Mark schemes

Q1.

(a) Row 1 = no (visible) change/reaction / stays orange/yellow

Row 1 - allow stays brown (ignore red)

Row 2 = name or formula of a (hydrogen)carbonate (e.g. Na_2CO_3, $NaHCO_3$, $CaCO_3$)
OR
name or formula of reactive metal (e.g. Mg, Na)

Row 2 - name or formula, but formula must be correct if given (even if correct name also given); allow bicarbonate for hydrogencarbonate; ignore reference to limewater for a (hydrogen)carbonate

Row 3 = no (visible) change/reaction/stays blue

Do not allow nothing/no observation for Row 1/3

3

(b) **M1** mass of H = 0.50 - 0.45 (= 0.05(0)) (g)

Correct answer scores 3 marks

M1 10% H, 90% C

M2 $C\ \frac{0.45}{12(.0)} = 0.0375,\ H = \frac{0.05}{1(.0)} = 0.05$

Allow ECF from M1 to M2

Allow ECF from M2 (if an attempt at moles) to M3

M3 C_3H_4

Alternative M1/2

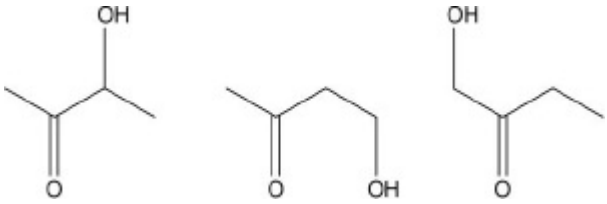
M2 $C\ \frac{90}{12(.0)} = 7.5,\ H = \frac{10}{1(.0)} = 10$

3

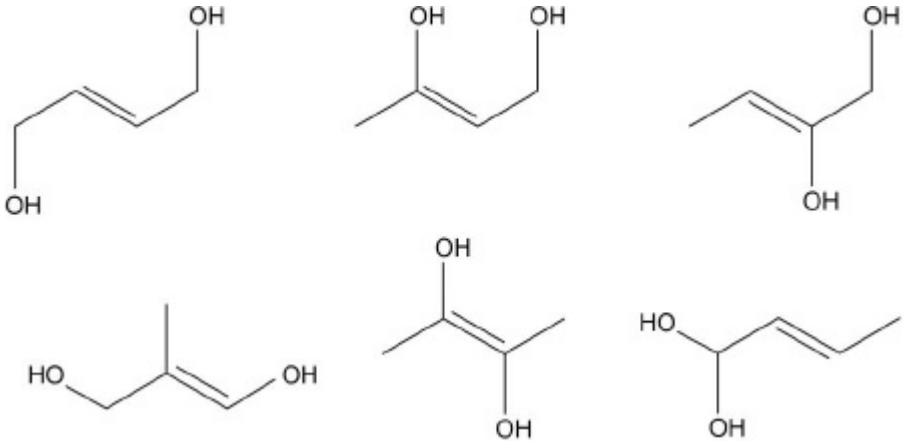
[6]

Q2.

(a) Compound **A** - structural formula of any compound with formula $C_4H_8O_2$ containing C=O and alcohol O-H group, e.g.



Compound **B** - structural formula of any compound with formula $C_4H_8O_2$ containing C=C and two alcohol O-H groups, e.g.

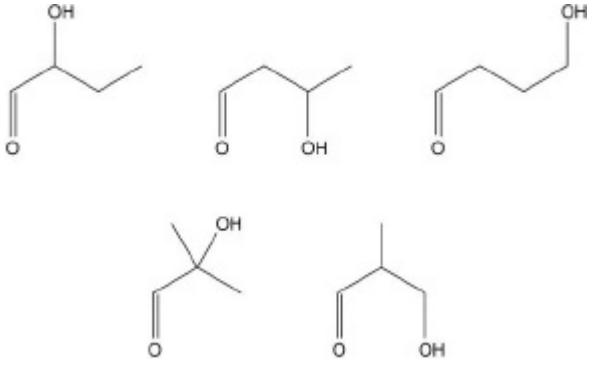


Answers may be given by the spectra.

Ignore (in)correct name.

*Compound **A**:*

- *Do NOT allow carboxylic acids*
- *Allow compounds with aldehyde and alcohol OH groups*



*Compound **B**:*

- *The C=C must be shown in the structure*
- *Allow compounds with one C=C, one alcohol OH and an ether group*

(b) **M1** use fingerprint region

M1 Allow region below 1500 cm^{-1} for fingerprint region

M2 look for (exact) match to known spectrum

M1 If values are quoted the top number must be 1500 cm^{-1}

2

(c) Methane/it absorbs IR (radiation/light) or
Methane/it absorbs (radiation/light) around 3000 and/or 1200 (cm^{-1})

Answer must have idea of absorbing/taking in IR (or wavenumbers that correspond to IR)

Allow (C-H) bonds absorbing IR radiation (penalise reference to bonds other than C-H)

Ignore re-emission of (IR) radiation by methane

1

[5]

Q3.

(a) **M1** Misty / white / steamy fumes

M1 (immediate) White precipitate forms

M2 No visible change

M2 White precipitate forms <u>slowly</u>

2

(b) **M1** Propanal AND (blue solution gives a brick) red precipitate

If **M1** incorrect, allow ECF for suitable tests on remaining liquids

M1	(Warm with) acidified potassium dichromate (VI)	add Na	warm with a named carboxylic acid with conc H_2SO_4	(Warm with) acidified potassium manganate (VII)
M2	Propan-1-ol/alcohol AND (orange solution) goes green	Propan-1-ol/alcohol AND effervescence	Propan-1-ol/alcohol AND fruity smell	Propan-1-ol/alcohol AND (purple solution) goes colourless

3

[5]

Q4.

(a) **M1** Tollens' reagent or ammoniacal silver nitrate

M2 silver mirror

M3 no reaction / no (visible) change / colourless

Alternative

M1 *sodium*

M2 *no reaction / no (visible) change*

M3 *fizzing / bubbles / effervescence*

OR

M1 Fehling's solution

M2 orange/brick/red solid/precipitate

M3 no reaction / no (visible) change

Do not allow acidified potassium dichromate(VI)

*If no reagent or incorrect reagent in **M1**, then no marks can score in **M2/3***

*Allow name or formula of suitable reagent for **M1**. Penalise incorrect formula of correct reagent in **M1** (even if correct name also given) but mark on for **M2/3***

*For Tollens': ignore $AgNO_3$ or $[Ag(NH_3)_2]^+$ or silver mirror test or "Tollings' reagent" on their own, but mark on for **M2/3.** Allow silver/black precipitate/solid/deposit for **M2**.*

*For Fehling's (or Benedict's): ignore $Cu^{2+}(aq)$ or $CuSO_4$ or "Fellings" on their own, but mark on for **M2/3***

Ignore "nothing (happens)" / "no observation"

3

(b) **M1** bromine (water) / Br_2 / Br_2(aq)

M2 orange/yellow / no reaction / no (visible) change

M3 colourless / decolourised

Alternative

M1 *acidified potassium manganate(VII) / $KMnO_4/H^+$*

M2 *no reaction / no (visible) change / purple*

M3 *colourless / decolourised*

*If no reagent or incorrect reagent in **M1**, then no marks can score in **M2/3***

*Allow name or formula of suitable reagent for **M1**. Penalise incorrect formula of correct reagent in **M1** (even if correct name also given) but mark on for **M2/3**.*

*Allow brown-red or brown for **M2**. (Ignore red)*

*Ignore clear for **M3***

3

(c) **M1** H = 1.0078

M2 C = 12.0096

M3 M_r= (6 × M1) + (6 × M2) = 78.1044

M2 *Allow ECF from **M1***

M3 *Allow ECF from **M1** and **M2***

Penalise not giving answers to 4dp once only (on the first occasion it would score otherwise)

(providing answers are given to at least 2dp)

3

[9]

Q5.

(a) Use H_2SO_4

Allow HCl / H_3PO_4

Ignore conc / dilute

1

(b) M1 Cool test 2

warm (water bath)

Allow heat / hot

M2 Gas is tested with lighted splint in test 3

Bubble into limewater

Allow no test on gas needed

2

(c) M1 J and M

M2 Test 1 (Orange solution goes) green

M3 M

M4 Test 2 (Blue solution gives a brick) red precipitate

Allow (Brown-red/orange/orange-red)

M5 J and L

M6 Test 3 (Colourless gas that turns) limewater cloudy

Allow M6 Test 3 fizz / effervescence

M7 K

M8 Test 4 (Orange solution goes) colourless

Allow (Brown/Brown-red/yellow/yellow-orange)

Allow decolorises bromine

8

(d) M1 S - Fractionating column

M1 Allow beads

M2 <u>Both</u> T - Water out <u>AND</u> U - Water in

M3 Liquids K and M are likely to have similar boiling points

3

[14]

Q6.

This question is marked using levels of response. Refer to the Mark Scheme Instructions for Examiners for guidance on how to mark this question.

Level 3 **5-6 marks**	**All stages are covered and each stage is generally correct and virtually complete.** (6 v 5) Answer is well structured, with no repetition or irrelevant points, and covers all aspects of the question. Accurate and clear expression of ideas with no errors in use of technical terms.
Level 2 **3-4 marks**	**All stages are covered but stage(s) may be incomplete or may contain inaccuracies OR** **two stages are covered and are generally correct and virtually complete.** (4 v 3) Answer has some structure and covers most aspects of the question. Ideas are expressed with reasonable clarity with, perhaps, some repetition or some irrelevant points. If any, only minor errors in use of technical terms.
Level 1 **1-2 marks**	**Two stages are covered but stage(s) may be incomplete or may contain inaccuracies OR** **only one stage is covered but is generally correct and virtually complete.** (2 v 1) Answer includes statements which are presented in a logical order and / or linked.
0 marks	Insufficient correct chemistry to gain a mark.

Stage 1
Identifying aldehyde / 2-methylpropanal
1a Tollens' or Fehling's
1b silver mirror or orange-red precipitate

Stage 2
Identifying alcohol / 2-methylpropan-1-ol
2a acidified potassium dichromate
2b (orange to) green
2c tests done in suitable sequence to distinguish aldehyde from alcohol, or to state that aldehyde would give same result if this test is done first

If aldehyde is identified, alcohol may be identified by elimination of the other two as acids using Na_2CO_3/$NaHCO_3$/Mg/indicator (2a = appropriate reagent, 2b = correct observations, 2c = in a suitable sequence)

Stage 3
Distinguishing the acids
3a using IR spectroscopy to distinguish the two acids (or other suitable technique)
3b use finger-print region of IR spectrum (feature of spectrum to use)
3c look for exact match to spectra of known compounds (what the difference is)

[6]