

Mark schemes

Q1.

(a) Dehydration

Allow (acid catalysed) Elimination

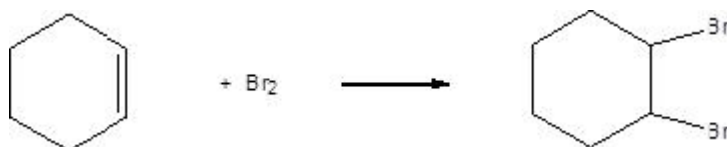
M1

Conc H₂SO₄*Allow Conc H₃PO₄*

M2

(b) Br₂*Allow bromine (water)**Allow Cl₂ or I₂**Allow O₂ if epoxide route used*

M1

*allow conseq equation to H₂, H₂O, HBr, HCl, HI and H₂SO₄**An epoxide is a feasible alternative that could score here and consequentially M3 and M4*

M2

NaOH

Or KOH or other suitable strong alkali

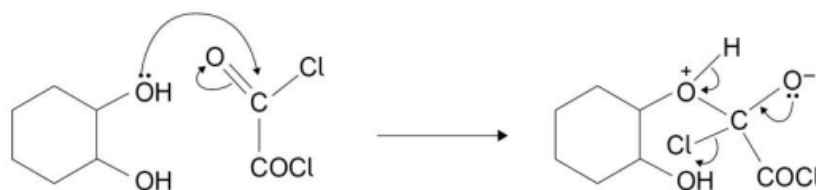
M3

*Allow this equation with molecular formulae*

M4

(c) **M1** (nucleophilic)addition-elimination*Note lone pair required for M5*

M1

**M2** curly arrow from lp on O to C
M3 curly arrow from double bond to O**M4** for structure of intermediate
M5 for 3 curly arrowsM2
M3
M4
M5(d) Less energy used **OR** Better yield

OR reduces practical losses, simpler plant,

M1

Less waste *OR* Less pollution

OR maximises the use of raw materials in the process into useful products, saves resources

M2

[13]

Q2.

B



[1]

Q3.

A

[1]

Q4.

(a)

M1 NaOH

Only score M2 if M1 gained, but mark on from hydroxide. Mention of acid loses M1 & M2

1

M2 Aqueous/(warm)

Ignore alcoholic / conc / dil.

1

M3 (Fractional) distillation or described

Not just evaporation; not reflux

Allow chromatography

1

(b) M1 S is $\text{CH}_3\text{CH}(\text{CN})\text{CH}_2\text{CH}_3$

Allow without brackets

1

Step 3

M2 KCN (mark on from CN^-)

Not HCN, not KCN with acid

1

M3 Alcoholic / (aqueous)

Allow ethanolic

Can only score M3 if M2 gained

1

Step 4

M4 H₂

LiAlH₄

Na

Can only score M5 if M4 gained

1

M5 Ni or Pt or Pd

Ethoxyethane or ether

LiAlH₄ with acid loses both M4 and M5

Ignore 'followed by acid'

Na

Ethanol

NOT NaBH₄ OR Sn/HCl

Penalise other extras as list

Ignore pressure or temperature

1

[8]