Organic Analysis Practice Test
Mark Scheme

Name ..... Class: .....

Start Time ..... End Time ..... Time Taken .....

Time allowed: 38 minutes

INSTRUCTIONS TO CANDIDATES

- This document is designed to be used as a practice test.
- Complete the test under exam conditions in one sitting.
- Optional: Before marking it, go through the paper with a set of notes and improve your answers.
- Mark the test using the mark scheme make corrections on the paper.
- Complete the table on the front page.
- Improve your notes so that they better reflect your weaknesses.
- Make a note of your strengths and weaknesses for future revision.

Success Criteria	Questions in Paper	Mark	Out of	%	Rank Order
Structural Isomerism	1a		1		
Test Tube Reactions	1b, 2, 3b, 5c		10		
IR Spec	1c, 5b		3		
Free Radical Substitution	1d		5		
Mass Spec	1e, 3a		12		
Calculation	6a		1		
Chromatography	6b				
Total			36		

Q1.

(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*)

M2 silver mirror

OR

black solid/precipitate
(NOT silver precipitate)

M3 (stays) colourless
or no change or no reaction

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

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• once only

Second propagation
$Cl_2 + •CH_2CH_2CH_3 \rightarrow CH_3CH_2CH_2Cl + Cl•$

OR

C_3H_7Cl

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

Termination (must make C_6H_{14})
$2 •CH_2CH_2CH_3 \rightarrow C_6H_{14}$ 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]

Q2.

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]

Q3.

(a) **For 2 marks at least one correct reference either to M_r or value to 5 decimal places required**

***QoL** (associated with the bold statement here)*

M1 Compounds 1 and 3 (butanal and butanone) have the same M_r (to 5dp) because **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 same number of atoms of the same / each element
- are both C_4H_8O
- have the same molecular formula

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

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

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

2

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

M1 silver mirror

OR black solid/precipitate

(NOT silver (mirror) precipitate)

M2 (stays) colourless

OR no change / no reaction

OR no silver mirror

With Fehling's (solution)

M1 Red solid/precipitate

(Credit orange or brown solid)

M2 (stays) blue

OR no change / no reaction

OR no red solid

OR no (red) precipitate

N.B No mark is awarded for the reagent

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]

Q4.

(a) H ***OR*** hydrogen ***OR*** H•

Ignore brackets ignore dot
penalise + or – charge

1

(b) CH_3 ***OR*** methyl ***OR*** CH_3• ***OR*** •CH_3

Ignore brackets ignore dot
penalise + or – charge

1

(c) Either order

C_2H_5 ***OR*** ethyl ***OR*** CH_3CH_2• ***OR*** C_2H_5•

Ignore brackets ignore dot
penalise + or – charge

1

CHO ***OR*** HCO ***OR*** COH ***OR*** H—C=O

1

(d) I A

1

II C

1

III D

1

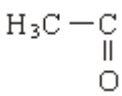
IV B

1

[8]

Q5.

(a) (i)



or $RCOCH_3$;

(or description in words)
(ignore trailing bonds)

1

(ii) H_3C—O or $ROCH_3$;

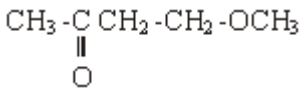
(allow 1 if both (i) and (ii) give CH_3- or H_3C– only)

1

(iii) CH_2CH_2 or two adjacent methylene groups;

1

(iv)



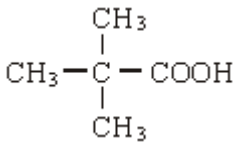
OR

$CH_3COCH_2CH_2OCH_3$;

1

(b) (i) OH <u>in acids</u> or (carboxylic) acid present

(ii)



OR Methylbutanoic acid OR Pentanoic acid

(Note that this had the NMR part of the question removed, hence why there are multiple possible answers)

(c)

reagent	$K_2Cr_2O_7$ /H^+	$KMnO_4$ /H^+
Y	no reaction	no reaction
Z	orange to green or turns green	purple to colourless or turns colourless

5

[9]

Q6.

(a) (32.1 / 102.1) = 31.4%

Do not penalise precision but do not allow 1 significant figure.

1

(b) Zineb is mixed with a <u>solvent / water</u>

Max=2 if M1 missed

1

Use of column / paper / TLC

Lose M1 and M2 for GLC

1

Appropriate collection of the ETU fraction
OR Appropriate method of detecting ETU

Allow ETU is an early fraction in a column or collecting a range of samples over time, lowest retention time / travels furthest on paper or TLC (allow 1 mark for having the longest

retention time in GLC).

1

Method of identification of ETU (by comparison with standard using chromatography)

If method completely inappropriate, only M1 is accessible

1

[8]