1.

(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]

2. (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]

3. (a) copper (II) → blue

iron (III) → brown

more than one line from any box negates the mark

1
1

(b) aluminium

allow correct answer shown in box if answer line blank

1

(c) (i) yellow

allow orange **1**

(ii) lilac

allow purple

1

(iii) one colour masks the other

allow colours mixed

1

[6]

4. (a) **X:**

Fe^{2+} / iron(II), SO_4^{2-} / sulfate

allow iron(II) sulfate
or *$FeSO_4$*

1

Y:

Na^+ / sodium, I^- / iodide

allow sodium iodide
or *NaI*

1

Z:

Fe^{3+} / iron(III), Br^- / bromide

allow iron(III) bromide
or *$FeBr_3$*

correct identification of any two ions = one mark

correct identification of any four ions = two marks

1

(b) any **five** from:

allow converse arguments

method 1

- weighing is accurate
- not all barium sulfate may be precipitated
- precipitate may be lost
- precipitate may not be dry
- takes longer
- requires energy

allow not all the barium hydroxide has reacted

method 2

- accurate
- works for low concentrations

allow reliable / precise

5

[8]

5. (a) (i) ionic (bonding) **1**

(ii) ions cannot move in solid **or** are in fixed positions

*do **not** accept electrons / atoms / molecules*

ignore particles

***must** mention ions*

1

but can move in solution

1

(b) silver chloride formed

1

which is insoluble

1

(c) (i) aluminium

1

calcium

accept other metal ions that also give white precipitates (such as lead and zinc)

1

(ii) add excess sodium hydroxide solution

the second mark of each pair is dependent on the first mark being awarded.

1

precipitate remains

1

carry out a flame test

1

not red / orange

accept any colour that is not orange / red

*give full credit for answers that correctly eliminate other cations in **(c)(i)** that would give white precipitates with a few drops of NaOH*

1

[11]

6. Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks
No relevant content

Level 1 (1 – 2 marks)
Any description of a method used and / or a result given

Level 2 (3 – 4 marks)
Description of workable methods used, with results to identify positive **or** negative ions

Level 3 (5 – 6 marks)
Description of methods used to identify both positive **and** negative ions, with relevant results

examples of the points made in the response

extra information

Test: add (platinum / nichrome) wire (for the flame test)

accept any method of introducing the solution into the flame, eg a splint soaked in the solution or sprayed from a bottle

Result: the sodium compounds result in a yellow / orange / gold flame **or** the potassium compound results in a lilac / purple / mauve flame

student could state that potassium carbonate gives a different colour to the three sodium compounds as long as it is clear that the flame test colour comes from Na^+ or K^+

Test: add dilute nitric acid to all four solutions

allow any acid

Result: sodium carbonate and potassium carbonate will effervesce **or** sodium chloride and sodium iodide will not effervesce

Test: add dilute nitric acid followed by silver nitrate

Result: sodium chloride and sodium iodide produce a precipitate **or** sodium chloride produces a white precipitate and sodium iodide produces a yellow precipitate

accept sodium carbonate and potassium carbonate do not produce a precipitate

[6]

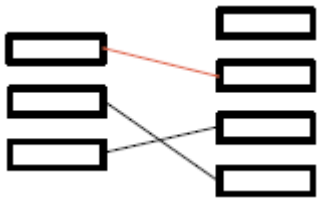
7. (a) (i) *method of introducing sample into flame*
e.g. wire / splint / spray

1

clean wire or colourless flame
allow blue / roaring flame

1

(ii)



1
1

(iii) (potassium) chloride
allow KCl ***or*** *Cl^-*

1

(b) (i) copper
allow Cu^{2+}

1

(ii) sulfate

1

[7]

8. (a) (i) Na_2CO_3: HCl → gas / effervescence / bubbles (1)
CO_2 / carbon dioxide / turns lime water milky (1)

1

NaCl: $AgNO_3$ → white ppt (1)
silver chloride (1)

1

$NaNO_3$: Al + NaOH → pungent / sharp smell / choking gas (1)
NH_3 / ammonia / turns (red) litmus blue(1)

1

Na_2SO_4: $BaCl_2$ → white ppt (1)
barium sulfate (1)

1

each correct test and one result = ***1*** *mark*
one *other result for any test =* ***1*** *mark this mark can only be awarded once*

(ii) all would give a yellow / yellow-orange (flame) / same coloured (flame) / same results

allow orange (flame) 1

or

they all contain sodium

1

(b) any **two** from:

ignore cost/errors

- fast / quick or comment about speed

  allow precise

- small amounts/sensitive

  allow can be left to run/continuous analysis

- accurate

- ease of automation

  accept operators do not need chemical skills

- sample not used up

- reliable / efficient

2

[7]