1

has same R_f value

*allow none of them, as none has the same R_f value for **2** marks*

1

(d) any **one** from:

- more accurate
- more sensitive
- uses small quantities of samples
- quicker / faster / more rapid
- can link to mass spectrometer (MS)

1

[12]

15 Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks
No relevant content

Level 1 (1 – 2 marks)
Any description of a method used and / or a result given

Level 2 (3 – 4 marks)
Description of workable methods used, with results to identify positive **or** negative ions

Level 3 (5 – 6 marks)
Description of methods used to identify both positive **and** negative ions, with relevant results

examples of the points made in the response

extra information

Test: add (platinum / nichrome) wire (for the flame test)

accept any method of introducing the solution into the flame, eg a splint soaked in the solution or sprayed from a bottle

Result: the sodium compounds result in a yellow / orange / gold flame **or** the potassium compound results in a lilac / purple / mauve flame

student could state that potassium carbonate gives a different colour to the three sodium compounds as long as it is clear that the flame test colour comes from Na^+ or K^+

Test: add dilute nitric acid to all four solutions

allow any acid

Result: sodium carbonate and potassium carbonate will effervesce **or** sodium chloride and sodium iodide will not effervesce

Test: add dilute nitric acid followed by silver nitrate

Result: sodium chloride and sodium iodide produce a precipitate **or** sodium chloride produces a white precipitate and sodium iodide produces a yellow precipitate

accept sodium carbonate and potassium carbonate do not produce a precipitate

[6]