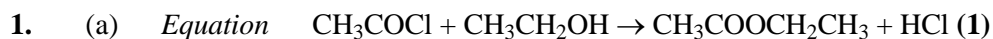
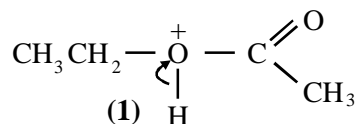
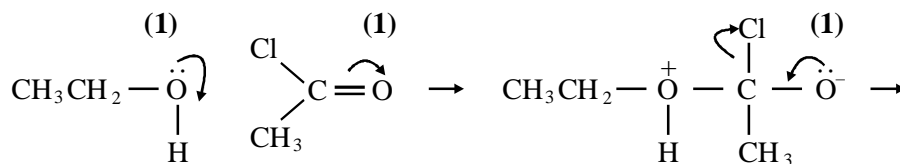


4.8, 4.9 EXAM QUESTIONS MS



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) $\text{C}_2\text{H}_4 + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_5\text{OH}$ - must show the functional group (1)

1

(ii) vapour phase / high temperature ($300 \pm 50^\circ\text{C}$) (1)

high pressure $70\text{cl} \pm 20$ (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

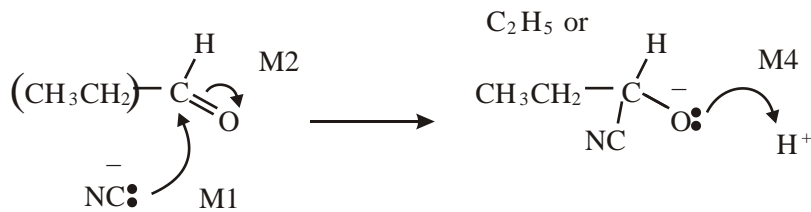
(iii) electrophilic (1)

addition (1)

2

[11]

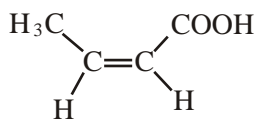
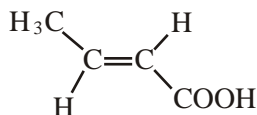
3. (a) nucleophilic addition; 1



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 δ⁺ if correct)
(M4 for arrow and lone pair (only allow for correct M3 or close))

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

(ii)

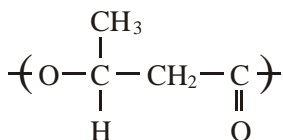


1

1

geometric(al) or cis-trans 1

- (c) (i)



1

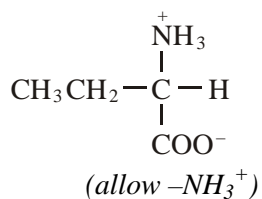
(one unit only) (ignore brackets or n) (trailing bonds are needed)

- (ii) can be hydrolysed

OR

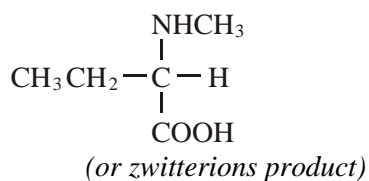
can be reacted with/attacked by acid/base/nucleophiles/H₂O/OH⁻; 1

(d) (i)



1

(ii)



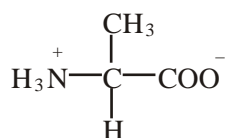
1

(iii) nucleophilic substitution;

1

[14]

4. (a) (i)



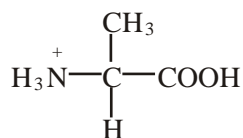
penalise $^+\text{NH}_3$ — or + on H once per paper

1

zwitterions

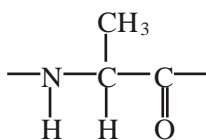
1

(ii)



1

(b)



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

1

condensation or (nucleophilic) addition-elimination

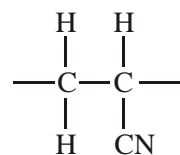
1

(c) 3-methylpent-2-ene

1

[6]

5. (a) (i)



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

1

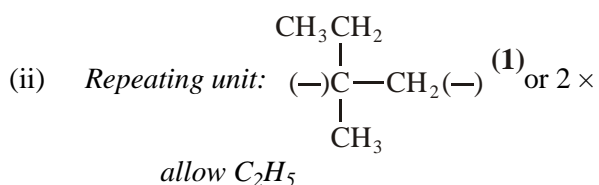
(ii) Addition or radical

1

- (b) (i) 2-aminobutanoic (acid) 1
- (ii)
$$\begin{array}{c} \text{CH}_2\text{CH}_3 \\ | \\ \text{H}_3\text{N}^+ - \text{C} - \text{COOH} \\ | \\ \text{H} \end{array}$$
 1
- (c) (i) $\text{C}_3\text{H}_4\text{O}_2$ 1
- (ii)
$$\text{HO} - \underset{\text{O}}{\parallel}{\text{C}} - \text{CH}_2\text{CH}_2 - \underset{\text{O}}{\parallel}{\text{C}} - \text{OH}$$
 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

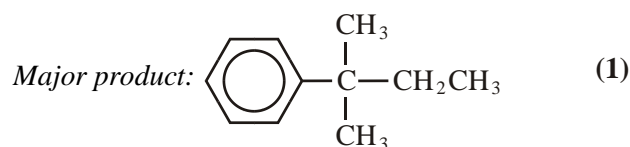
[8]

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



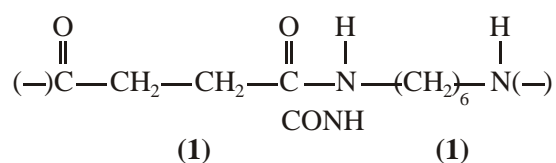
Type of polymerisation: addition or radical (1)

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



- (iv) $\text{CH}_3\text{CH}=\text{CHCH}_2\text{CH}_3$ (1) 6

- (b) Repeating unit:



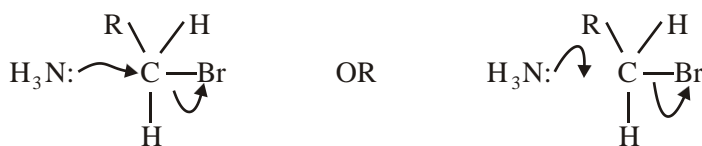
Type of polymerisation: condensation (1)

- Name of linkage: (poly)peptide or (poly)amide (1) 4

allow outer horizontal bonds to be omitted
allow $\text{HO} - [\dots] - \text{H}$ if $[\dots]$ 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

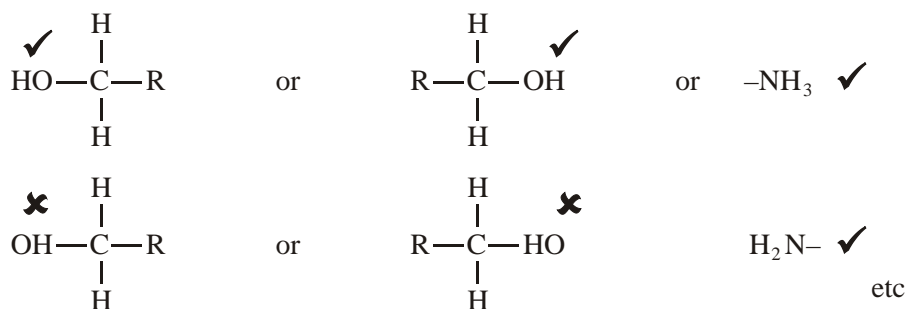
Organic points

- (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. $\begin{array}{c} | \\ -C- \\ | \end{array}$) once per paper



Penalise once per paper

allow CH_3- or $-\text{CH}_3$ or CH_3 or CH_3

or $\text{H}_3\text{C}-$

[10]

7. (a) (i) (1) 1
- (ii) allow $\text{HOCH}_2\text{CH}_2\text{OH}$ (1) 1
- (iii) (1) 2
- ester linkage correct i.e. $-\text{COO}-\text{CH}_2-$ shown as fully graphical structure (1)
- rest of molecule correct including $\left(\quad \right)_n$ (1)
- repeat unit may start and finish in different place
allow e.c.f. from (a)(ii)
- (b) polyesters (1) 1

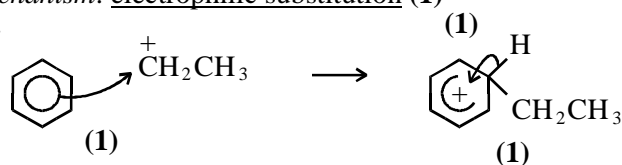
- (c) addition: joining together (of monomers with double bond) → one product only (1)
 condensation: also involves the elimination of a small molecule (1)
 allow specific example e.g. H₂O, HCl, CH₃OH 2
- (d) poly(ethene) / poly(propene)
 condone missing brackets (1) 1

[8]

8. (a) *Substance 1:* HCl or HBr (1)
Substance 2: AlCl₃ / AlBr₃ / FeCl₃ / FeBr₃ (1) 2

- (b) H₂C=CH₂ + HCl + AlCl₃ → CH₃CH₂⁺ + AlCl₄⁻ (1)
 Allow 2 equations 1

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



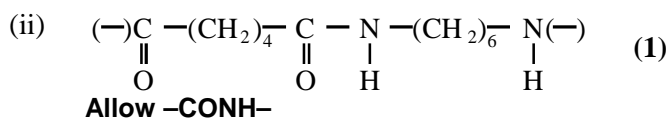
- (d)  (1) 1

- (e) *Type of polymerisation:* addition (1)
Repeating unit: -CH₂-CH- (1) 2

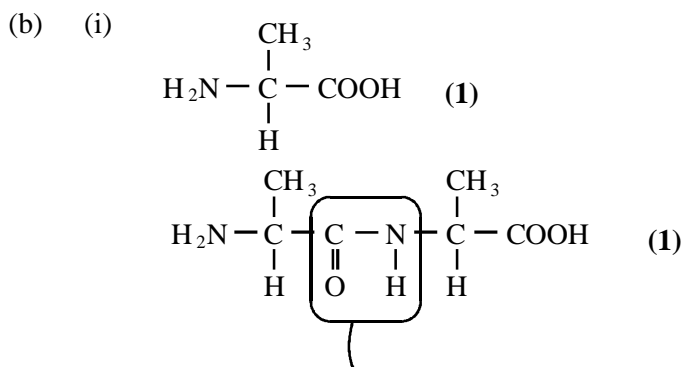


[10]

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



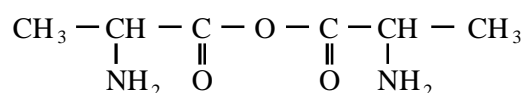
2



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 quaternary

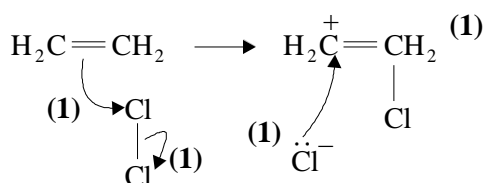
(ii) *Reagent:* CH₃Br or bromomethane (1)
penalise CH₃Cl but allow excess for any halomethane

Condition: excess (CH₃Br) (1)

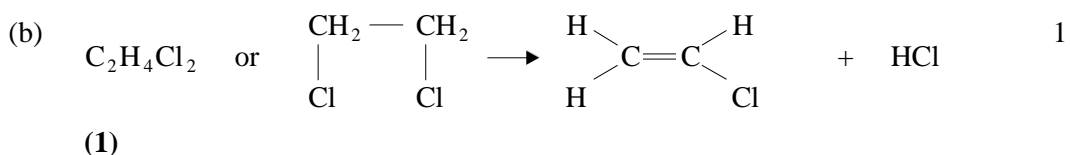
(iii) nucleophilic substitution (1) 4

[8]

10. (a) electrophilic addition (1)



5



(c) ester or alkoxy alcohol (1) 1

(d) (i) HO-CH₂-CH₂-OH (1)

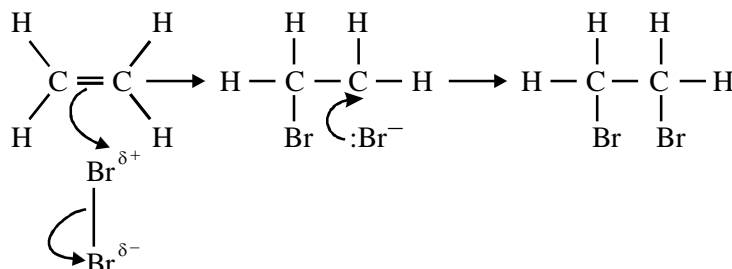
(ii) high electron density of double bond (1)
repels OH⁻ or nucleophile (1) 3

[10]

11. (a) (i) the joining together of monomers / small molecules (1)
to form long chains / large molecules (1) 2
- (ii) $n\text{CH}_2 = \text{CH}_2 \rightarrow (-\text{CH}_2-\text{CH}_2)_n$ (1)
allow $n \text{CH}_2 \text{CH}_2$ **not** $n \text{C}_2\text{H}_4$ 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 $\text{Br}-\text{Br}$ (1)

correct carbocation intermediate (allow triangular representation) (1)

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

- (d) (i) $\text{C } 38.71/12 = 3.23$; $\text{H } 9.68/1 = 9.68$; $\text{O } 51.61/16 = 3.23$ (1)
ratio $\text{C}:\text{H}:\text{O} = 1:3:1$ /empirical formula = CH_3O (1)
empirical mass = 31 so molecular formula = $2 \times \text{CH}_3\text{O} = \text{C}_2\text{H}_6\text{O}_2$ (1) 3

(ii) reagent = NaOH / KOH (1)
conditions = aqueous solution (dependent on first mark) (1) 2

(iii) $\text{CH}_2\text{BrCH}_2\text{Br} + 2\text{NaOH} \rightarrow \text{CH}_2(\text{OH})\text{CH}_2\text{OH} + 2\text{NaBr}$
product = $\text{CH}_2(\text{OH})\text{CH}_2\text{OH}$ (condone missing brackets) (1)
correctly balanced (1) 2

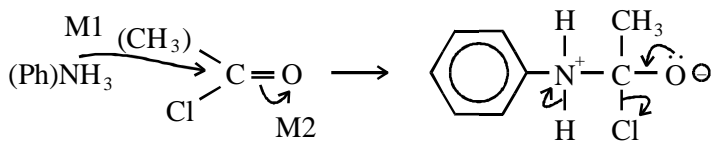
if $\text{C}_2\text{H}_6\text{O}_2$ given, allow second mark only

for $\text{CH}_2 \text{ Br } \text{CH}_2 \text{ Br} + 2\text{H}_2\text{O} \rightarrow \text{CH}_2(\text{OH})\text{CH}_2(\text{OH}) + 2\text{HBr}$
allow 2 marks if reagent in (ii) is H_2O or aqueous solution

[15]

12. (a) CH_3COCl or $(\text{CH}_3\text{CO})_2\text{O}$ (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

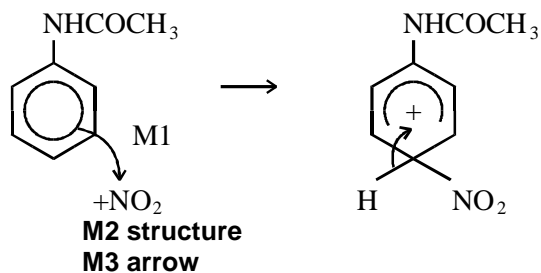
Allow M1 for attack on $\text{CH}_3\text{-C}^+=\text{O}$

Penalise Cl^- removing H^+

6

- (b) Conc HNO_3 (1)
 Conc H_2SO_4 (1)
 $\text{HNO}_3 + 2 \text{H}_2\text{SO}_4 \rightarrow \text{NO}_2^+ + \text{H}_3\text{O}^+ + 2 \text{HSO}_4^-$ (2)
 (or H_2SO_4) (or $\text{H}_2\text{O} + \text{HSO}_4^-$)
 $\text{HNO}_3 / \text{H}_2\text{SO}_4$ scores 1
Any 2

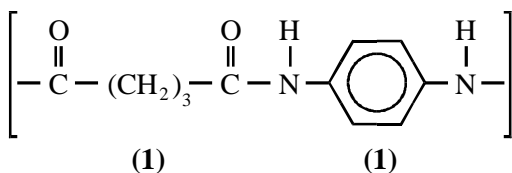
electrophilic substitution (1)



M2 structure
M3 arrow

6

- (c) Sn (or Fe) / HCl or Ni / H_2 (1)
NOT LiAlH_4 NaBH_4



(1)

(1)

3

[15]