

## Mark schemes

**1**

(a) (i) **W** 3

1

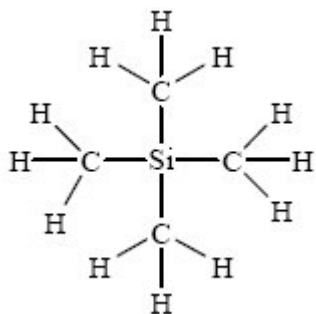
**X** 4

1

**Y** 2

1

(ii)



*displayed formula shows ALL bonds*

1

(b) (i)  $\text{NO}_2^+$

*allow + anywhere  
can score in equation*

1



1

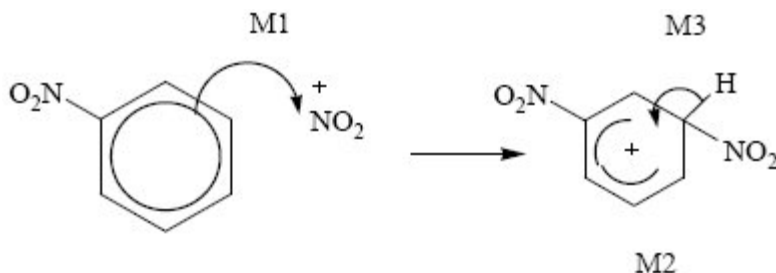
**OR**



*or use two equations via  $\text{H}_2\text{NO}_3^+$*

- (ii) electrophilic substitution  
*Not Friedel Crafts*

1



Allow Kekule structures

+ must be on N of  $^+\text{NO}_2$  (which must be correct)

both  $\text{NO}_2$  must be correctly positioned and bonded to gain M2

*M1 arrow from circle or within it to N or to + on N*

*horseshoe must not extend beyond C2 to C6 but can be smaller*

*+ not too close to C1*

*M3 arrow into hexagon unless Kekule*

*allow M3 arrow independent of M2 structure*

*ignore base removing H in M3*

3

- (c) (i)  $\text{H}_2/\text{Ni}$  or  $\text{H}_2/\text{Pt}$  or  $\text{Sn}/\text{HCl}$  or  $\text{Fe}/\text{HCl}$  (conc or dil or neither)

allow dil  $\text{H}_2\text{SO}_4$

ignore mention of  $\text{NaOH}$

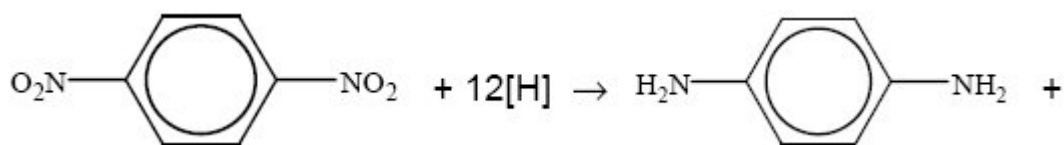
*Not  $\text{NaBH}_4$*

*Not  $\text{LiAlH}_4$*

*Not  $\text{Na}/\text{C}_2\text{H}_5\text{OH}$*

*not conc  $\text{H}_2\text{SO}_4$  or any  $\text{HNO}_3$*

1



$4\text{H}_2\text{O}$

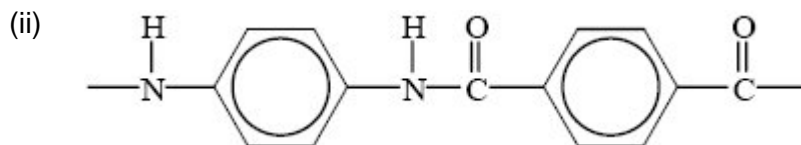
Or  $6\text{H}_2$

*allow  $\text{C}_6\text{H}_4(\text{NO}_2)_2$  etc ,*

*allow  $\text{NO}_2-\text{NH}_2-$*

*i.e. be lenient on structures, the mark is for balancing equ*

1



allow  $-CONH$

ignore  $[ ]_n$  as in polymer

1<sup>st</sup> mark for correct peptide link

2<sup>nd</sup> mark for the rest correct including trailing bonds

2

(iii) **M1** Kevlar is biodegradable but polyalkenes not

allow Kevlar is more biodegradable

1

**M2** Kevlar has polar bonds/is a (poly) amide/has peptide link

comment on structure of Kevlar

1

**M3** can be hydrolysed/attacked by nucleophiles/acids/  
bases/enzymes

1

**M4** polyalkenes non polar/has non-polar bonds

comment on structure of polyalkenes but not just strong bonds

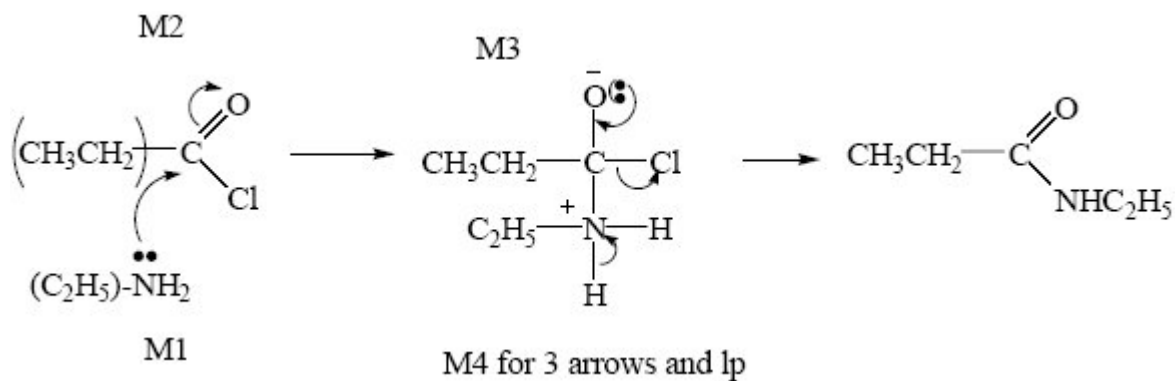
1

[18]

2

(a) (nucleophilic) addition-elimination

1



4

N-ethylpropanamide

*minus on NH<sub>2</sub> loses M1*

*M2 not allowed independent of M1, but allow M1 for correct attack on C+*

*+C=O loses M2*

*only allow M4 after correct or very close M3*

*lose M4 for Cl<sup>-</sup> removing H<sup>+</sup> in mechanism, but ignore HCl as a product*

*Not N-ethylpropaneamide*

1

(b) CH<sub>3</sub>CN or ethan(e)nitrile or ethanonitrile

*not ethanitrile*

*but allow correct formula with ethanitrile*

1

for each step wrong or no reagent loses condition mark

*contradiction loses mark*

1

Step 1 Cl<sub>2</sub>

uv or above 300 °C

*wrong or no reagent loses condition mark*

1

Step 2 KCN

1

aq and alcoholic (both needed)

*allow uv light/(sun)light/uv radiation*

1

Step 3 H<sub>2</sub>/Ni or LiAlH<sub>4</sub> or Na/C<sub>2</sub>H<sub>5</sub>OH

*not CN<sup>-</sup> but mark on*

*NOT HCN or KCN + acid, and this loses condition mark*

*NOT NaBH<sub>4</sub>*

*Sn/HCl (forms aldehyde!)*

*ignore conditions*

1

[12]

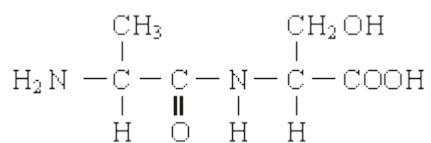
<b>3</b>	<b>H</b>	CH <sub>3</sub> CN or ethanenitrile	1
	<b>S</b>	CH <sub>3</sub> CH <sub>2</sub> NH <sub>2</sub> or ethylamine 1Step 1 KCN	1
		aq/alcoholic	1
	Step 2	H <sub>2</sub>	1
		Ni	1
	<b>W</b>	secondary amine	1
		$\left[ \begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3\text{CH}_2 - \text{N} - \text{CH}_3 \\   \\ \text{CH}_3 \end{array} \right]^+ \quad (\text{Br}^-)$	1
		nucleophilic substitution	1

**[9]**

<b>4</b>	Acidified potassium dichromate(VI)	1
	Turns green with propan-2-ol and propanal	1
	No reaction with hexene and 1-bromopropane	1
	Tollens with propan-2-ol and propanal	1
	only propanal gives silver mirror	1
	Bromine water	1
	Decolourised by hexene	1
	No reaction with 1-bromopropane	1
	Warm NaOH followed by acidified AgNO <sub>3</sub>	1
	White ppt with 1-bromopropane	1
		<b>[10]</b>

<b>5</b>	(a) (i) CH <sub>3</sub> CH=CHCH <sub>3</sub>	1
	Addition or radical ( <b>QoL</b> )	1
	(ii) CH <sub>3</sub> CH(OH)CH(OH)CH <sub>3</sub> or with no brackets	1
	butan(e)- <u>2,3</u> -diol or <u>2,3</u> -butan(e)diol	1
	$\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{HOOC}-\text{C}-\text{C}-\text{COOH} \\   \quad   \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$	1
	allow $\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{ClOC}-\text{C}-\text{C}-\text{COCl} \\   \quad   \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$	1
	<u>2,3</u> -dimethylbutan(e)dioic acid <u>2,3</u> -dimethylbutan(e)diol chloride	1
	ignore -1,4-	1
	condensation ( <b>QoL</b> )	1
	(iii) NaOH or HCl etc or Na <sub>2</sub> CO <sub>3</sub>	1
	<i>Allow conc sulphuric/nitric</i>	
	<b>NOT</b> water nor acidified water nor weak acids	1

(b) Structure 1



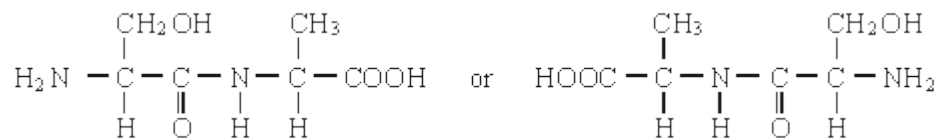
*Allow -CONH- and -COHN-*

*Allow zwitterions*

**NOT polypeptides/repeating units**

1

Structure 2 either of



1

(c) (i)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$

*allow -Cl, -I*

1

(ii)  $\text{CH}_3\text{CH}_2\text{CN}$

1

(iii) (nucleophilic) substitution or from  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$

*if reduction written here, no further marks*

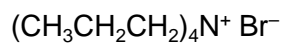
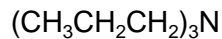
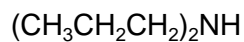
1

further substitution/reaction occurs or other products are formed

*Allow reduction forms only one product*

1

one of



*Allow salts including  $\text{NH}_4\text{Br}$*

*Allow  $\text{HBr}$*

1

[15]

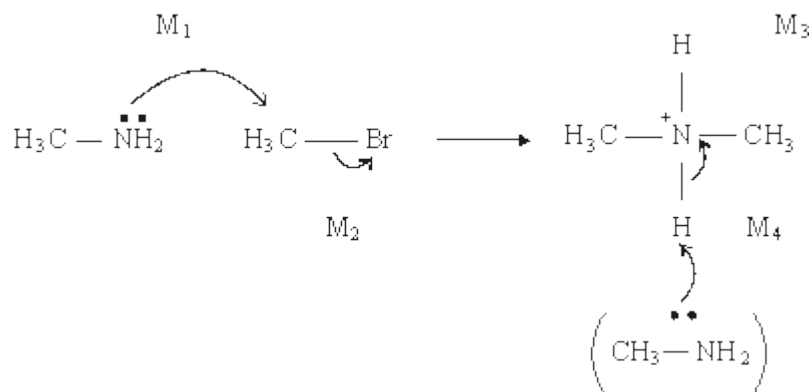
6

(a) dimethylamine

1

(b) nucleophilic substitution

1



4

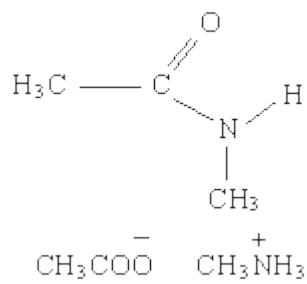
(c) quaternary ammonium salt

1

(cationic) surfactant / bactericide / detergent / fabric softener or conditioner/hair conditioner

1

(d)



(allow  $\text{CH}_3\text{COOH}$  or  $\text{CH}_3\text{COO}^- \text{NH}_4^+$ )

2

[10]