

**M1.(a)** water level above the start line  
**and**  
start line drawn in ink  
*allow water level too high* 1

*water level*  
food colours would dissolve into water  
**or**  
*start line*  
the ink would 'run' on the paper 1

(b) (distance moved by **A**) 2.8cm **and** 8.2 cm (distance moved by solvent)  
*allow values in range 2.7 – 2.9 cm and 8.1 – 8.3 cm* 1

$\frac{2.8}{8.2}$  1

0.34  
*allow 0.33 or 0.35*  
*allow ecf from incorrect measurement to final answer for 2 marks*  
*if given to 2 significant figures*  
*accept 0.34 without working shown for 3 marks* 1

(c) 6.6 cm  
*allow values between 6.48 and 6.64 cm* 1

(d) solvent moves through paper 1

different dyes have different solubilities in solvent

1

and different attractions for the paper

1

and so are carried different distances

1

(e) calcium ions

*allow  $\text{Ca}^{2+}$*

1

sodium ions

*allow  $\text{Na}^+$*

1

(f) two different colours

**or**

$\text{Ca}^{2+}$  / one is orange-red and  $\text{Na}^+$  / the other is yellow

*allow brick red for  $\text{Ca}^{2+}$  and / or orange for  $\text{Na}^+$*

*allow incorrect colours if consistent with answer to 7.5*

1

(so) colours mix

**or**

(so) one colour masks the other

1

(g) (Student **A** was incorrect)

because sodium compounds are white not green

**or**

because sodium carbonate is soluble

1

so can't contain sodium ions

1

(Student **B** was incorrect)

because adding acid to carbonate produces carbon dioxide

1

so must contain carbonate not chloride ions

1

[18]

**M2.(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]