Mark schemes

Q1.

(a) flame emission spectroscopy

1

flame test

1

(b) white

1

(c) barium chloride (solution)

1

(d) (conversion)

(800 cm^3 = $\frac{800}{1000}$ =) 0.8

1

(dm^3)

allow correct use of incorrect / no volume conversion

1

(mass =) 0.8 × 258 (g)

1

= 206.4 (g)

= 206 (g)

allow an answer correctly calculated to 3 significant figures from an incorrect calculation which uses the values in the question

1

alternative approach:
(conversion)

(258 g/dm^3 = $\frac{258}{1000}$=) 0.258 (g/cm^3) (1)

(mass =) 0.258 × 800 (g) (1)

allow correct use of incorrect / no concentration conversion

= 206.4 (g) (1)

= 206 (g) (1)

allow an answer correctly calculated to 3 significant figures from an incorrect calculation which uses the values in the question

[8]

Q2.

(a) flame test

allow description of flame test

1

lilac (flame)

1

(b) flame emission spectroscopy

1

(c) white precipitate

ignore precipitate dissolves

1

(d) (add) excess sodium hydroxide (solution)

allow (add) more sodium hydroxide (solution)

1

precipitate dissolves

1

(e) add barium chloride (solution)

allow add barium nitrate (solution)

1

add (dilute) hydrochloric acid

allow add (dilute) nitric acid

1

white precipitate

dependent on MP1 being awarded

1

[9]

Q3.

(a) green

allow blue-green

1

(b) did not clean the metal wire (between tests)
or
copper sulfate (solution) is still present

1

(so) colours are mixed / blended / masked

1

(c) (copper sulfate solution) blue precipitate

allow blue solid

1

(calcium iodide solution) white precipitate

allow white solid

1

(d) barium chloride (solution)

allow barium nitrate (solution)

1

(e) silver nitrate (solution)

1

yellow precipitate

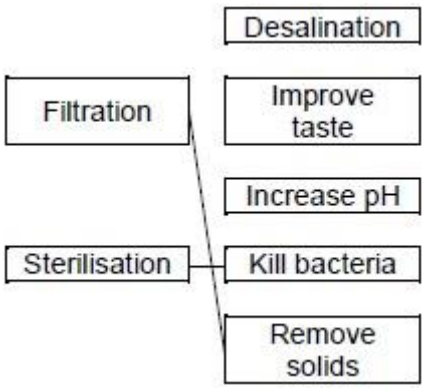
allow yellow solid
allow pale yellow precipitate / solid

1

[8]

Q4.

(a)



an extra line from a step to a reason for that step negates that mark

2

(b) chlorine

1

ozone

1

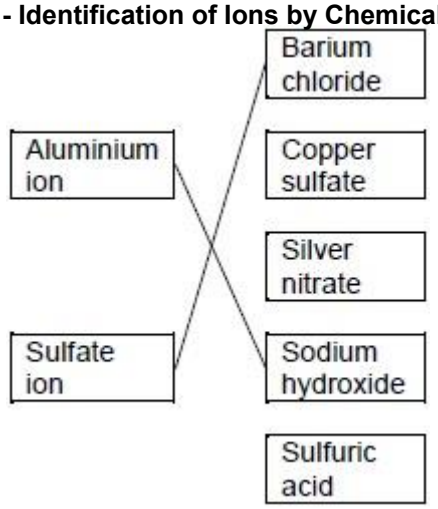
(c) evaporate all water from the sample

1

measure the sample's boiling point

1

(d)



an extra line from an ion to a compound needed negates that mark

2

(e) distillation

1

[9]

Q5.

(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

lithium:
- crush tablets or dissolve tablet (in water or acid)
- clean wire
- place on wire
- place in (roaring / blue / non-luminous) flame
- observe flame colour
- crimson flame

carbonate:
- add hydrochloric acid
- effervescence / fizzing
- bubble gas through limewater
- limewater becomes cloudy

(b) formulation(s)

1

(c)

*an answer of 58.3333333 (%) correctly rounded to at least 2 significant figures scores **3** marks*

1.20 g = 1200 mg
or
700 mg = 0.700 g

1

$\frac{700}{1200} \times 100$ **or** $\frac{0.700}{1.20} \times 100$

allow correct use of incorrectly or not converted values from step1

1

= 58.3 (%)

allow 58.3333333 (%) correctly rounded to at least 2 significant figures

1

[10]

Q6.

(a) add sodium hydroxide (solution to water sample)

1

white precipitate (forms)

dependent on correct test in MP1

1

(precipitate which is) soluble in excess (NaOH)

dependent on correct test in MP1

1

(b) add barium chloride (solution) **and** (dilute) hydrochloric acid (to water sample)

allow barium nitrate (solution)
allow (dilute) nitric acid

1

white precipitate (forms)

dependent on addition of barium chloride / nitrate (solution) in MP1

1

(c) **Level 2**: The design/plan would lead to the production of a valid outcome. All key steps are identified and 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

- weigh (evaporating) basin / dish
- add measured volume of water
- weigh (evaporating) basin / dish and water
- heat to evaporate water

- reweigh
- repeat heating until constant mass obtained
- subtract mass of (evaporating) basin / dish from mass
- repeat and calculate a mean, discarding anomalous results
- calculate the mass in 100 cm^3 water if necessary

[9]

Q7.

(a) yellow

allow orange
allow orange-yellow

1

(b) copper (ion)

allow Cu^{2+}
allow copper (II)
allow barium (ion)
allow Ba^{2+}

1

(c) (flame) colours are masked

allow (flame) colours mix / blend
allow only see one colour
allow cannot see two colours at once
ignore hard to distinguish

1

(d) Li^+

1

Na^+

1

(e) bromide (ion)

allow Br^-
ignore bromine

1

(f) add barium chloride (solution)

allow barium nitrate (solution)

1

add hydrochloric acid

allow nitric acid
allow acidified
*do **not** accept sulfuric acid*

1

white precipitate produced

dependent on use of a barium compound

1

[9]

Q8.

(a) $\frac{125}{8}$

1

= 15.6(25) (g)

1

*an answer of 15.6(25) (g) scores **2** marks*

(b) copper (ions)

allow in either order

1

sulfate (ions)

1

(c) flame test

1

yellow (flame)

1

(d) add dilute acid

allow named acid

1

(bubble gas produced through) limewater

1

(turns) cloudy / milky

allow forms white precipitate

1

[9]

Q9.

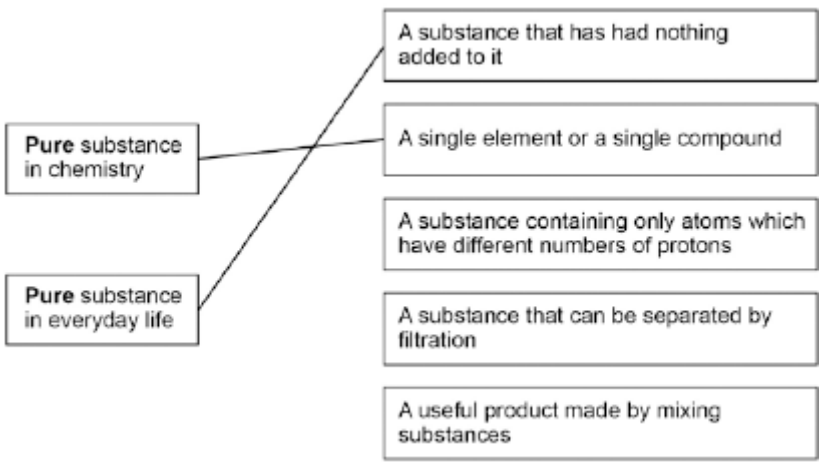
(a) Air

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]

Q10.

(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 Ca^{2+}

1

sodium ions

allow Na^+

1

(f) two different colours
or
Ca^{2+} / one is orange-red and Na^+ / the other is yellow

allow brick red for Ca^{2+} 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]

Q11.

(a) (i) fizz / effervescence / bubbles

allow calcium carbonate decreases in size or dissolves

1

because carbon dioxide produced / released

allow because gas produced / released

1

limewater turns cloudy / milky / white

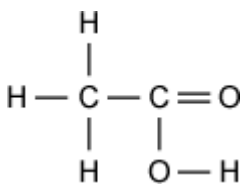
1

because (a precipitate of or solid) calcium carbonate forms

allow because of carbon dioxide if not already credited

1

(ii)



allow -OH

do not allow lower case 'h'

1

(iii) acid

must be in this order

ignore any name of an acid

1

ester(s)

1

(b) white (precipitate) no change

no change no change

all four correct 2 marks

any two correct 1 mark

2

(c) (i) lilac

allow purple

1

red

1

must be in this order

(ii) colours are masked / changed by each flame colour

1

[12]