



New Document 1

Name: _____

Class: _____

Date: _____

Time: **38 minutes**

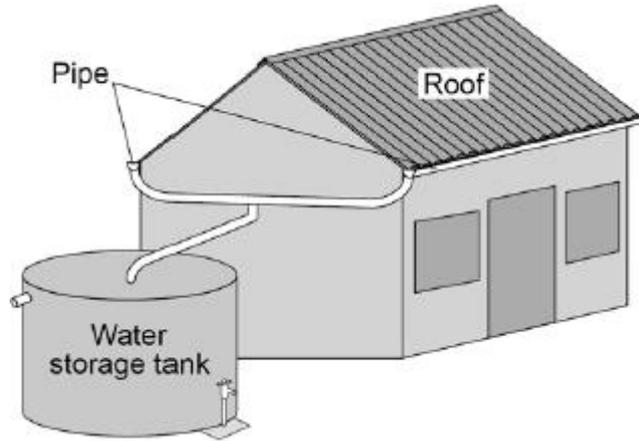
Marks: **38 marks**

Comments:

Q1.

Rainwater is collected from the roofs of houses as shown in **Figure 1**.

Figure 1



- (a) The water in the storage tank is **not** potable.

What does potable mean?

Tick **one** box.

- | | |
|-------------------------------|--------------------------|
| Contains dissolved substances | <input type="checkbox"/> |
| Pure | <input type="checkbox"/> |
| Safe to drink | <input type="checkbox"/> |
| Tastes nice | <input type="checkbox"/> |

(1)

- (b) Why should the water in the tank be filtered to make it potable?

Tick **one** box.

- | | |
|------------------------------|--------------------------|
| To kill microbes | <input type="checkbox"/> |
| To remove dissolved gases | <input type="checkbox"/> |
| To remove dissolved solids | <input type="checkbox"/> |
| To remove undissolved solids | <input type="checkbox"/> |

(1)

(c) A gas which bleaches litmus paper can be added to the water to make it potable.

Name this gas and explain why it is added.

(2)

(d) The storage tank is made from concrete reinforced with steel wire, as shown in **Figure 2**.

Figure 2.

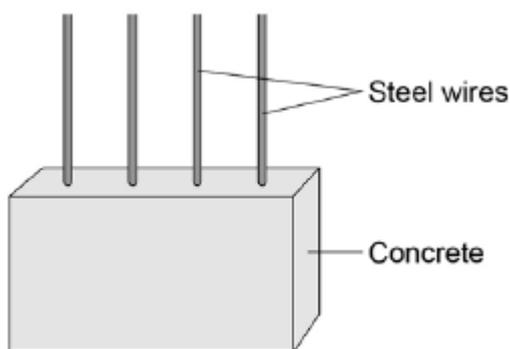
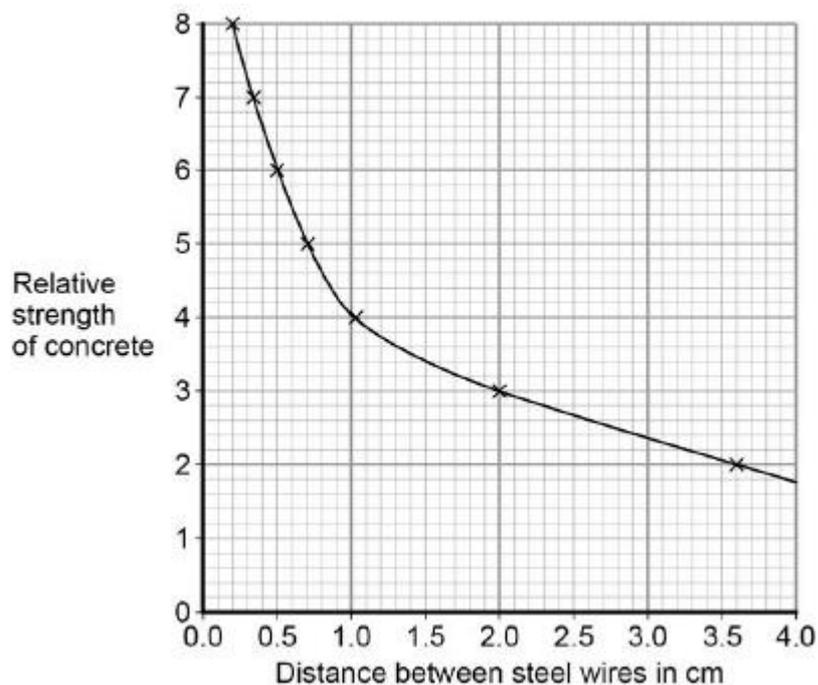


Figure 3 shows how the distance between the steel wires affects the relative strength of the concrete.

Figure 3

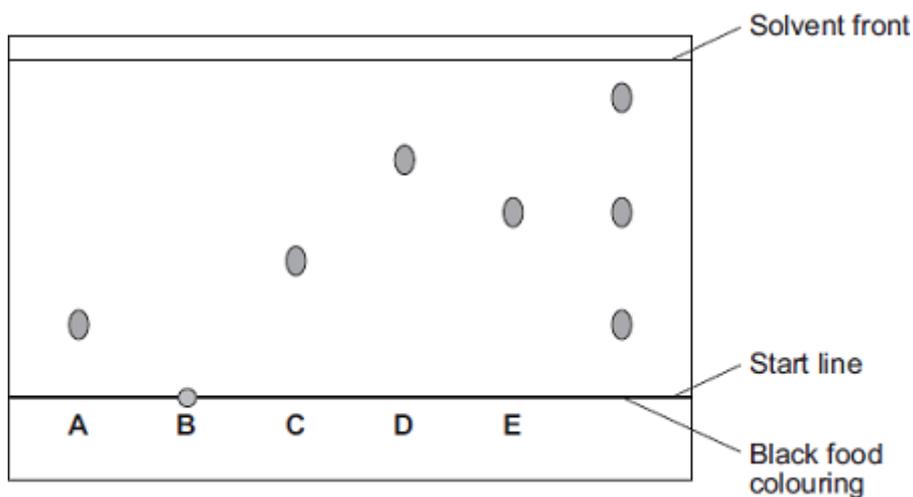


Use values from **Figure 3** to describe the relationship shown by the graph.

(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)

Q3.

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.

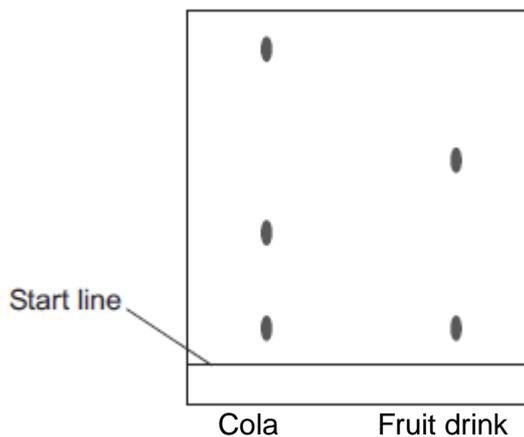
(1)

(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)

Q4.

This is part of an article about food additives.

<p>THE PERIL OF FOOD ADDITIVES</p> <p>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.</p>

(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?

(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.

(2)
(Total 9 marks)

Mark schemes

Q1.

- (a) Safe to drink 1
- (b) To remove undissolved solids 1
- (c) the gas is chlorine / Cl₂ 1
- which sterilises water 1
- (d) as distance between steel increases strength of concrete decreases 1
- change above and change below 1.0 cm separation is compared and described
must refer to graph values for this mark 1

[6]

Q2.

- (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]

Q3.

(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]

Q4.

(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]