M1.1-chloropropane no visible change

Accept 'small amount of precipitate' or 'precipitate forms slowly'.

1

ethanoyl chloride white precipitate

Accept 'large amount of precipitate' or 'precipitate forms immediately'.

1

[2]

M2.(a) **For 2 marks at least <u>one correct reference either to M_r</u> or <u>value to 5 decimal places required</u>**

QoL *(associated with the bold statement here)*

M1 Compounds <u>1 and 3</u> (butanal and butanone) have the same M_r (to 5dp) <u>because</u> **either**

It may be possible to award 2 marks if there is a clear statement about oxygen having a different precise A_r in the context of the comparison

- they contain the <u>same</u> number of atoms of the same / each element
- are <u>both</u> C_4H_8O
- have the <u>same molecular formula</u>

  NB The word "similar" does not mean "the same"
- contain the same number of C, H and O atoms

M2 Compound <u>2</u> (pentane) has a different M_r (to 5dp) <u>because</u> **either**

- it has <u>different</u> numbers of atoms of different elements
- is C_5H_{12} / <u>only contains</u> C and H
- <u>different molecular formula</u>
- does not contain oxygen (atom) / C=O

2

(b) **WithTollens' (reagent)**

M1 <u>silver mirror</u>

OR <u>black solid/precipitate</u>

(NOT silver (mirror) precipitate)

M2 (stays) colourless

OR no change / no reaction

OR no silver mirror

With Fehling's (solution)

M1 <u>Red solid/precipitate</u>

(Credit orange or brown <u>solid</u>)

M2 (stays) blue

OR no change / no reaction

OR no red solid

OR no (red) precipitate

<u>N.B No mark is awarded for the reagent</u>

If no reagent given allow 1 mark for a consistent statement of M1 and M2

For M2, ignore "nothing (happens)"

And ignore "no observation"

2

[4]

M3. Test bromine (water) / iodine

Accept 'Br_2' or 'bromine in a named solvent'.

Do not accept 'Br'

Use of UV light, CE (lose next mark as well)

1

Observation orange / yellow / (red-)brown to colourless

Must have correct reagent to score this mark.

For I_2, allow red-brown / purple to colourless.

1

[2]

M4.(a) M1 concentrated sulfuric acid OR c(onc) H_2SO_4

*If no reagent or incorrect reagent in **M1, CE= 0** and no marks for **M2** or **M3***

M2 (cream solid) turns orange
OR orange / red / brown fumes / gas / vapour

*If dilute sulfuric acid **OR** "aq" (alone) **CE=0***

M3 (yellow solid) turns black
OR purple fumes / gas / vapour
OR correct reference to H_2S observation (eg bad egg smell)

*If H_2SO_4 / sulfuric acid given but not stated whether dilute or concentrated, penalise **M1** and mark on for **M2** and **M3***
*If incorrect formula for the acid, penalise **M1** but mark **M2** and **M3***

***OR* as an alternative**

M1 concentrated ammonia ***OR*** c(onc) NH_3

*If NH_3 / ammonia / aq ammonia given, but not stated as concentrated **OR** if dilute ammonia given, penalise **M1** but mark on for **M2** and **M3***
*Ignore "partially" and ignore "clear" in **M2***

M2 (cream solid) dissolves / solution formed

M3 precipitate remains / does not dissolve / insoluble
OR no reaction / no change / (yellow solid) turns to white solid

*If incorrect formula for ammonia, penalise **M1** but mark **M2** and **M3***

*In **M3** for ammonia.*
ignore "nothing (happens)".
ignore "no observation".

3

(b) M1 $AgNO_3$ ***OR*** silver nitrate ***OR*** any soluble silver salt

*If no reagent **OR** incorrect reagent in **M1**, **CE= 0** and no marks for **M2 OR M3***

M2 white precipitate or white solid / white suspension

*An insoluble silver salt OR Tollens' **OR** Ag **OR** ammoniacal silver nitrate or HCl / $AgNO_3$ **CE= 0** for the clip.*

M3 remains colourless ***OR*** no reaction ***OR*** no (observed) change ***OR*** no precipitate

*For **M1***
*Credit acidified (**OR** HNO_3) silver nitrate for **M1** and mark on.*
If silver ions or incorrect formula for silver nitrate, penalise

M1** but mark **M2** and **M3

Credit alternative test for nitrate ions

*For **M2***
*Ignore "cloudy solution" **OR** "suspension".*
*For **M3***
Ignore "nothing (happens)".
Ignore "no observation".
Ignore "clear".
Ignore "dissolves".

3

(c) M1 Br_2 ***OR*** bromine (water) ***OR*** bromine (in CCl_4 / organic solvent)

*If no reagent or incorrect reagent in **M1**, **CE= 0** and no marks for **M2** or **M3***

Either Order

M2 (stays) Orange / red / yellow / brown / the same
OR no reaction ***OR*** no (observed) change
OR reference to colour going to cyclohexane layer

*No credit for combustion observations; **CE=0***
*For **M2 in every case**.*
Ignore "nothing (happens)".
Ignore "no observation".
Ignore "clear".

M3 decolourised / goes colourless / loses its colour

With bromine (water)
***For M1**, it must be a whole reagent and / or correct formula.*
If oxidation state given in name, it must be correct.
For M1** penalise incorrect formula, but mark **M2** and **M3

***OR* as an alternative**

Use $KMnO_4/H_2SO_4$

M1 acidified potassium manganate(VII) or $KMnO_4/H_2SO_4$
OR $KMnO_4/ H^+$ ***OR*** acidified $KMnO_4$
M2 (stays) purple or no reaction or no (observed) change

With potassium manganate(VII)
For M1

M3 purple to colourless solution ***OR*** goes colourless

*If "manganate" or "manganate(IV)" or incorrect formula or no acid, penalise **M1** but mark **M2** and **M3***

Credit alternative test using **iodine** (for **M1**)
M2 (brown) to purple or accept no change, M3 colourless
Credit alternative test using concentrated $H_2 SO_4$
M2 no change, M3 brown

*Credit alkaline / neutral $KMnO_4$ for possible full marks but **M3** gives brown precipitate or solution goes green.*

3

(d) M1 Tollens' (reagent) OR 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)
M2 silver mirror
OR black solid / precipitate (Ignore silver precipitate)
M3 (stays) colourless or no reaction or no (observed) change

*If no reagent or incorrect reagent in **M1**, **CE= 0** and no marks for **M2** or **M3***

For M3 in every case
Ignore "nothing (happens)".
Ignore "no observation".

Alternative using Fehling's (solution)
M1 Fehling's (solution) or Benedict's solution
(Ignore $Cu^{2+}(aq)$ or $CuSO_4$ on their own, but mark M2 and M3)
M2 Red solid / precipitate (Credit Orange or brown solid)
M3 (stays) blue or no reaction or no (observed) change

With potassium dichromate(VI)
For M1
*If "dichromate" or "(potassium) dichromate(IV)" or incorrect formula or no acid, penalise **M1** but mark **M2** and **M3***

Alternative using $K_2Cr_2O_7/H_2SO_4$
M1 acidified potassium dichromate or $K_2Cr_2O_7/H_2SO_4$
OR $K_2Cr_2O_7/H^+$ ***OR*** acidified $K_2Cr_2O_7$
M2 (Orange to) green solution OR goes green
M3 (stays) Orange or no reaction or no (observed) change

*For **M3***
Ignore dichromate described as "yellow" or "red".

With potassium manganate(VII)
For M1
If "manganate" or "(potassium manganate(IV)" or incorrect formula or no acid, penalise M1 but mark M2 and M3

Alternative using $KMnO_4/H_2SO_4$
M1 acidified potassium manganate(VII) or $KMnO_4/H_2SO_4$
OR $KMnO_4/H^+$ ***OR*** acidified $KMnO_4$
M2 purple to colourless solution OR goes colourless
M3 (stays) purple or no reaction or no (observed) change

*Credit alkaline / neutral $KMnO_4$ for possible full marks but **M2** gives brown precipitate or solution goes green.*

3

[12]

M5.(a) **If 2 stage test for one compound, award no marks for that compound, eg no**

mark for ROH or RX to alkene then Br_2 test. If reagent is wrong or missing, no mark for that test; if wrong but close/incomplete, lose reagent mark but can award for correct observation. In each test, penalise each example of wrong chemistry, eg $AgClr_2$

propan-1-ol

acidifiedpotassiumdichromate

sodium

Named acid + conc H_2SO_4

named acyl chloride

PCl_5

M1 **1**

(orange) turns green

effervescence

Sweet smell

Sweet smell /misty fumes

Misty fumes

M2 **1**

propanal

add Tollens or Fehlings / Benedicts

acidifiedpotassiumdichromate

Bradys or 2,4-dnph

if dichromate used for alcohol cannot be used for aldehyde

M3 **1**

Tollens: silver mirror or Fehlings/ Benedicts: red ppt

(orange) turns green

Yellow or orange ppt

M4

1

propanoic acid

Named carbonate/ hydrogencarbonate

water and UI (paper)

Named alcohol + conc H_2SO_4

sodium or magnesium

PCl_5

if sodium used for alcohol cannot be used for acid

M5

1

effervescence

orange/red

Sweet smell

effervescence

Misty fumes

if PCl_5 used for alcohol cannot be used for acid

M6

1

1-chloro propane

NaOH then acidified $AgNO_3$

$AgNO_3$

If acidification missed after NaOH,no mark here but allow mark for observation

M7

1

white ppt

white ppt

M8

1

(b) oxidation (of alcohol by oxygen in air)

M1

1

absorption at 1680 -1750 (due to C=O)

Must refer to the spectrum

M2

1

comparison of polarity of molecules or correct imf statement:propanone is less polar OR propan-2-ol is more polarOR propanone has dipole-dipole forcesOR propan-2-ol has hydrogen bonding

M3

1

about attraction to stationary phase or solubility in moving phasePropan-2-ol has greater affinity for stationary phase or vice versaOR propanone is more soluble in solvent/moving phase or vice versa

M4

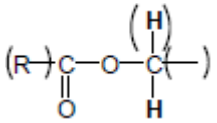
1

[12]

M6.(a) M1 Ester **1**

If Ester 2, can score M3 only.

1

M2 peak at δ = 4.1 due to 

When marking M2 and M3, check any annotation of structures in the stem at the top of the page.

1

M3 (δ = 4.1 peak is) quartet as adjacent / next to / attached to CH_3

1

M4 Other spectrum quartet at δ = 2.1-2.6 (or value in this range)

1

(b) M1 Quaternary (alkyl) ammonium salt / bromide

1

M2 CH_3Br or bromomethane

Penalise contradictory formula and name.

1

M3 Excess (CH_3Br or bromomethane)

Mention of acid eg H_2SO_4 OR alkali eg NaOH loses both M2 and M3.

1

M4 Nucleophilic substitution

Can only score M3 if reagent correct.

Ignore alcohol or ethanol (conditions) or Temp.

1

(c)

	Bromine (penalise Br but mark on)	Acidified $KMnO_4$ (Penalise missing acid but mark on)

Wrong reagent = no marks.

If bromine colour stated it must be red, yellow, orange, brown or any combination, penalise wrong starting colour.

1

Benzene	no reaction / colour remains / no (visible) change	no reaction / colour remains / no (visible) change

Ignore 'clear', 'nothing'.
Allow colour fades slowly.
Allow 'nvc' for no visible change.

1

cyclohexene	(Bromine) decolourised	(Acidified $KMnO_4$) decolourised

1

[11]

M7. Identification of acid by suitable method eg named indicator, named carbonate, specified reactive metal

Ignore any reference to the smell of the ester.

1

with expected results

Do not allow the use of any instrumental method eg i.r. or n.m.r.; must be a <u>chemical</u> test.

1

Identification of alcohol by suitable method eg oxidation by acidified potassium dichromate(VI)

1

with expected results

1

[4]