M1. (a) (i) **M1** (yellow precipitate is) silver iodide OR AgI (which may be awarded from the equation)

M2 $Ag^+ + I^- \longrightarrow AgI$ (Also scores M1 unless contradicted)

M3 sodium chloride OR NaCl

For M2

Accept multiples

Ignore state symbols

Allow crossed out nitrate ions, but penalise if not crossed out

3

(ii) The silver nitrate is acidified to

- react with / remove <u>ions that would interfere</u> with the test
- prevent the formation of other <u>silver precipitates / insoluble</u> <u>silver compounds</u> that would interfere with the test
- remove (other) <u>ions that react</u> with the silver nitrate
- react with / remove carbonate / hydroxide / sulfite (ions)

Ignore reference to ''false positive''

1

(iii) **M1 and M2 in either order**

M1 <u>Fluoride</u> (ion) OR <u>F^-</u>

M2 • <u>Silver fluoride / AgF</u> is soluble / dissolves (in water)

• <u>no precipitate</u> would form / <u>no visible /observable</u> change

Do not penalise the spelling ''fluoride'',

Penalise "fluride" once only

Mark M1 and M2 independently

2

(b) **M1** $Ba^{2+} + SO_4^{2-} \longrightarrow BaSO_4$

(or the ions together)

M2 <u>white precipitate / white solid / white suspension</u>

M3 Barium meal or (internal) X-ray or to block X-rays

M4 $\underline{BaSO_4}$ / barium sulfate is insoluble (and therefore not toxic)

For M1, ignore state symbols

Allow crossed out sodium ions, but penalise if not crossed out

For M2, ignore ''milky''

If $BaSO_3$ OR BaS used in M1 and M4, penalise once only

For M3 Ignore radio-tracing

For M4 NOT barium ions

NOT barium

NOT barium meal

NOT ''It'' unless clearly $BaSO_4$

4

(c) **M1** **2**(12.00000) + **4**(1.00794) = 28.03176

M2 Ethene and CO or "they" have an imprecise **M**$_r$ of 28.0 / 28

OR

Ethene and CO or "they" have the same M_r to one d.p.

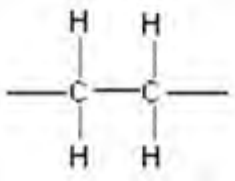
OR

These may be shown by two clear, simple sums identifying both compounds

M3 C_2H_4 + **2**O_2 ⟶ **2**CO + **2**H_2O

($H_2C{=}CH_2$)

M4 Displayed formula



M5 Type of polymer = Addition (polymer)

M1 must show working using 5 d.p.for hydrogen

Penalise ''similar'' or ''close to'', if this refers to the <u>imprecise value in M2</u>, since this does not mean ''the same''

For M3, accept CH_2=CH_2 OR CH_2CH_2

For M4, <u>all bonds</u> must be drawn out including those on either side of the unit.

Penalise ''sticks''

*Ignore brackets around **correct** repeating unit but penalise ''n''*

Penalise ''additional''

5

[15]

M2. (a) Cross between the Na cross and the Mg cross

1

(b) $Al(g) \rightarrow Al^{+}(g) + e-$

$Al(g) - e- \rightarrow Al^{+}(g)$

$Al(g) + e- \rightarrow Al^{+}(g) + 2e-$

One mark for state symbols consequential on getting equation correct.

Electron does not have to have the – sign on it

Ignore (g) if put as state symbol with e^- but penalise state symbol mark if other state symbols on e^-

2

(c) 2nd/second/2/II

Only

1

(d) Paired electrons <u>in (3)p orbital</u>

Penalise wrong number

If paired electrons repel allow M2

1

repel

1

(e) Neon/Ne

No consequential marking from wrong element

1

$1s^2 2s^2 2p^6$/[He}$2s^2 2p^6$

Allow capital s and p
Allow subscript numbers

1

(f) Decreases

CE if wrong

1

Atomic radius increases/electron removed further from nucleus or nuclear charge/electron in higher energy level/Atoms get larger/more shells

Accept more repulsion between more electrons for M2
Mark is for distance from nucleus
Must be comparative answers from M2 and M3
CE M2 and M3 if mention molecules
Not more sub-shells

1

As group is descended more shielding

1

[11]

M3.(a) Remove undissolved barium hydroxide / <u>excess</u> solid

Do not accept 'remove impurities'.

1

(b) Filtration

Do not accept 'decanting' or 'sieving'.
Ignore references to heating or drying.

1

(c) Remove (excess) sulfuric acid

1

(d) $Ba(OH)_2 + H_2SO_4 \rightarrow BaSO_4 + 2H_2O$

Accept multiples.

Accept $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$

Ignore state symbols.

1

(e) (i) 233.4

Accept 233

1

(ii) 0.018(2)

Do not penalise additional significant figures, but do not allow 0.02

Allow consequential answer from (i).

1

(iii) 0.018(2) ×171.3 = 3.12

Do not penalise precision.

If 0.018 used, answer = 3.08

1

×10 = 31.2

Do not penalise precision.

Allow this mark if 0.18(2) used directly.

Correct answer without working scores one mark only.

Allow consequential answer on (ii)

1

(f) Barium sulfate / it is insoluble

Do not accept answers based on small amount ingested.

Do not accept barium.

1

[9]

M4.(a) Hydrochloric acid = **C**

1

Barium chloride = **A**

1

(b) Barium sulfate is insoluble

1

$CuSO_4 + BaCl_2 \rightarrow BaSO_4 + CuCl_2$

Accept multiples.

Accept ionic equation.

Do not penalise lack of state symbols, but if used they must be correct.

1

(c) CO_2 / Carbon dioxide

1

(d) Reagent 1 silver nitrate (solution)

Ignore lack of reference to acidifying prior to addition of silver nitrate solution.

1

Observation 1 White precipitate

1

Reagent 2 (dilute) ammonia solution / aqueous ammonia

*Do not accept addition of **ammonia** only.*

1

Observation 2 (Colourless) solution

Allow ppt dissolves.

Do not allow 'goes colourless' or 'goes clear'.

Chlorine and no visible change or solution does not become orange scores M3 and M4.

1

(e) Gloves / wash hands after use

Ignore 'eye protection'.

Do not accept 'do not ingest the chemicals', 'wipe up spillages', 'use a fume cupboard', 'wear a lab coat' (list principle).

1

[10]

M5.(a) (i) Blue to green

Accept blue to yellow.

1

(ii) Decrease / less acid needed

Ignore references to rate

1

(iii) Gloves **or** avoid skin contact

Allow 'if reagent contacts skin wash off (immediately)' or answers to that effect.

Do not accept 'wash' only.

Ignore 'eye protection' or 'lab coat' or 'use of fume cupboard' or 'don't ingest'.

1

(iv) Less chance of losing liquid on swirling / liquid doesn't splash on swirling

Do not accept 'easier to swirl' on its own.

Do not accept 'easier to stir'.

1

(v) Idea that a single titration could be flawed / anomalous

Allow an indication that the first titration is a rough titration.

Do not allow 'to improve accuracy' without qualification.

Do not allow vague references to 'outliers'.

1

(b) (i) $2.3(3) \times 10^{-2}$

Do not penalise additional significant figures, but do not allow 0.02

1

(ii) Dilution of acid needed / may react with carbon dioxide in air

Accept 'poor end-point' or 'no suitable indicator' or 'a large volume (of calcium hydroxide) will be needed'.

Ignore references to low solubility or concentration too low.

1

[7]