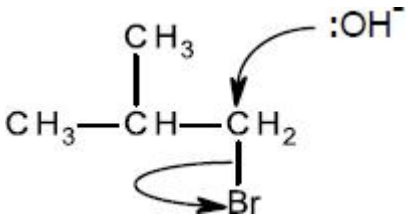
Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Mark Schemes

Q1.

(a) **M1** nucleophilic substitution



*Penalise **M3** for formal charge on C and/or Br of C-Br or incorrect partial charges on C-Br*

*Max 1 out of 2 for **M2** & **M3** for incorrect reactant or product (ignore poorly drawn bond from C to OH group in product if shown)*

For SN^2

*penalise **M2** for any additional arrow(s) on NaOH*

*penalise **M3** for any additional arrow(s) to/from the Br to/from anything else*

1

M2 curly arrow from lone pair on O of OH^- to C of C-Br

1

M3 curly arrow from C-Br bond to the Br

1

If SN^1 mechanism given (loss of Br first followed by attack by OH^-) then:

***M2** curly arrow from C-Br bond to the Br*

***M3** curly arrow from lone pair on O of OH^- to positive C atom of correct carbocation*

*penalise **M2** for any additional arrow(s) to/from the Br to/from anything else*

*penalise **M3** for any additional arrow(s) on NaOH*

*If curly arrows represent an attempt at an elimination mechanism, cannot score **M2** or **M3***

(b) **M1** Amount 1-bromo-2-methylpropane
(= (2 × 1.26) / 136.9 = 2.52/136.9) = 0.0184 mol

Correct answer scores 3 marks; answer to at least 2sf and any individual marks for M1/2 should be at least 2sf; answers that are a factor of 10^x out score 2;

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1

M2 mass of 2-methylpropan-1-ol expected
(= 0.0184 × 74.0) = 1.36 g

Allow ECF through the question

1

M3 % yield = 100 × (0.895/1.36) = 65.7% (65-67%)

1

Alternative method:

M2 *amount of 2-methylpropan-1-ol produced*
= 0.895/74.0 = 0.0121 mol
M3 *% yield = 100 × (0.0121/0.0184) = 65.7% (65 -67%)*

Allow 2 marks for 82.7 -83% (comes from starting with 2 g not 2.52 g), with answers that are a factor of 10^x out from this scoring 1

(c) **M1** methylpropene

M1 *Do not allow any names with numbers for the position of the double bond. Allow 2-methylpropene but no other answer*
Ignore any drawn mechanism

1

M2 elimination

M2 *allow base (or basic) elimination but no other answer*

1

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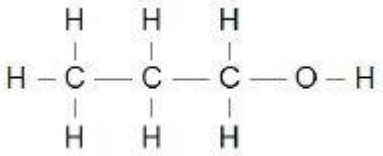
Q2.

(a)



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(b) Nucleophilic substitution

1

Excess NH_3

Ignore aqueous, alcoholic, conc, dil, temp, heat, pressure

1

(c) Amount of $CH_3CH_2CH_2Br$ 25.2/122.9 (=0.205) (mol)

M1

Amount of $CH_3CH_2CH_2NH_2$ M1 × 0.75 (= 0.154) (mol)

M2

Mass $CH_3CH_2CH_2NH_2$ 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 $CH_3CH_2CH_2Br$)

OR

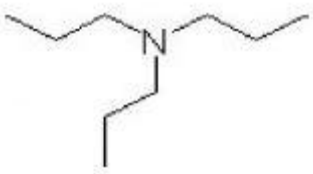
Max mass amine = M1 × 59.0 (= 12.1) (g)

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

Ignore lone pair

1

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

1

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

***NOT** aqueous*

Ignore heat, temp, conc., dil,

Accept alcoholic for ethanol

1

(f) (Basic) Elimination

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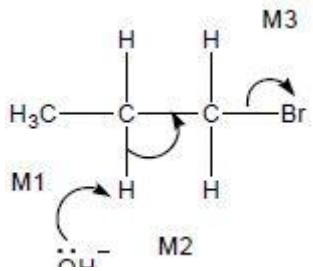
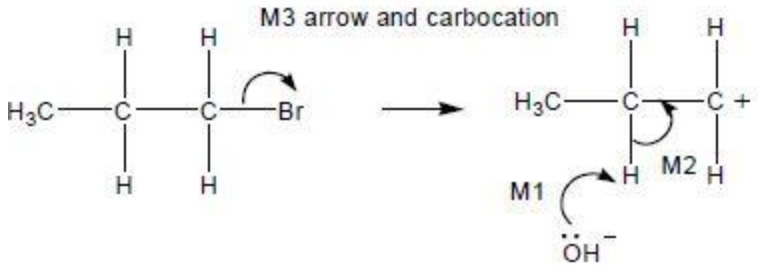


Also credit E1 mechanism



1

M1 arrow from <u>lone pair on O</u> 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 <u>lone pair on O</u> 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)

3

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