

M1.(a) filtration  
or  
by passing through filter beds to remove solids 1

sterilisation to kill microbes  
*allow chlorine / ozone allow ultraviolet light* 1

(b) water needs more / different processes 1

because it contains any **two** from:  
• more organic matter  
• more microbes  
• toxic chemicals or detergents 2

(c) *(as part of glassware attached to bung)*  
salt solution in (conical) flask  
*allow suitable alternative equipment, eg boiling tube* 1

*(at end of delivery tube)*  
pure water in test tube which must not be sealed  
*allow suitable alternative equipment, eg, beaker, condenser* 1

heat source (to heat container holding salt solution) 1

*if no other mark obtained allow for 1 mark suitable equipment drawn as part of glassware attached to bung **and** at end of delivery tube*

(d) determine boiling point

1

should be at a fixed temperature 100°C

*allow should be 100°C*

*allow if impure will boil at a temperature over 100°C*

1

(e) high energy requirement

1

[11]

**M2.(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]

M3.(a) (i) (phosphoric) acid

*allow phosphoric*

1

(ii) H<sup>+</sup> / 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<sub>f</sub> 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]

**M4.** (a) (i) prevent evaporation of solvent  
*allow prevent loss of solvent*  
*allow to support the (chromatography) paper* 1

(ii) ink dissolves in the solvent  
*allow ink 'runs' / spreads or pencil does not 'run' / spread*  
*allow ink would affect the result / mixes with colours*

**or**

carbon / graphite does not dissolve in the solvent  
*accept pencil for carbon / graphite* 1

(b) (i) 4 1

(ii) *no mark for 'no / don't know',*

*ignore numbers*

any **one** from:

- because not all colours match
  - not all colours are safe
  - some colours could be unsafe
  - some colours travelled higher (than safe colours)
- 1

(c) (i) any **two** from:  
*ignore reliable / precise*

- rapid / quick
- accurate

- sensitive **or** detects very small quantities  
*accept small sample*

2

(ii) separates

1

(iii) identifies solvents / compounds / substances

*accept (relative) molecular mass*

*accept formula mass*

*accept  $M_r$*

*accept relative mass*

*accept molecular ion peak*

1

[8]



**M5.** (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]

<b>M6.</b>	use of solvent / solution / water / any named solvent	1
	separates / carries colour(s) / dye(s) <i>allow any idea of movement</i> <i>eg runs / moves</i>	1
	match against Rf value / known chromatogram / similar pattern <b>or</b> comparison to permitted additive / colour <i>removal of coloured additive from salmon does not gain any marks</i> <i>ignore reasons for separation</i> <i>maximum 2 if technique clearly doesn't work</i>	1

[3]

**M7.** (a) check if safe to eat / healthy

**or**

permitted

*accept references to allergies / medical problems*

1

(b) any **three** from:

*accept dye for colour*

- made up of two colours / dots
- contains an unknown colour / dot
- contains a harmful colour
- contains E104 / quinoline yellow  
**or** does not contain E133 / brilliant blue
- further analysis needed

3

(c) ignore No or Yes but No must be implied

there could be other additives (in the sweets)

*accept any other type of additives but **not** colourings*

1

could still contain / use / add natural colours

*accept non-artificial for natural*

**or**

*named natural colours*

1

[6]