

- M1.** (a) (i) There are three pairs of equivalent carbon atoms 1
- (ii) 75ppm 1
- (b) (i) 4 1
- (ii) 2 1
- (c) Each structure can represent a pair of cis/Z and trans/E isomers  
OR  
Optical isomers 1

[5]

**M2.** (a) (i)

Reagent	Tollens	Fehlings or Benedicts	$K_2Cr_2O_7/H^+$ or acidified	$KMnO_4/H^+$	$I_2/NaOH$
Propanal	silver (mirror)	red ppt or goes red ( <i>not red solution</i> )	goes green	goes colourless	No reaction
Propanone	no reaction	no reaction	no reaction	no reaction	Yellow (ppt)

(penalise incomplete reagent e.g.  $K_2Cr_2O_7$  or  $Cr_2O_7^{2-}/H^+$  then mark on)

- (ii) propanal 3 peaks 3  
*ignore splitting even if wrong*
- propanone 1 peak 1

1

(b) X is  $\text{CH}_3\text{CH}_2\text{COOH}$  or propanoic acid if both name and formula given,  
both must be correct, but

1

Y is  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$  or propan-2-ol allow propanol with correct formula

1

**Mark the type of reaction and reagent/condition independently.  
The reagent must be correct or close to score condition**

Step 1 Oxidation

$\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+$  or other oxidation methods as above  
allow  $\text{Cr}_2\text{O}_7^{2-}/\text{H}^+$  if penalised above (ecf)  
reflux (not Tollens/Fehlings) or heat or warm

1

Step 2

reduction or nucleophilic addition	reduction or nucleophilic addition	reduction or hydrogenation	1
$\text{NaBH}_4$	$\text{LiAlH}_4$	$\text{H}_2$	1
in (m)ethanol or water or ether or dry	ether or dry	Ni / Pt etc	1

Step 3 esterification or (nucleophilic) addition-elimination or condensation

1

(conc)  $\text{H}_2\text{SO}_4$  or  $\text{HCl}$

1

warm (allow without acid reagent if X and Y given as reagents)

1

or reflux or heat

1

[15]

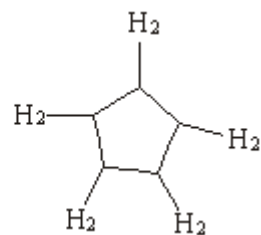
M3. (a) A any C<sub>5</sub> alkene

1

B

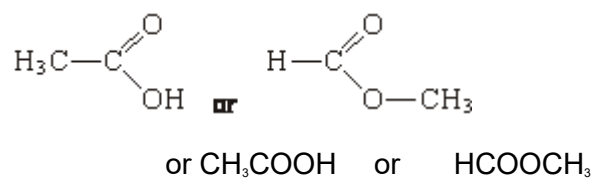


penalise



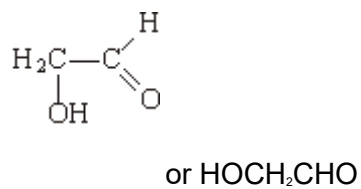
1

(b) C



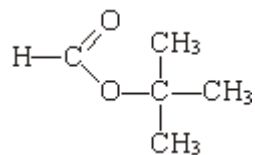
1

D



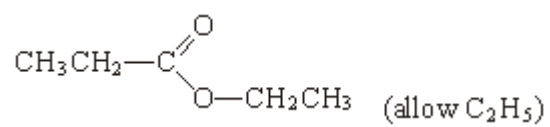
1

(c) E



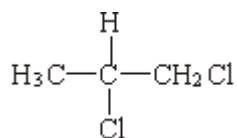
1

F



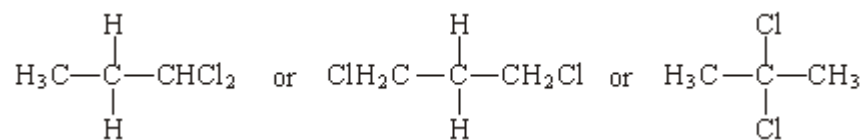
1

(d) **G**



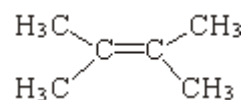
1

**H**



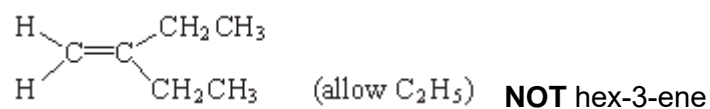
1

(e) **I**



1

**J**



1

[10]

**M4.** (a) **X** (O-H) (alcohols)

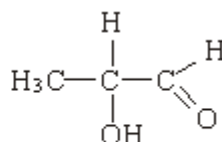
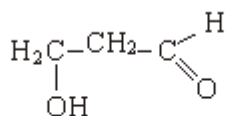
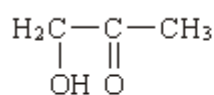
*penalise acid or missing "alcohol"*

1

**Y** C=O

*allow carbonyl*

1

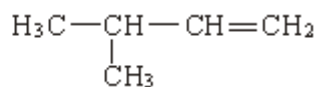
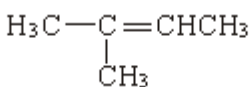
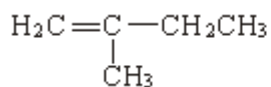


**A**

*NOT acid*

4

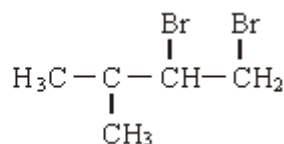
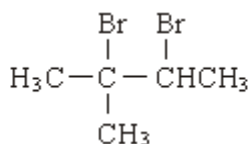
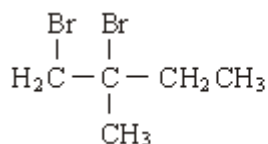
(b)



*Allow conseq dibromocompounds following incorrect unbranched alkenes*

*NOT allow dibromocompound consequent on a duplicate alkene*

*NOT allow monobromocompounds if HBr added*



3

3

6:3:1 either next to correct structure or to none

1

Allow a mark for identifying correct dibromocompound with three peaks even if integration ratio is wrong

1

if 6:3:1 missing or wrong, no marks for splitting

Only award a mark for splitting if it is clear which integration number it refers to

6 singlet or drawn

1

3 doublet or drawn

1

1 quartet/quadruplet or drawn

1

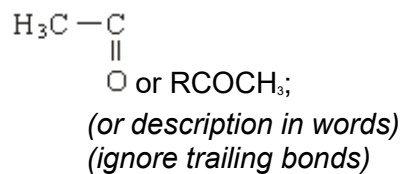
(max 10 marks)

[16]

M5.D

[1]

M6. (a) (i)



1

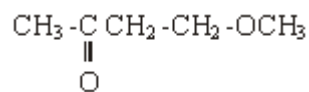
(ii)  $\text{H}_3\text{C}-\text{O}$  or  $\text{ROCH}_3$ ;  
(allow 1 if both (i) and (ii) give  $\text{CH}_3-$  or  $\text{H}_3\text{C}-$  only)

1

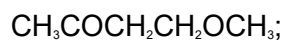
(iii)  $\text{CH}_2\text{CH}_2$  or two adjacent methylene groups;

1

(iv)



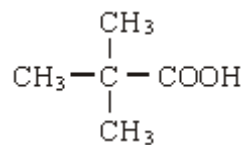
OR



1

(b) (i) OH in acids or (carboxylic) acid present

(ii)



(c)

reagent	$\text{K}_2\text{Cr}_2\text{O}_7 / \text{H}^+$	$\text{KMnO}_4 / \text{H}^+$
---------	--	------------------------------

<b>Y</b>	no reaction	no reaction
<b>Z</b>	orange to green or turns green	purple to colourless or turns colourless

5

[9]

**M7.B**

[1]