



TOPIC 9 HW MS

1. Compare spectrum of aldehyde with known spectrum of pentanal
Must be a specific reference to a comparison. 1
- Exact match 1
Allow 'fingerprint regions match exactly'. 1 [2]
2. (a) If 2 stage test for one compound, award no marks for that compound, eg no mark for ROH or RX to alkene then Br₂ 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 AgClr₂
- propan-1-ol
- acidifiedpotassiumdichromate
 - sodium
 - Named acid + conc H₂SO₄
 - named acyl chloride
 - PCl₅
- M1 1
- (orange) turns green
 effervescence
 Sweet smell
 Sweet smell /misty fumes
 Misty fumes
- M2 1
- propanal
- add Tollens or Fehlings / Benedicts
 - acidifiedpotassiumdichromate
 - Brady's 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

[8]

3. (a) (i) C

1

(ii) A

1

(iii) D

1

(iv) B

1



- (b) **M1** Br₂ **OR** bromine (water) **OR** bromine (in CCl₄ / organic solvent)

*If M1, has no reagent or an incorrect reagent,
CE=0*

Ignore "acidified"

*For M1 penalise Br (or incorrect formula of
other correct reagent), but mark on*

*For M1, it must be a whole reagent and/or
correct formulae*

Either order

*If oxidation state given in name, it must be
correct.*

- M2** cyclohexane **OR A** or the alkane: remains orange / red / yellow /
brown /

the same **OR** no reaction **OR** reference to colour going to
cyclohexane layer

For M2 credit "no change"

Ignore "nothing"

Ignore "nothing happens"

Ignore "no observation"

- M3** cyclohexene **OR D** or the alkene: decolourised / goes colourless /
loses
its colour

For M3, ignore "goes clear"

Alternatives : potassium manganate(VII)

M1 KMnO₄ in acid **M2** purple **M3** colourless

M1 KMnO₄ in alkali / neutral **M2** purple **M3** brown solid

Give appropriate credit for the use of iodine and observations

No credit for combustion observations

3

- (c) **M1** acidified potassium or sodium dichromate

*For M1, it must be a whole reagent and/or
correct formulae*

OR eg H₂SO₄ / K₂Cr₂O₇ **OR** H₂/ K₂Cr₂O₇

OR correct combination of formula and name

*If oxidation state given in name, it must be
correct.*

3



M2 oxidation **OR** oxidised **OR** redox

Do not penalise incorrect attempt at formula if name is correct or vice versa

M3 secondary / 2° (alcohol)

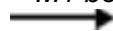
*Credit acidified potassium chromate(VI) / H_2SO_4
+ K_2CrO_4*

3



(d) **M1** (free-) radical substitution (mechanism)

M1 both words required



Penalise absence of dot once only.



Penalise + or - charges every time



Accept dot anywhere on methyl radical

Accept a correct termination step for 1 mark if neither M3 nor M4 are scored; otherwise ignore termination steps

Mark independently

NB If Cl_2 is used, penalise every time (this may be for M2, M3 and M4)

If cyclohexane is used, penalise every time (this may be for M3 and M4)

M5 Condition

ultra-violet / uv / sun light

OR high temperature

OR $125\text{ }^\circ\text{C} \leq T \leq 600\text{ }^\circ\text{C}$

OR $400\text{ K} \leq T \leq 870\text{ K}$

For M5 ignore "heat"

5

[15]

4. (a) Fractional distillation (under reduced pressure)

1

(b) BaSO_4 insoluble / remove by filtration

Do not allow answers which refer to reaction rate

1

(c) Both contain OH group

Allow OH stretch in ir spectrum of each compound

Do not allow 'same bonds'

5



1

[3]



MEGA LECTURE

5. (a) Secondary **OR** 2° (alcohol); 1

(b) Spectrum is for **butanone (or formula) or butan-2-one**

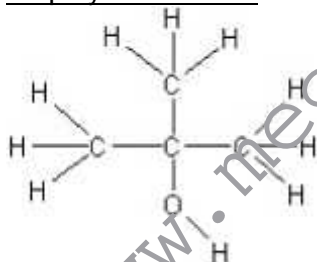
The explanation marks depend on correctly identifying butanone.

If butanone is correctly identified, award any two from

- (Strong) absorption / peak at approximately 1700 (cm⁻¹) / 1710 (cm⁻¹) / in the range 1680 – 1750 (cm⁻¹) This needs to be stated.
- (Characteristic) absorption / peak for C=O (may be shown on the spectrum in the correct place).
- No absorption / peak in range 3230 to 3550 cm⁻¹ 1

- No absorption / peak for an OH group.
*Look at the spectrum to see if anything is written on it that might gain credit.
 Allow the words "dip" OR "spike" OR "low transmittance" as alternatives for absorption.* 2

(c) Displayed structure for 2-methylpropan-2-ol



*Must have **all bonds** drawn out but ignore the bond angles*

1

[5]

6. (a) Allow 1 mark each for any correctly drawn primary, secondary and tertiary alcohol of molecular formula C₄H₁₀O

3

Tertiary alcohol cannot be oxidised

1

(b) Region 1500–400 cm⁻¹

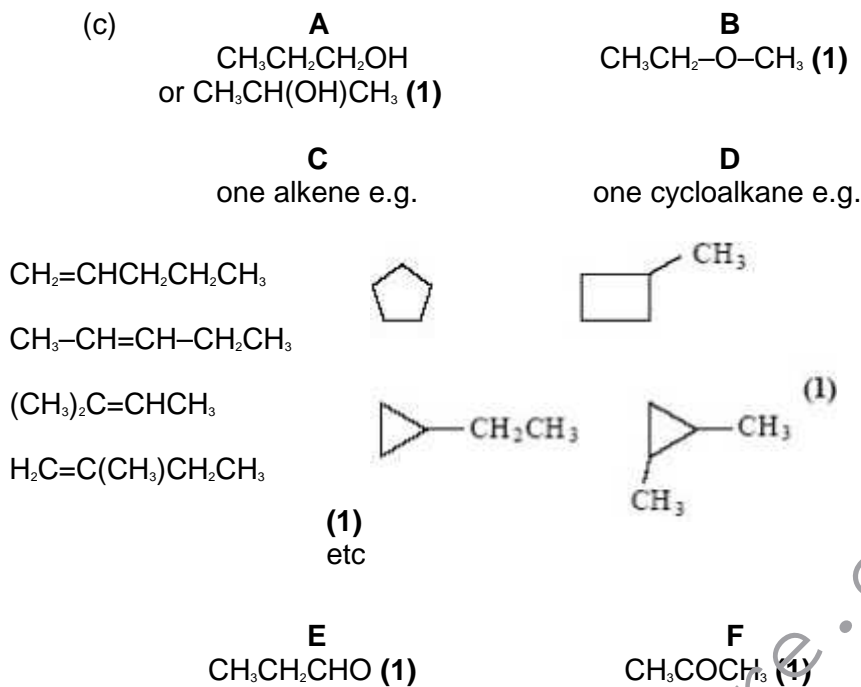
1



exact match to spectrum of known compound

1





6

[12]

7. Dichromate(VI) will also oxidise / give a positive test with alcohols

Allow 'dichromate'.

Allow 'dichromate(VI) will oxidise other organic molecules / functional groups'.

[1]

8. (Mix the alcohol with warm) $\text{K}_2\text{Cr}_2\text{O}_7 / \text{H}^+$ allows 3° identification by lack of reaction

Scheme must allow the alcohol to be distinguished to get all marks.

1

Distillation of initial product needed for $1^\circ / 2^\circ$

If distillation stage not clear then max. 2 (M1 and M3).

Awareness of correct reactions / lack of reaction relating to each class of alcohol is worth 1 mark.

1

Effect of Tollens' / Fehling's on oxidation product to identify 1° or 2° (by default)



Reacting Tollens' / Fehling's with alcohols directly is incorrect and gains no M2 or M3.

Detailed observations relating to the reactions are not needed but should be penalised where incorrect.

1

[3]



9. Test bromine (water) / iodine
 Accept 'Br₂' 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 I₂, allow red-brown / purple to colourless. 1
- [2]
10. (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 1
 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

MEGA LECTURE

- (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.*
- Contains hydrogen bonding 1
- Some comparison with other compounds explaining that the intermolecular forces are stronger in propanoic acid 1
- [15]

11. (a) (i) Electron pair donor

OR

Species which uses a pair of electrons to form a co-ordinate/covalent bond.

Credit "lone pair" as alternative wording

Credit "electron pair donator"

1

(ii) Replacement of the halogen (atom) (by the nucleophile)

OR

The carbon-halogen bond/C-X breaks and a bond forms with the nucleophile or between the carbon and the nucleophile

They must describe the idea of substitution in a haloalkane.

Accept the idea that a nucleophile replaces the halogen which becomes a halide ion

Penalise reference to "halogen molecule" and penalise the idea that the haloalkane contains a halide

1

(iii) Splitting molecules using/by water

OR

breaking/splitting/dissociating (C₁VX) bond(s)/using/by water

NOT simply the reaction with water or simply the addition of water.

Ignore "compound"

1

(iv) (Heat) energy/enthalpy required/needed/absorbed (at constant



pressure) to break/split it/the (carbon-halogen) bond

OR

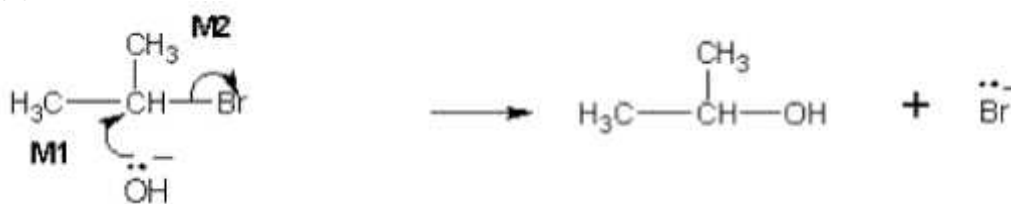
(Heat) energy/enthalpy required/needed/absorbed (at constant pressure) for homolysis of the (C-X/the carbon-halogen) bond

Ignore bond formation

Ignore "average"

1

(b)



M1 must show an arrow from the lone pair of electrons on the oxygen atom of the negatively charged hydroxide ion to the central C atom.

M2 must show the movement of a pair of electrons from the C-Br bond to the Br atom. Mark M2 independently.

Award full marks for an S_N1 mechanism in which M1 is the attack of the hydroxide ion on the intermediate carbocation.

Penalise M1 if covalent KOH is used

Penalise M2 for formal charge on C or incorrect partial charges

Penalise once only for a line and two dots to show a bond.

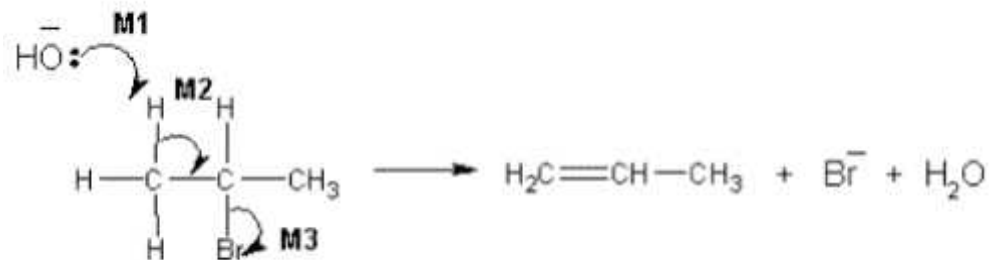
Max 1 mark for the wrong reactant

Accept the correct use of "sticks"

2

MEGA LECTURE

(c) (i)



- M1** must show an arrow from the lone pair on oxygen of a negatively charged hydroxide ion to the correct H atom
- M2** must show an arrow from the correct C-H bond to the C-C bond and should only be awarded if an attempt has been made at M1
- M3** is independent provided it is from the original molecule

Award full marks for an E1 mechanism in which M2 is on the correct carbocation.

Penalise M1 if covalent KOH

Penalise M3 for formal charge on C or incorrect partial charges

Penalise once only for a line and two dots to show a bond.

Max 2 marks for wrong reactant

Accept the correct use of "sticks" for the molecule except for the C-H being attacked

3

(ii) **M1** Stated that the spectrum has an absorption/absorbance/peak in the range 1620 cm⁻¹ to 1680 (cm⁻¹) or specified correctly in this range from the spectrum

M2 depends on correct range or wavenumber being specified

M2 (Infrared absorption) due to C=C OR carbon-carbon double bond

QoL for correct M1 statement which includes both the word absorption (or alternative) and the correct range or wavenumber

Allow "peak" OR "dip" OR "spike" OR "trough" OR "low transmittance" as alternatives for



absorption.

For M2 it is not sufficient simply to state that an alkene has C=C

M2 could be on the spectrum

Ignore reference to other absorptions

2

[11]



- | | |
|-------|-----|
| 12. B | [1] |
| 13. D | [1] |
| 14. D | [1] |

www.megalecture.com