

Mark schemes

Q1.

- (a) **Level 3:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced. 5-6

Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced. 3-4

Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear. 1-2

No relevant content 0

Indicative content**Method**

- draw (pencil) start line on (chromatography) paper
- place spot of food colouring on start line
- use of suitable solvent
- place solvent in beaker / container
- place (chromatography) paper in beaker / container
- so (chromatography) paper is in solvent
- but solvent is below start line
- use a lid
- wait for solvent to travel up the (chromatography) paper (until near top)
- mark solvent front
- dry the (chromatography) paper

Measurements

- measure distance between start line and centre of spot
- measure distance between start line and solvent front
- use of measurements to determine R_f value

- (b) different solvent used 1

- (c) paper 1

[8]

Q2.

- (a) $\frac{2.7}{9.0}$ 1

$$= 0.3$$

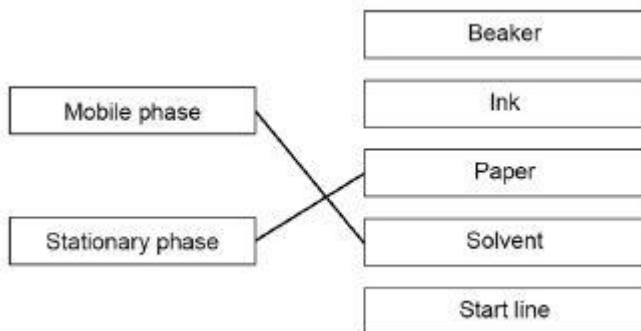
ignore units

(b) **C and D**

1

1

(c)



1

additional line from a box on the left negates the mark for that box

1

(d) 17 : 3

1

(e) formulation

1

(f) the R_f value would stay the same

1

[8]

Q3.

(a) $0.60 = \frac{5.7}{\text{distance moved by solvent}}$

1

(distance moved by solvent =) $\frac{5.7}{0.60}$

1

= 9.5 (cm)

1

(b) some of the compounds are colourless (in solution)

or

dyes / compounds have the same R_f values

allow there are only two compounds that are coloured (in solution)

1

- (c) allow the solvent front to travel further 1
 use a different solvent 1
- (d) so that the (shade of) green is the same
allow because the green ink is a formulation 1
- (e) the dye is less soluble in the new solvent and more attracted to the new paper 1
- [8]**

Q4.

- (a) crush the flower 1
 use more flowers 1
- (b) the start line is drawn in ink 1
 uses water as the solvent 1
- (c) flower A contains a single pure colour 1
 the colour in flower C is a mixture 1
- (d) $\frac{7.2}{9.0}$ 1
 = 0.8 1
*an answer of 0.8 scores 2 marks
 ignore units*
- [8]**

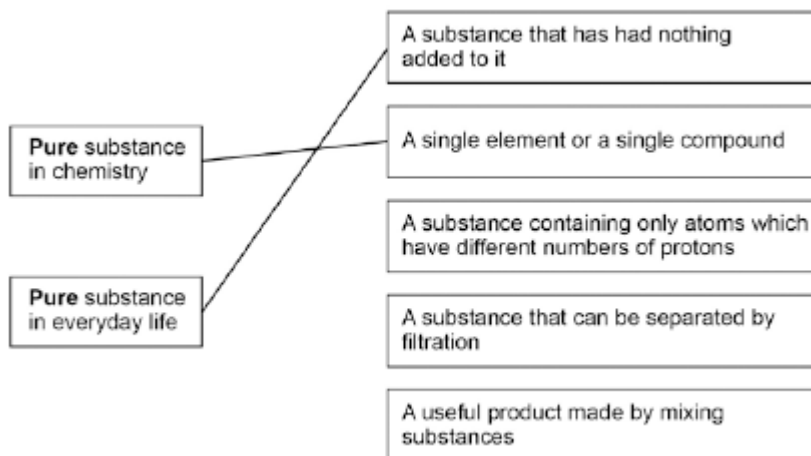
Q5.

- (a) start line drawn in ink
allow start line should have been drawn in pencil 1
- (so) ink dissolves
(as) pencil does not dissolve

- or**
ink runs in solvent / water
or
pencil does not run in solvent / water 1
- water used (as solvent)
allow ethanol not used
- or**
water in beaker 1
- (so) colours will not dissolve / move 1
- (b) any **two** from:
- the flowers have no colours in common
allow the flowers are not the same colour
 - A / B contain one colour
 - C contains two colours
allow C is a mixture of colours
 - (the colour in) B is most soluble
allow (the colour in) B has the highest R_f value
allow one of the colours in C is the least soluble 2
- (c) (distance moved) = $\frac{3.2}{0.65}$ 1
- (distance moved) = 4.9 (cm)
allow 4.923076923 (cm) correctly rounded 1
an answer of 4.9 (cm) scores 2 marks
- [8]**

Q6.

- (a) Air 2
- Steel 1
- (b)



Allow 1 mark for the correct meanings linked to context but incorrect way around

- | | | |
|-----|-------------------------------|------------|
| | | 1 |
| (c) | Damp litmus paper turns white | 1 |
| (d) | Iron(III) | 1 |
| | | [6] |

Q7.

- | | | |
|-----|--|---|
| (a) | The start line was drawn in ink | 1 |
| | The water level was above the spots | 1 |
| (b) | 3 | 1 |
| (c) | A | 1 |
| (d) | <i>(distance moved by dye A) 38 (mm)</i>
<i>allow values in range 36-40</i> | 1 |
| | <i>(distance from start line to solvent front)</i>
102 (mm)
<i>allow values in range 101-103</i> | 1 |
| | $\frac{38}{102}$
<i>allow ecf from Table 1</i> | 1 |
| | 0.37254 ...
<i>allow values in range 0.35 – 0.39</i> | |

1

0.37

1

accept 0.37 with no working shown for 5 marks

[9]

Q8.

- (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 Ca²⁺

- 1
- sodium ions
allow Na⁺
- 1
- (f) two different colours
or
Ca²⁺ / one is orange-red and Na⁺ / the other is yellow
allow brick red for Ca²⁺ and / or orange for 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]**