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.

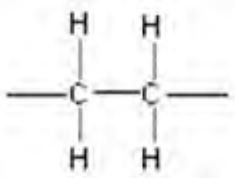
OR

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

M3 $C_2H_4 + \mathbf{2}O_2 \longrightarrow \mathbf{2}CO + \mathbf{2}H_2O$

($H_2C{=}CH_2$)

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) GLC or distillation

1

(b) C=O

1

(c) (i) Cl has two isotopes

1

(ii) $CH_3\overset{+}{C}=O$

1

$C_4H_7ClO^{+\cdot} \rightarrow CH_3\overset{+}{C}=O + C_2H_4Cl^{\cdot}$

1

(d) (i) e.g. $CDCl_3$ or CCl_4

1

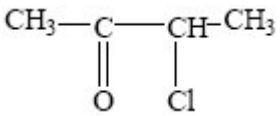
(ii) $Si(CH_3)_4$

1

(e) 0 and 3

1

(f)



1

(g) $CH_3CH_2CH_2COCl$ or $(CH_3)_2CHCOCl$

1

[10]

M3. (a) Functional group (isomerism)

1

(b)

M1 Tollens' (reagent) (*Credit ammoniacal silver nitrate* **OR** *a description of making Tollens'*) (*Ignore either $AgNO_3$ or $[Ag(NH_3)_2^+]$ or "the silver mirror test" on their own, but mark M2 and M3*)	**M1** Fehling's (solution) or Benedict's solution (*Ignore $Cu^{2+}(aq)$ or $CuSO_4$ on their own, but mark on to M2 and M3*)
M2 silver mirror **OR** black solid/precipitate *(NOT silver precipitate)*	**M2** Red solid/precipitate (*Credit orange or brown solid*)
M3 (stays) colourless or no change or no reaction	**M3** (stays) blue or no change or no reaction

Mark on from an incomplete/incorrect attempt at the correct reagent, penalising M1

No reagent, CE=0

Allow the following alternatives
M1 *(acidified) potassium dichromate(VI) (solution)*
M2 *(turns) green*
M3 *(stays) orange/no change*
OR
M1 *(acidified) potassium manganate(VII) (solution)*
M2 *(turns) colourless*
M3 *(stays) purple/no change*

For M3
Ignore "nothing (happens)"
Ignore "no observation"

3

(c) (Both have) C=O ***OR*** a carbonyl (group)

1

(d) (i) (Free-) radical substitution ONLY

Penalise "(free) radical mechanism"

1

(ii) **Initiation**

$Cl_2 \rightarrow 2Cl\bullet$

Penalise absence of dot once only.

First propagation

$Cl\bullet + CH_3CH_2CH_3 \rightarrow \bullet CH_2CH_2CH_3 + HCl$

OR C_3H_8

Penalise incorrect position of dot on propyl radical once only.

Penalise $C_3H_7\bullet$ once only

Second propagation

$Cl_2 + \bullet CH_2CH_2CH_3 \rightarrow CH_3CH_2CH_2Cl + Cl\bullet$

OR

C_3H_7Cl

Accept $CH_3CH_2CH_2\bullet$ with the radical dot above/below/to the side of the last carbon.

Termination (must make C_6H_{14})

$2 \bullet CH_2CH_2CH_3 \rightarrow C_6H_{14}$ or $CH_3CH_2CH_2CH_2CH_2CH_3$

Use of the secondary free radical might gain 3 of the four marks

4

(e) M_r = 44.06352 (for propane)

M_r = 43.98982 (for carbon dioxide)

Mark independently

M1 a correct value for both of these M_r values.

M2 a statement or idea that two peaks appear (in the mass spectrum)

OR

two molecular ions are seen (in the mass spectrum).

2

[12]