

Name of the Student: _____

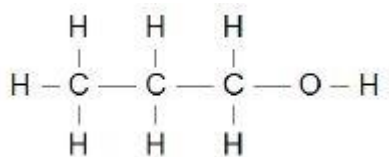
Max. Marks : 22 Marks

Time : 22 Minutes

Mark Schemes

Q1.

(a)

*Must be displayed*

1

(b) Nucleophilic substitution

1

Excess NH₃*Ignore aqueous, alcoholic, conc, dil, temp, heat, pressure*

1

(c) Amount of CH₃CH₂CH₂Br 25.2/122.9 (=0.205) (mol)

M1

Amount of CH₃CH₂CH₂NH₂ M1 × 0.75 (= 0.154) (mol)

M2

Mass CH₃CH₂CH₂NH₂ M2 × 59.0 = 9.07g Must be 3sf

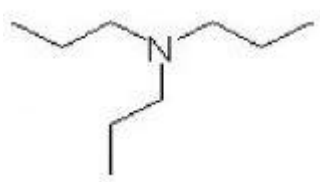
M3

*If either Mr incorrect or used incorrectly then only award 1 mark for 75% yield calculation**(ignore rounding to 123 for CH₃CH₂CH₂Br)*

OR

*Max mass amine = M1 × 59.0 (= 12.1) (g)**Actual mass = M2 × 0.75 = 9.07g Must be 3sf**Allow 9.09 but if 9.08 check for AE**18.9 scores 1 for 75%*

(d)

*Must be skeletal*

tertiary amine or 3° amine (only award if a tertiary amine shown)

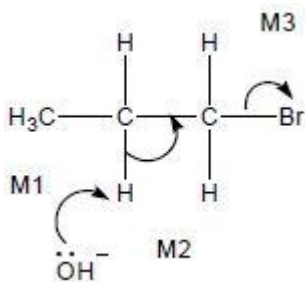
- (e) NaOH/ ethanol or KOH / ethanol (both required)

NOT aqueous

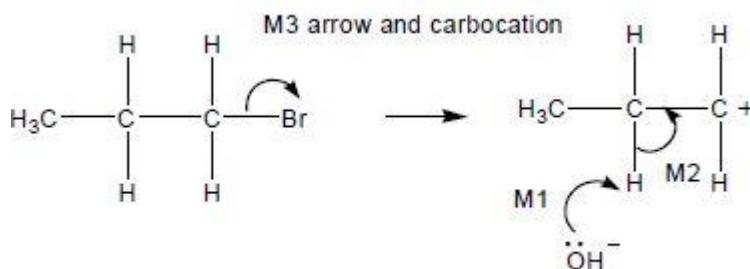
Ignore heat, temp, conc., dil,

Accept alcoholic for ethanol

- (f) (Basic) Elimination



Also credit E1 mechanism



M1 arrow from lone pair on O of hydroxide to correct H (or to space mid way between hydroxide O and H)

M2 arrow from C-H bond to C-C bond following attack by OH⁻ on the correct H

M3 arrow from C-Br bond to Br

If nucleophilic substitution shown then allow M3 only in mechanism

If wrong haloalkane used then Max 2 for mechanism

M3 curly arrow for loss of Br⁻ & structure of carbocation

M1 arrow from lone pair on O of hydroxide to H (or to space mid way between hydroxide O and H) (same as E2)

M2 arrow from C-H bond to C-C bond (same as E2)

Q2.

(a) 7–10.2

any range (i.e. 2 values) within this range

1

(b) $K_a = \frac{[H^+][X^-]}{[HX]}$

ALLOW H_3O^+ for H^+ and A for X

IGNORE $[H^+]^2/[HX]$

must be square brackets

IGNORE state symbols

1

(c) Amount NaOH = $(24.0 \times 0.100)/1000 = 2.40 \times 10^{-3}$ mol

(= amount HX)

Conc HX = $2.40 \times 10^{-3}/0.025 = 0.0960$ mol dm⁻³

ecf for M1/0.025

(d) ($K_a = 2.62 \times 10^{-5} = [H^+]^2/0.0960$)

$[H^+] = \sqrt{(2.62 \times 10^{-5} \times 0.0960)} (= 1.59 \times 10^{-3} \text{ mol dm}^{-3})$

ecf from part (c) $[H^+] = \sqrt{(2.62 \times 10^{-5} \times \text{ans to part (c)})}$

From alternative data

$[H^+] = \sqrt{(2.62 \times 10^{-5} \times 0.600)} (= 3.96 \times 10^{-3} \text{ mol dm}^{-3})$

(pH = $-\log 1.59 \times 10^{-3}$) = 2.80 (must be 2 or more dp)

1

pH = 2.40 (must be 2 or more dp)

M2 dependent on a calculation of $[H^+]$

1

(e) (pH at half-neutralisation = pK_a)

= $-\log 2.62 \times 10^{-5} = 4.58$ (must be 2 or more dp)

ALLOW 1dp if already penalised in part (d)

1

(f) Both points plotted correctly and line touches both points

ecf from (d) and (e) within 1 small square

1

Line steeper at start then levels (to show buffering)

Mark independently

1

[9]