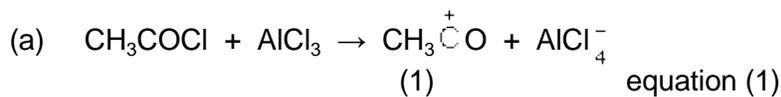


Mark schemes

1



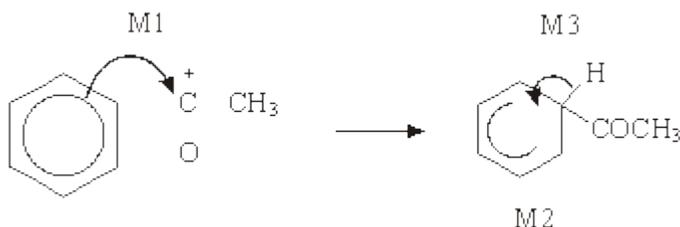
2

penalise wrong alkyl group once at first error
 position of + on electrophile can be on O or C or outside []
 penalise wrong curly arrow in the equation or lone pair on AlCl_3 else ignore

Electrophilic substitution

NOT F/C acylation

1



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

M1 arrow from within hexagon to C or to + on C

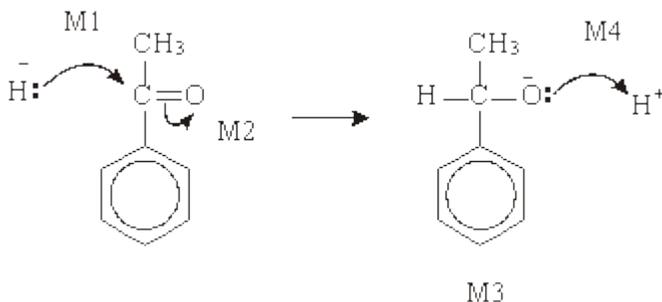
+ must be on C of $\overset{+}{\text{RCO}}$

3

(b) Nucleophilic addition

NOT reduction

1



M2 not allowed independent, but can allow M1 for attack of H- on C+ formed

4

1-phenylethan(-1-)ol or (1-hydroxyethyl)benzene

1

(c) dehydration or elimination

1

(conc) H_2SO_4 or (conc) H_3PO_4

allow dilute and Al_2O_3

Do not allow iron oxides

1

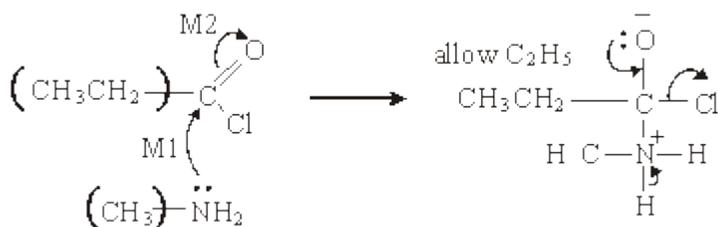
[14]

2

[1]

3

(a) (nucleophilic) addition-elimination;



(M3 for structure)

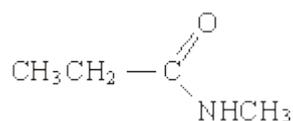
(M4 for 3 arrows and lone pair)

(M2 not allowed independent of M1, but allow M1 for correct attack on C^+ if M2 show as independent first.)

(+on C of $\text{C}=\text{O}$ loses M2 but ignore δ^+ if correct)

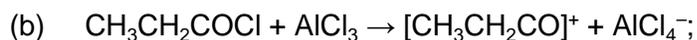
(Cl⁻ removing Ft loses M4)

1



(If MS lost above for wrong C chain, do not penalise same error again here)

5

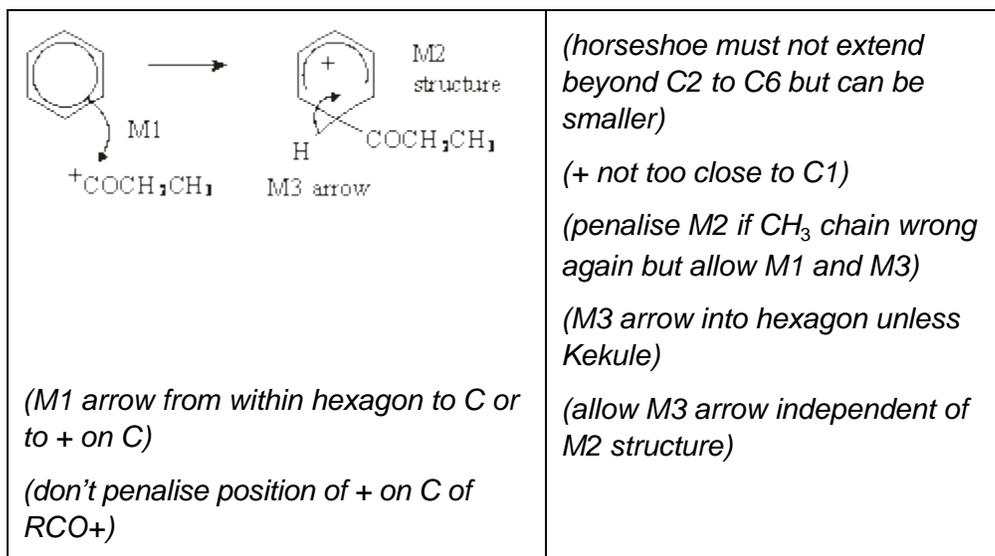


(penalise wrong alkyl group once at first error)

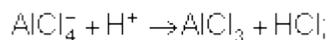
(position of + on electrophile can be on O or C or outside [])

(penalise wrong curly arrow in the equation or lone pair on AlCl_3)

1

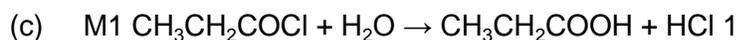


3



(or can be gained in mechanism);

1



(penalise wrong alkyl group once at first error)

1

M2 M_r of $\text{CH}_3\text{CH}_2\text{COCl} = 92.5$ 1

(if M_r wrong, penalise M2 only)

1

M3 moles of $\text{CH}_3\text{CH}_2\text{COCl} = 1.48/92.5 = 0.016$ 1

1

M4 moles $\text{NaOH} = 2 \times 0.016 = 0.032$ 1

(allow for $\times 2$ consequ to wrong no of moles)

1

M5 volume of $\text{NaOH} = 0.032/0.42 = 0.0762 \text{ dm}^3$ or 76.2 cm^3 1

(with correct units)

(if $\times 2$ missed in M4 lose M5 also)

1

[16]

4

[1]

5

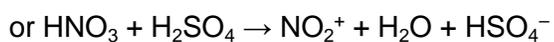
(a) (i) conc HNO₃

1

conc H₂SO₄

allow 1 for both acids if either conc missing

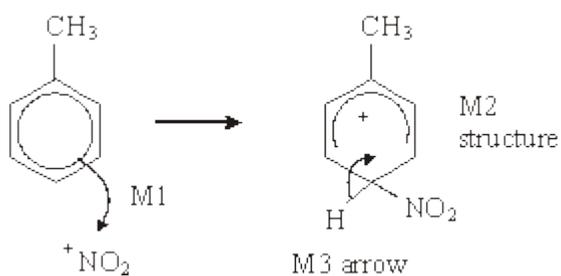
1



1

(iii) electrophilic substitution CH₃

1



horseshoe must not extend beyond C2 to C6 but can be smaller
+ must not be too close to Cl

3

(b) Sn or Fe / HCl (conc or dil or neither)
or Ni / H₂ not NaBH₄ LiAlH₄

1

(c) (i) NH₃

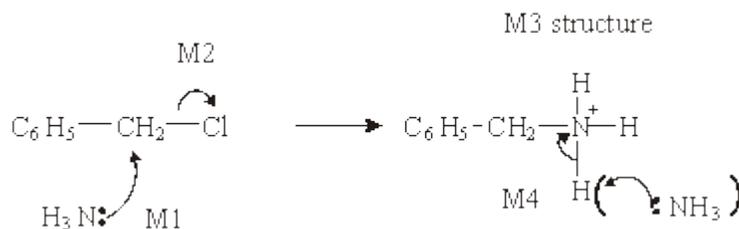
1

Use an excess of ammonia

1

(ii) nucleophilic substitution

1



4

[15]