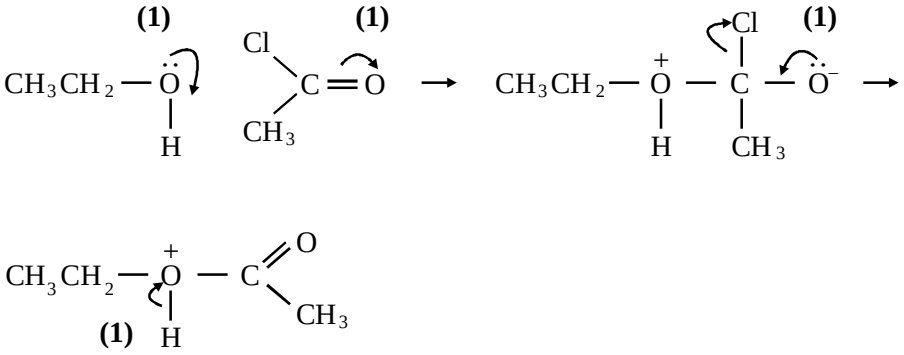
4.8, 4.9 EXAM QUESTIONS MS

1. (a) *Equation* $CH_3COCl + CH_3CH_2OH \rightarrow CH_3COOCH_2CH_3 + HCl$ **(1)**

Name of mechanism addition-elimination **(1)**

Mechanism



6

(b) Only the polyester **(1)** is hydrolysed **(1)** by alkali 2

[8]

2. (a) elimination **(1)** 1

(b) melting point increases **(1)**

boiling point increases**(1)**

or they are liquids, the higher members are solids**(1)**

density increases**(1)**

viscosity increases**(1)** max 2

(c) addition **(1)**

polymerisation **(1)** 2

(d) (i) $C_2H_4 + H_2O \rightarrow C_2H_5OH$ - must show the functional group **(1)** 1

(ii) vapour phase / high temperature (300 ± 50°C) **(1)**

high pressure 70cl ± 20 **(1)**

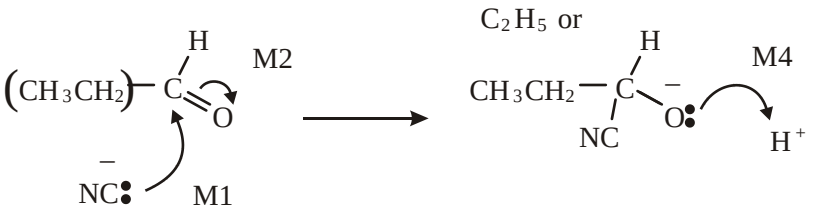
if high *T* and high *p*, then only 1 mark, value for either gives 2nd mark
strong acidic catalyst /H_3PO_4 **(1)** 3

(iii) electrophilic **(1)**

addition **(1)** 2

[11]

3. (a) necleophilic addition; 1

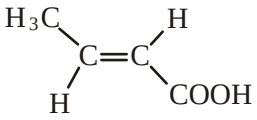


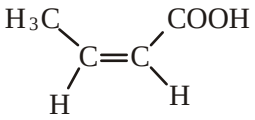
M3 structure ; 4

(be lenient on position of charge on CN–)
(M2 not allowed independent of M1, but allow M1 for correct attack on C+
if M2 show as independent first.)
(+on C of C=O loses M2 but ignore ¢+ if correct)
(M4 for arrow and lone pair (only allow for correct M3 or close))

(b) (i) 2-hydroxybutanoic acid 1

(ii)



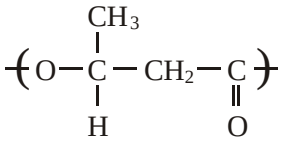


1

1

geometric(al) or cis-trans 1

(c) (i)



1

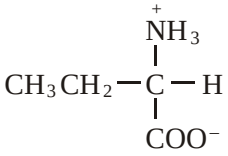
(one unit only) (ignore brackets or n) (trailing bonds are needed)

(ii) can be hydrolysed

OR

can be reacted with/attacked by acid/base/nucleophiles/H_2O/OH^-; 1

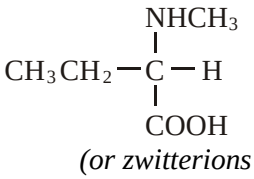
(d) (i)



1

(allow $-NH_3^+$)

(ii)



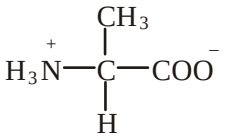
1

(or zwitterions product)

(iii) nucleophilic substitution; 1

[14]

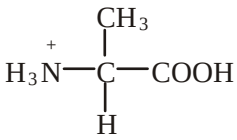
4. (a) (i)



penalise $^+NH_3$— or + on H once per paper 1

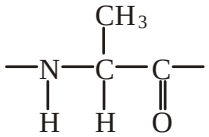
zwitterions 1

(ii)



1

(b)



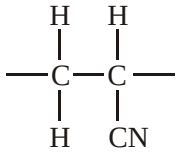
ignore n, but allow **one** drawn out repeating unit only 1

condensation or (nucleophilic) addition-elimination 1

(c) 3-methylpent-2-ene 1

[6]

5. (a) (i)

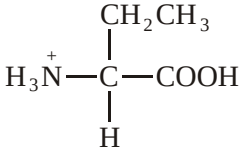


1

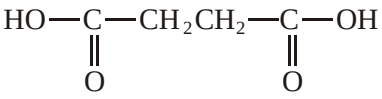
(Ignore n or brackets, but trailing bonds are essential)

(ii) Addition or radical 1

(b) (i) 2-aminobutanoic (acid) 1

(ii)  1

(c) (i) $C_3H_4O_2$ 1

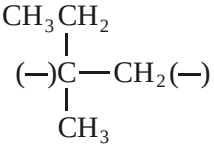
(ii)  1

(1,4-)butan(e)dioic (acid) 1
(allow succinic, but not dibutanoic nor butanedicarboxylic acid)

(iii) Can be hydrolysed / can react with acid or base or water / can react with nucleophiles 1

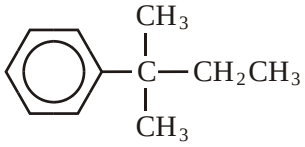
[8]

6. (a) (i) 2-methylbut-1-ene **(1)**
NOT ...butan....

(ii) *Repeating unit:*  **(1)** or 2 ×
allow C_2H_5

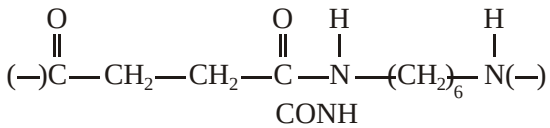
Type of polymerisation: addition or radical **(1)**

(iii) *Name of mechanism*: electrophilic substitution **(1)**

Major product:  **(1)**

(iv) $CH_3CH{=}CHCH_2CH_3$ **(1)** 6

(b) *Repeating unit*:

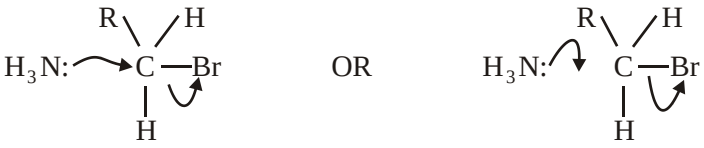

(1) **(1)**

Type of polymerisation: condensation **(1)**

Name of linkage: (poly)peptide or (poly)amide **(1)** 4
allow outer horizontal bonds to be omitted
allow HO–[.....]–H if [.....] shows the repeating unit; if brackets missing in the dimer, penalise one
C_2H_4 or C_6H_{12} first time only
allow CONH
*allow polypeptide or polyamide; peptide or amide **must** be spelled correctly*

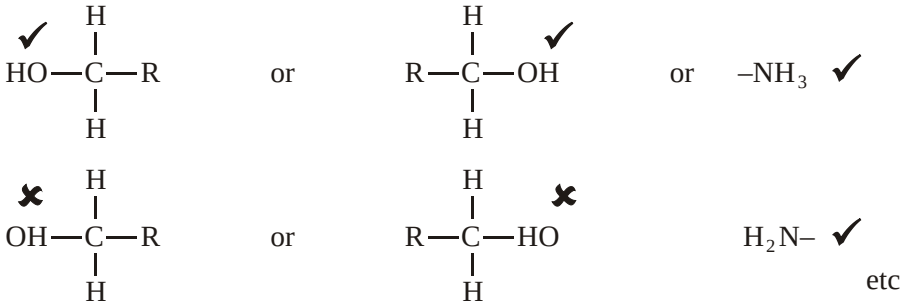
Organic points

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



(2) Structures

penalise sticks (i.e. ) once per paper

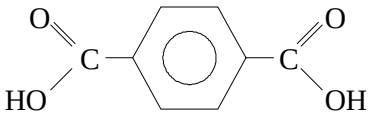


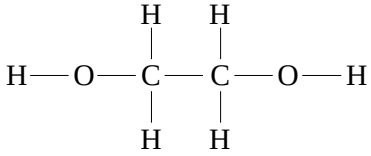
Penalise once per paper

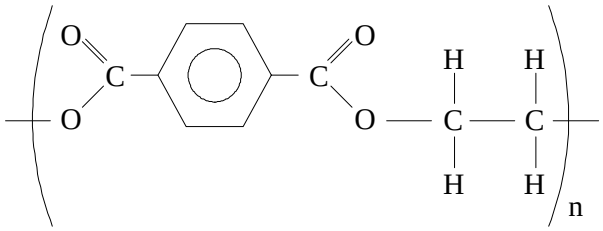
allow CH_3– or $–CH_3$ or  or CH_3

or H_3C–

[10]

7. (a) (i)  **(1)** 1

(ii)  allow $HOCH_2CH_2OH$ **(1)** 1

(iii) 

ester linkage correct ie $–COO–CH_2–$ shown as fully graphical structure **(1)**

rest of molecule correct including  **(1)**

repeat unit may start and finish in different place
allow e.c.f. from (a)(ii) 2

(b) polyesters **(1)** 1

(c) addition: joining together (of monomers with double bond) → one product only **(1)**

condensation: also involves the elimination of a small molecule **(1)**
allow specific example e.g. H_2O, HCl, CH_3OH 2

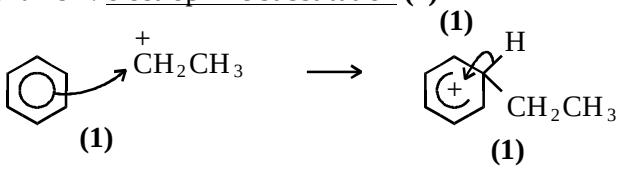
(d) poly(ethene) / poly(propene)
condone missing brackets **(1)** 1

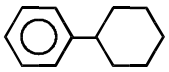
[8]

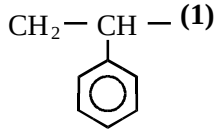
8. (a) *Substance 1*: HCl or HBr **(1)**
Substance 2: $AlCl_3$ / $AlBr_3$ / $FeCl_3$ / $FeBr_3$ **(1)** 2

(b) $H_2C{=}{=}CH_2 + HCl + AlCl_3 \rightarrow CH_3CH_2^+ + AlCl_4^-$ **(1)**
Allow 2 equations **1**

(c) *Name of mechanism*: electrophilic substitution **(1)**
Mechanism: 4

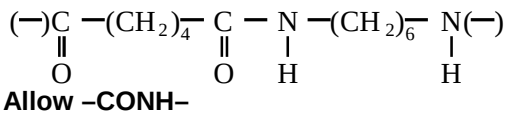


(d)  **(1)** 1

(e) *Type of polymerisation*: addition **(1)**
Repeating unit:  **(1)** 2

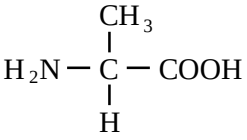
[10]

9. (a) (i) hexane-1,6-diamine or 1,6-diaminohexane **(allow ammine)**
or 1,6 hexan(e)diamine **(1)**

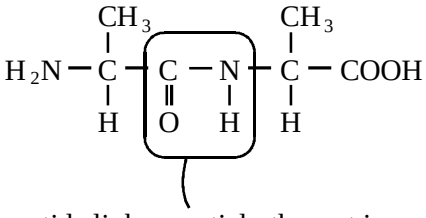
(ii)  **(1)**
Allow –CONH–

2

(b) (i)



(1)

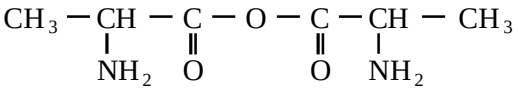


(1)

peptide link essential : the rest is consequential on b(i)
(allow CONH)

(ii) 2

allow anhydride



(c) (i) quaternary ammonium bromide salt **(1)**
(not ion, not compound)

Allow quarternery

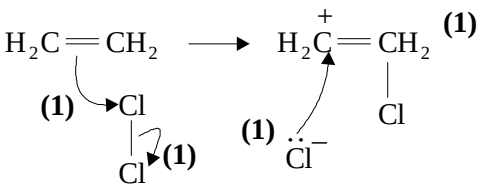
(ii) *Reagent*: CH_3Br or bromomethane **(1)**
penalise CH_3Cl but allow excess for any halomethane

Condition: excess (CH_3Br) **(1)**

(iii) nucleophilic substitution **(1)** 4

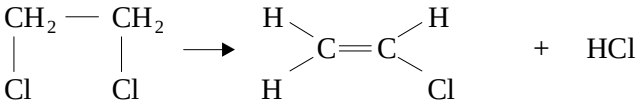
[8]

10. (a) electrophilic addition **(1)**



(1) **(1)** **(1)** **(1)**

5

(b) $C_2H_4Cl_2$ or  1

(1)

(c) ester or alkoxy alcohol **(1)** 1

(d) (i) $HO–CH_2–CH_2–OH$ **(1)**

(ii) high electron density of double bond **(1)**
repels OH^- or nucleophile **(1)** 3

[10]

11. (a) (i) the joining together of monomers / small molecules **(1)**

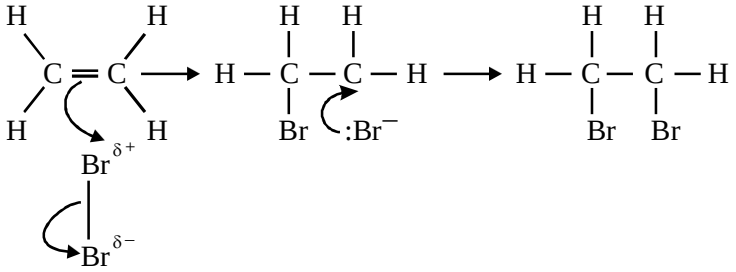
to form long chains / large molecules **(1)** 2

(ii) $nCH2 = CH2 \rightarrow (-CH2–CH2-)n$ **(1)**

allow n CH_2 CH_2 **not** n C_2H_4 1

(b) 1,2-dibromoethane **(1)** 1

(c) electrophilic addition **(1)**



words or diagrams to show attack by p electrons on Br atom
and either δ+/δ– on Br_2 or e^- shift on Br–Br **(1)**

correct carbocation intermediate (allow triangular representation) **(1)**

attack by Br^- (onto +ve carbon) leading to correct product **(1)** 4

(d) (i) C 38.71/12 = 3.23 ; H 9.68/1 = 9.68 ; O 51.61/16 = 3.23 **(1)**

ratio C:H:O = 1:3:1 /empirical formula = CH_3O **(1)**

empirical mass = 31 so molecular formula = 2 × CH_3O = $C_2H_6O_2$ **(1)** 3

(ii) reagent = NaOH / KOH **(1)**

conditions = <u>aqueous</u> solution (dependent on first mark) **(1)** 2

(iii) $CH_2BrCH_2Br + 2NaOH \rightarrow CH_2(OH)CH_2OH + 2NaBr$

product = $CH_2(OH)CH_2OH$ (condone missing brackets) **(1)**

correctly balanced **(1)** 2

if $C_2H_6O_2$ given, allow second mark only

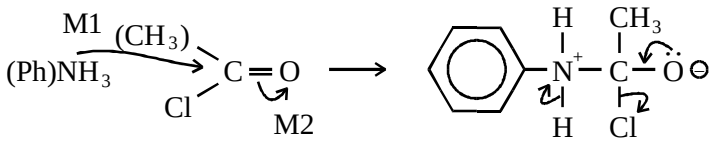
for CH_2 Br CH_2 Br + $2H_2O \rightarrow CH_2(OH)CH_2(OH) + 2HBr$
allow 2 marks if reagent in (ii) is H_2O or aqueous solution

[15]

12. (a) CH_3COCl or $(CH_3CO)_2O$ **(1)**

$AlCl_3$ or H_2O or CH_2SO_4 loses this mark
CH_3COOH loses reagent and M3, M4 = max 3

nucleophilic addition–elimination **(1)**



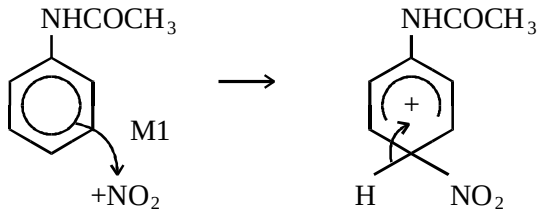
M3: structure
M4: 3 correct arrows
Allow M1 for attack on $CH3\text{-}C^{+}=O$
Penalise Cl^{-} removing H^{+}

6

(b) Conc HNO_3 **(1)**
Conc H_2SO_4 **(1)**
$HNO_3 + 2\ H_2SO_4 \rightarrow NO_2^{+} + H_3O^{+} + 2\ HSO_4^{-}$ **(2)**

(or H_2SO_4) **(or H_2O + HSO_4^{-})**
HNO_3 / H_2SO_4 scores 1
Any 2

electrophilic substitution **(1)**

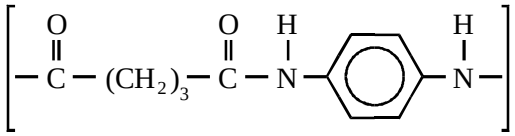


M2 structure
M3 arrow

6

(c) Sn **(or Fe)** / HCl or Ni / H_2 **(1)**

NOT $LiAlH_4$ $NaBH_4$



(1) **(1)**

3

[15]