Mark schemes

Q1.

(a) **M1** Electrophilic Addition

M2 HBr

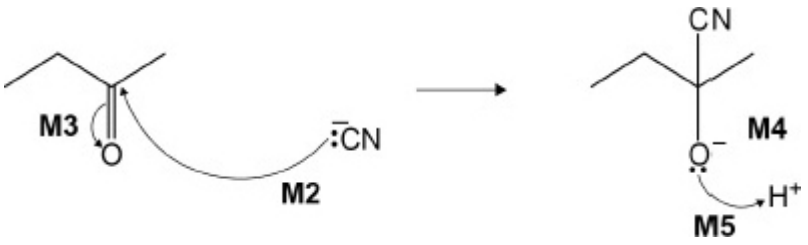
2

(b) **M1** Butan-2-ol or correct structure eg $CH_3CH(OH)CH_2CH_3$

M2 NaOH AND (warm) aqueous (Allow cold if stated)

2

(c) **M1** HCN or KCN/H_2SO_4



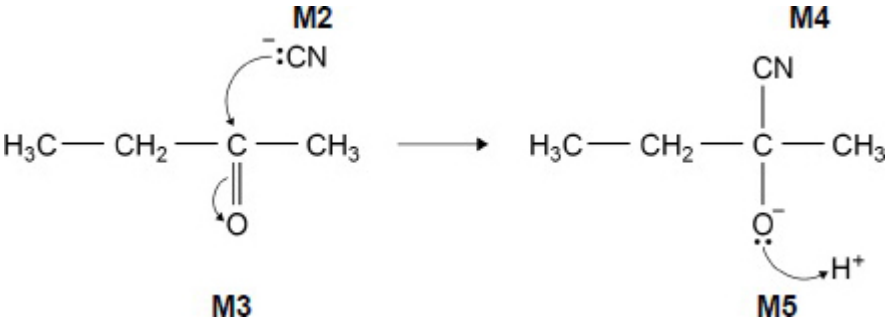
M2 Arrow from lone pair on C to C of C=O

M3 Arrow from C=O to O

M4 Structure of intermediate including negative on O

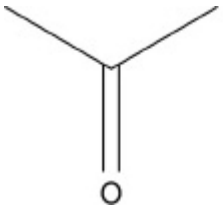
M5 Arrow from lone pair on O to H^+

OR



5

(d)



planar/ flat

Allow planar carbonyl group

M2 Equal chance (50/50) attack from above/below OWTTE

Either side

M3 Giving equal amounts of both optical isomers/enantiomers

3

[12]

Q2.

(a) 3-bromopropanenitrile

Allow 3-bromopropane-1-nitrile

1

(b)

This question is marked using levels of response. Refer to the Mark Scheme Instructions for Examiners for guidance on how to mark this question.	
Level 3 **5-6 marks**	All stages are covered and each stage is generally correct and virtually complete. Answer is communicated coherently and shows a logical progression from Stage 1 to Stages 2 and 3.
Level 2 **3-4 marks**	All stages are covered but stage(s) may be incomplete or may contain inaccuracies **OR** two stages are covered and are generally correct and virtually complete. Answer is communicated mainly coherently and shows a logical progression from Stage 1 to Stages 2 and 3.
Level 1 **1-2 marks**	Two stages are covered but stage(s) may be incomplete or may contain inaccuracies **OR** only one stage is covered but is generally correct and virtually complete. Answer includes isolated statements but these are not presented in a logical order.
Level 0 **0 marks**	Insufficient correct chemistry to gain a mark.

Indicative Chemistry content

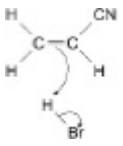
Stage 1 Types of Isomers formed

1a $CH_3CHBrCN$

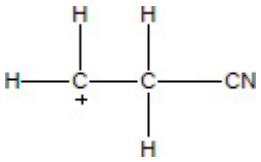
1b Exists as two Optical isomers / enantiomers

Stage 2 Mechanism

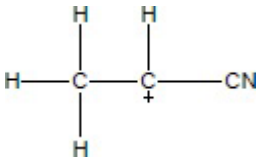
2a 2 curly arrows



2b Intermediate structure primary carbocation OR



2c Alternative Intermediate structure secondary carbocation OR



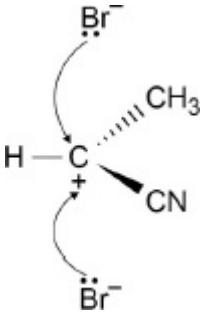
Stage 3 Optical isomerism

3a 2-bromo isomer has chiral carbon / C with four different groups / non superimposable mirror images

OR

3b Optical because (secondary) C^+ planar

3c So can be attacked from above or below



6

(c) M1 KCN or NaCN

Penalise acid in M1

M2 Aqueous AND ethanol (alcohol)

2

(d) M1 H_2 and Ni/Pt/Pd

Allow $LiAlH_4$ and (Dry) ether BUT <u>not</u> $NaBH_4$

M2 $NCCH_2CH_2CN + 4H_2 \rightarrow H_2N(CH_2)_4NH_2$

Allow with 8[H]

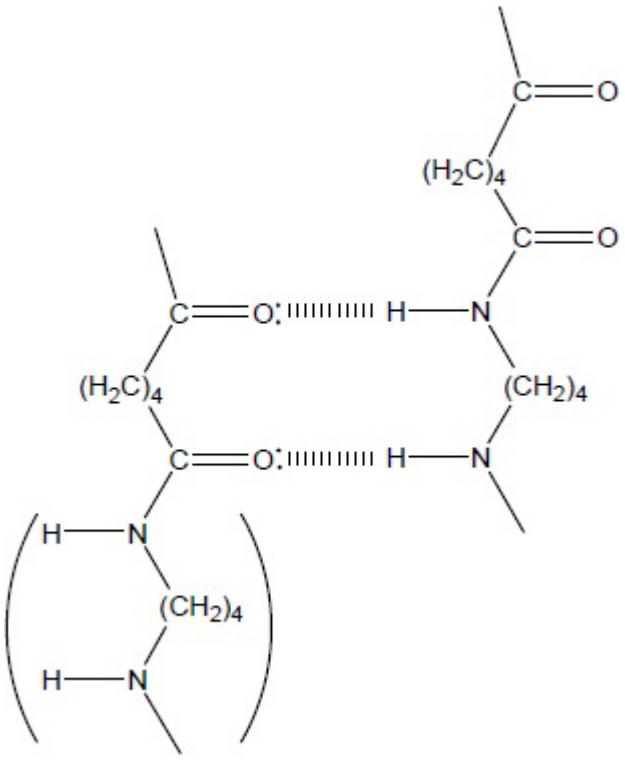
2

(e) M1 x = 5

M2 y = 9

2

(f)



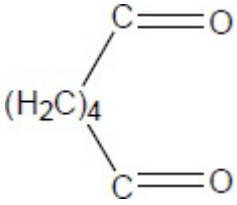
Structure shown on the left of the given structure.

The correct answer is the same irrespective of whether it's drawn on the left or right of the polymer section.

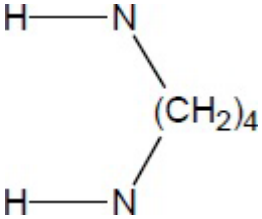
Deduct a mark(s) for error(s)/omission(s)

Must have the following:

• *Minimum correct structure*



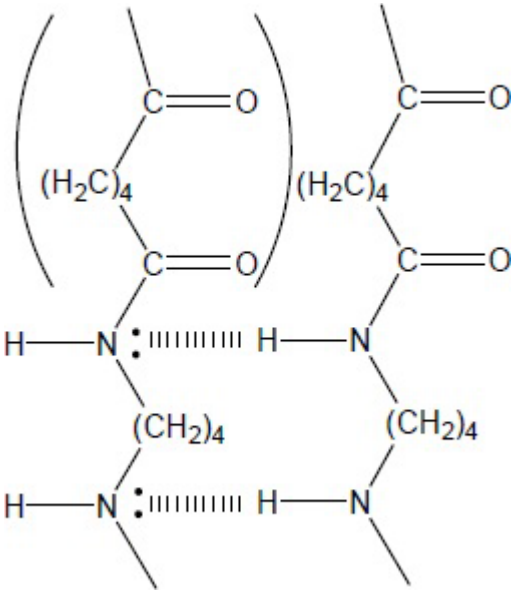
Or



• *Lp on O or N*

• *2 Linear dashed lines from O or N to H*

Allow alternative connection below



2

[15]