

- M1.(a)** (i) Green
Ignore shades of green. 1
- (ii) Excess acidified potassium dichromate(VI) 1
- Reflux (for some time) 1
- In the diagram credit should be given for
- a vertical condenser
Lose M3 and M4 for a distillation apparatus. 1
 - an apparatus which would clearly work
*Do not allow this mark for a flask drawn on its own.
Penalise diagrams where the apparatus is sealed.* 1
- (iii) Distillation 1
- Immediately (the reagents are mixed) 1
- (b) Keep away from naked flames
*Allow heat with water-bath or heating mantle.
If a list is given ignore eye protection, otherwise lose this mark.* 1

(c) (i) Tollens' or Fehling's reagents
Incorrect reagent(s) loses both marks.
Accept mis-spellings if meaning is clear. 1

Silver mirror / red ppt. formed
Accept 'blue to red' but not 'red' alone. 1

(ii) Sodium carbonate (solution) / Group II metal
Allow indicator solutions with appropriate colours.
Accept any named carbonate or hydrogen carbonate. 1

Effervescence / evolves a gas
Accept 'fizzes'. 1

(d) Propanoic acid
If this mark is lost allow one mark if there is reference to stronger intermolecular forces in the named compound.
Lose M1 and M3. 1

Contains hydrogen bonding 1

Some comparison with other compounds explaining that the intermolecular forces are stronger in propanoic acid 1 [15]

M2.D [1]

- M3.** (a) (i) $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$;
(penalise C_2H_6O once only in this question) 1
- (ii) Concentrated H_2SO_4 OR concentrated H_3PO_4 OR Al_2O_3 ;
(penalise aqueous or dilute as a contradiction) 1
- $C_2H_5OH \rightarrow C_2H_4 + H_2O$ OR $C_2H_5OH \rightarrow H_2C = CH_2 + H_2O$;
(penalise CH_2CH_2 and CH_2-CH_2 and CH_2 ; CH_2 for ethene) 1
- (b) Nickel OR Ni OR platinum OR Pt OR palladium OR Pd; 1
- Hydrogen OR H_2 ; 1
- (c) (i) $C_{18}H_{34}O_2$ Only; 1
- $C_9H_{17}O$ Only;
(empirical formula is not consequential on molecular formula) 1
- (ii) (An unsaturated compound) contains (at least) one double bond
OR
Contains $C=C$;
(must be a positive statement) 1
- (iii) M1: Bromine water
OR
 $Br_2(aq)$
OR
Bromine
OR
 Br_2 ;

(penalise "bromide water", but mark on)

1

M1: decolourised or goes colourless

OR

from brown/red/orange/yellow to colourless;

(Must be "colourless" not "clear" for M2)

(chemical error if no reagent or wrong reagent, loses both marks) (credit KMnO_4 for M1, (purple) to colourless for M2 (if acidified) OR (purple) to brown/brown precipitate (if alkaline or unspecified) (No credit for hydrogen or iodine as reagents)

1

[10]

M4. (a) (i)

	The addition of AgNO_3	followed by concentrated	the addition of $\text{NH}_3(\text{aq})$
Observation with $\text{NaBr}(\text{aq})$	Cream or off white precipitate or solid (1)		Precipitate dissolves (1)
Observation with $\text{NaI}(\text{aq})$	Yellow precipitate or solid (1)		Precipitate insoluble or no change (1)

(ii) Ag F is soluble;

5

(b) (i) identity: $[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$;

1

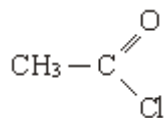
(ii) equation: $\text{AgI} + 2\text{S}_2\text{O}_3^{2-} \rightarrow [\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-} + \text{I}^-$

1

(iii) use: in photography or as a fixer;

1

(c) (i) Structure

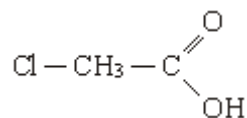


Observation: Vigorous or violent or exothermic reaction
or fumes or white precipitate formed immediately

1

1

(ii) Structure:



Observation: No immediate precipitate or reaction

OR

white precipitate formed very slowly;

1

1

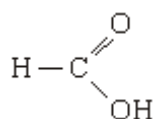
(d) (i) Silver-containing complex: $[\text{Ag}(\text{NH}_3)_2]^+$;

1

Shape: Linear;

1

(ii) Structure



1

Explanation: Methanoic acid contains an aldehyde group;

1

(iii) H_2CO_3 or CO_2 or $\text{OC}(\text{OH})\text{NH}_2$ or $(\text{NH}_2)_2\text{CO}$ or $(\text{NH}_4)_2\text{CO}_3$

OR

HCOONH_4 ;

1

[17]

M5. (a) Functional group (isomerism)

1

(b)

M1 Tollens' (reagent)
(Credit ammoniacal silver nitrate OR a description of making Tollens')
(Ignore either AgNO_3 or $[\text{Ag}(\text{NH}_3)_2]^+$ or "the silver mirror test" on their own, but mark M2 and M3)

M1 Fehling's (solution) or Benedict's solution
(Ignore $\text{Cu}^{2+}(\text{aq})$ or CuSO_4 on their own, but mark on to M2 and M3)

M2 silver mirror

M2 Red solid/precipitate
(Credit orange or brown solid)

OR

black solid/precipitate
(NOT silver precipitate)

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) $\text{C}=\text{O}$ OR a carbonyl (group)

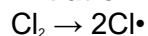
1

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

Penalise "(free) radical mechanism"

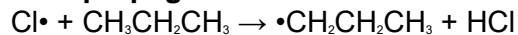
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(ii) **Initiation**



Penalise absence of dot once only.

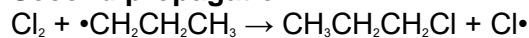
First propagation



Penalise incorrect position of dot on propyl radical once only.

Penalise $\text{C}_3\text{H}_7\cdot$ once only

Second propagation

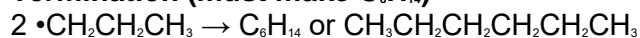


OR



Accept $\text{CH}_3\text{CH}_2\text{CH}_2\cdot$ with the radical dot above/below/to the side of the last carbon.

Termination (must make C_6H_{14})



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

4

- (e) $M_r = \underline{44.06352}$ (for propane)
 $M_r = \underline{43.98982}$ (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]