M1. (a) 2-chloropropanoic acid **(1)**

1

(b) δ 1.72 Doublet ∴ next to CH **(1)**

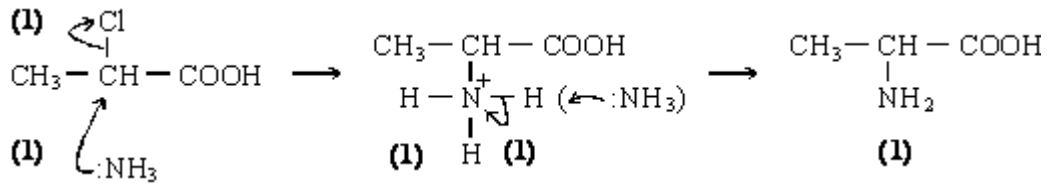
δ 4.44 Quartet ∴ next to CH_3 **(1)**

2

(c) Two triplets **(1)**

1

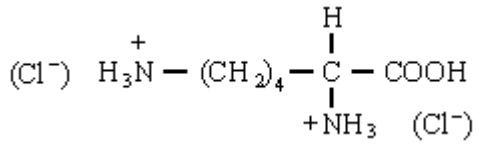
(d)



Allow S_N1

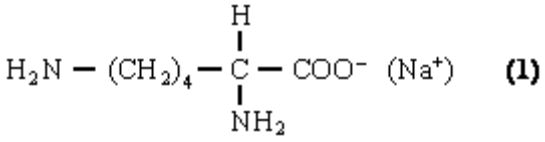
5

(e) (i)



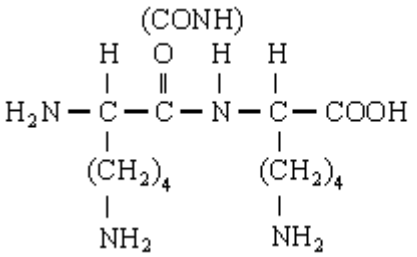
(1)

(ii)



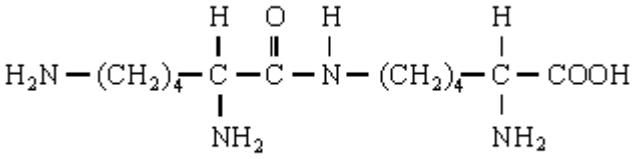
(1)

(iii)



(1)

or



Or anhydride

3

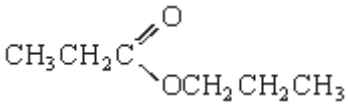
[12]

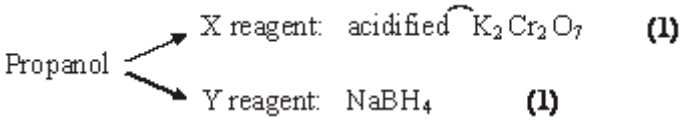
M2. (a) X contains > C=O **(1)**

if X and Y reversed lose this mark but allow remaining max 6/7

∴ X is CH_3CH_2COOH **(1)**

∴ Y is $CH_3CH_2CH_2OH$ **(1)**

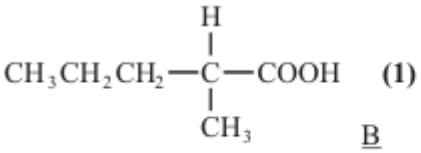
∴ A is  **(1)**



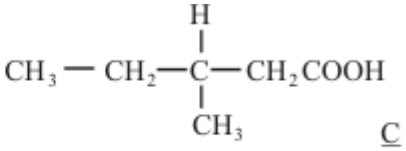
Conc H_2SO_4 : catalyst **(1)**

7

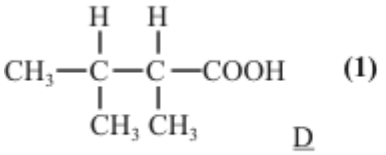
(b)



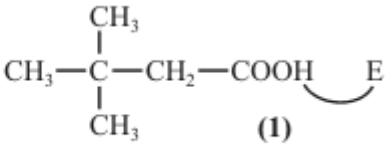
B (1)



C (1)



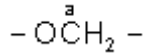
D (1)

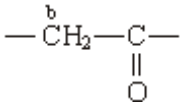


E (1)

in any order

4

(c)  3.1 – 3.9 **(1)**

 2.1 – 2.6 **(1)**

a: quartet **(1)** ⌒ 3 adjacent H **(1)**

b: triplet **(1)** ⌒ 2 adjacent H **(1)**

6

(d) 3269 cm^{-1} ∴ OH ⌒ alcohol **(1)**

∴ G is  (1)

2

Notes

(a) first mark for C=O stated or shown in **X**

Ignore wrong names

Y $CH_3CH_2CH_2OH$

allow C_3H_7 in **A** if **Y** correct or vice versa

Allow **(1)** for **A** if correct conseq to wrong **X** and **Y**

other oxidising agents: acidified $KMnO_4$; Tollens; Fehlings

other reducing agents: $LiAlH_4$; Na/ethanol; Ni/H_2; Zn or Sn or Fe/HCl

(b) give **(1)** for carboxylic acid stated or COOH shown in <u>each</u> suggestion
(1) for correct **E**
any 2 out of 3 for **B**, **C** or **D**
allow C_3H_7 for either the **B** or **D** shown on the mark scheme
i.e. a correct structure labelled **B**, **C** or **D** or **E** will gain 2.

(c) protons a – *quartet* must be correct to score *3 adjacent H* mark. Same for b

(d) allow **(1)** for any OH (alcohol) shown correctly in any structure – ignore extra functional groups. Structure must be completely correct to gain second mark

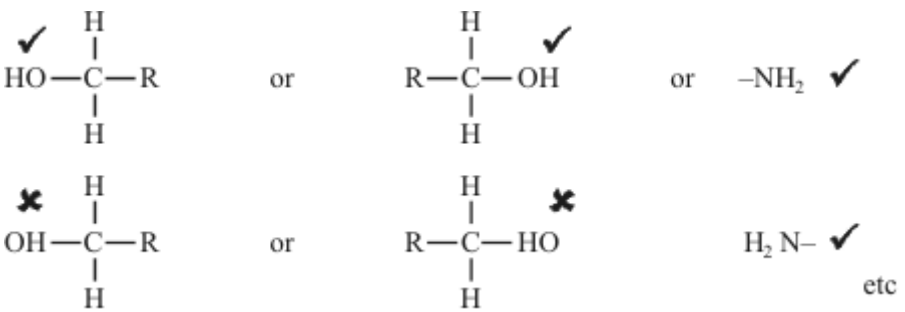
[19]

<u>Organic points</u>

(1) <u>Curly arrows:</u> must show movement of a pair of electrons,
i.e. from bond to atom or from lp to atom / space
e.g.

(2) <u>Structures</u>

penalise sticks (i.e. ) <u>once per paper</u>



<u>Penalise once per paper</u>

<u>allow</u> CH_3– or $–CH_3$ or  or CH_3
or H_3C–

M3.B

[1]

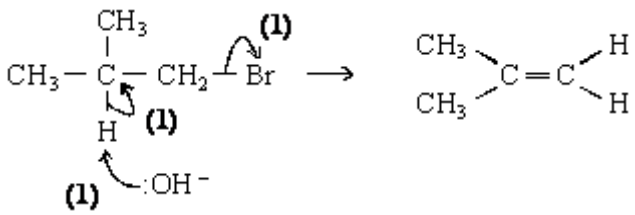
M4. (a) Identity of **X**; 2-methylpropene **(1)**
Absorption at 1650 cm^{-1} indicates an alkene present **(1)**
OR a chemical answer e.g. Br_2 (aq) brown to colourless

2

(b) Reagents
Step 1 KOH (allow NaOH) **(1)** alcoholic **(1)** warm **(1)**
Only allow solvent and warm if reagent correct

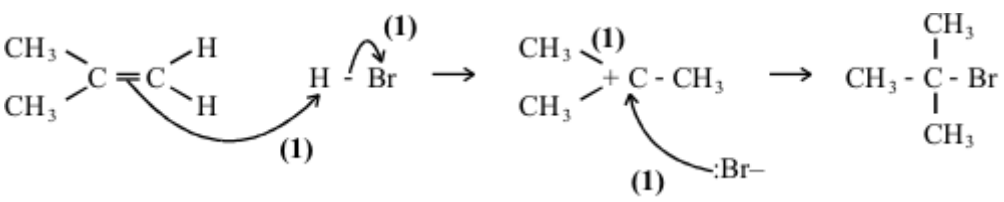
Step 2 HBr **(1)**

Mechanism: A → **X**



Or a carbocation mechanism

Mechanism **X** → B



11

(c) A gives three peaks **(1)**
B gives one peak **(1)**
Allow one for "A has more peaks than B" when no number of peaks is given

2

[15]