Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Halogenoalkanes

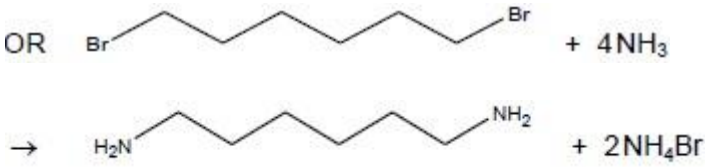
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Name of the Student:_____
Max. Marks : 27 Marks **Time : 27 Minutes**

Mark Schemes

Q1.

(a) $Br\text{-}(CH_2)_6\text{-}Br + 4\ NH_3 \rightarrow H_2N\text{-}(CH_2)_6\text{-}NH_2 + 2\ NH_4Br$

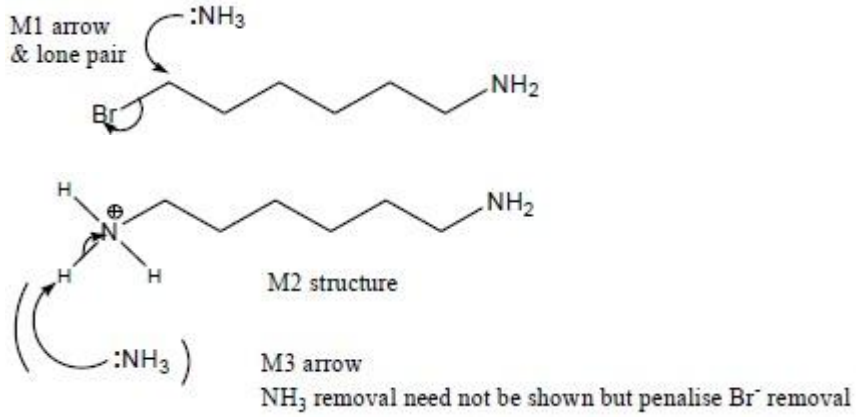
OR 

M1 *both organic compounds correct (not molecular formulae)*

Allow one correct structural formula and the other correct molecular formula of type $XC_6H_{12}X$

M2 *balanced*

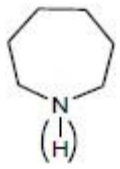
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(b) 

Or with structural formulae, $Br(CH_2)_6NH_2$ *etc*
Allow S_N1
Penalise incorrect partial charges in ***M1***

3

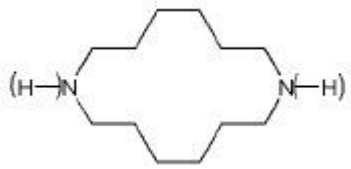
Impurity



(or as structural formula)

Allow

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1

(c) **M1** Stage 1 reagent KCN or NaCN

*Not HCN this loses **M1** and **M2***

*Any mention of acid loses **M1** & **M2***

1

M2 Stage 1 condition aqueous alcohol

***M2** dependent on correct **M1** (allow condition if only CN^- ions)*

1

M3 Stage 2 reagent & condition H_2 and Ni or Pt or Pd

***M3** only accessible if a cyanide is used in stage 1*

1

Allow $LiAlH_4$ (in dry ether) – acidic/aqueous = CE, but allow followed by acid.

NOT $NaBH_4$ NOT Sn/HCl or Fe/HCl

Ignore heat and reflux and pressure

Apply list principle to incorrect reagents/conditions

(d) In 3-aminopentane

Allow converse for ammonia

Lone pair on N more available or Lone pair on N accepts H^+ better

Or greater stability of protonated N

1

because of alkyl electron pushing /inductive effect

Mark independently

1

(e) No carbon (atom is) attached to 4 different groups

Allow central carbon has two alkyl groups

Allow symmetrical molecule

1

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Q2.

(a) 3-chloro-2,4-dimethylpentane

This answer only apart from slips with commas and dashes

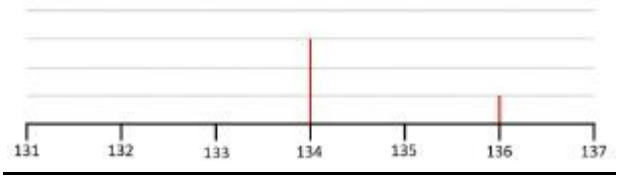
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(b) **M1** lines at 134 and 136

***M1** is for drawing the correct two lines (if other lines are drawn, penalise **M1** (but ignore any additional very small lines at 135 or 137)*

1

M2 line at 134 to be three times higher than line at 136

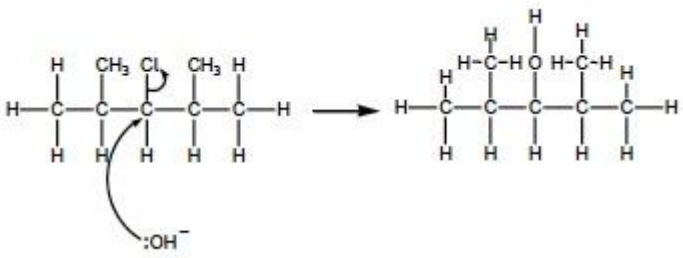


***M2** is for the line at 134 being three times as big as the one at 136 (ignore other lines)*

Accept cross to represent top of lines; if bars drawn – they should be narrow (less than 10% of division) and clear which value they refer to.

1

(c) **M1** nucleophilic substitution



1

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

*For SN2: penalise **M2** for any additional arrow(s) on NaOH, or for covalent NaOH; penalise **M3** for any additional arrow(s) to/from the Cl to/from anything else*

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

1

M3 curly arrow from C–Cl bond to the Cl

*Penalise **M3** for formal charge on C and/or Cl of C–Cl or incorrect partial charges on C– Cl; ignore other partial charges on uncharged atoms*

*For SN2: penalise **M2** for any additional arrow(s) on NaOH, or for covalent NaOH; penalise **M3** for any additional arrow(s) to/from the Cl to/from anything else*

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

If SN1 mechanism given (loss of Cl first followed by attack by OH^-) then:
***M2** curly arrow from C–Cl bond to the Cl*
***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 Cl to/from anything*

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

1

M4 correct structure of alcohol (in any form)

***M4** is independent*

***M4** ignore presence of non-organic products*

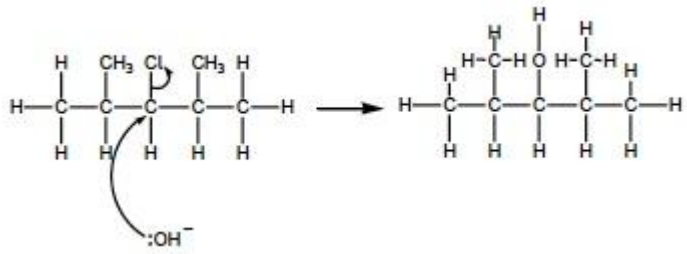
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(d) **M1** elimination

***M1** allow base elimination (but nothing else)*

1

M2 base



***M2** allow proton acceptor*

1

M3 curly arrow from lone pair on O of OH^- to H on one of the C atoms adjacent to the C–Cl

*If curly arrows represent an attempt at a substitution mechanism, cannot score **M3** or **M4***

1

M4 curly arrow from a correct C-H bond adjacent to the C–Cl to a correct C-C bond. Only award if an arrow is shown attacking the H atom of a correct adjacent C-H bond in **M3**

*If curly arrows represent an attempt at a substitution mechanism, cannot score **M3** or **M4***

1

M5 curly arrow from C–Cl bond to the Cl (mark is independent

Penalise M5 for formal charge on C and/or Cl of C–Cl or incorrect partial charges on C–Cl; ignore other partial charges on uncharged atoms

1

M6 correct structure of alkene (in any form)

***M6** is independent*

***M6** ignore presence of non-organic products*

If E1 mechanism given (loss of Cl first followed by attack by OH^-) then:
***M3** curly arrow from C–Cl bond to the Cl*
***M4** curly arrow from lone pair of OH^- to a correct H on the correct C adjacent to C^+ on the carbocation*
***M5** curly arrow from a correct C-H bond to a correct C-C bond*
*penalise **M3** for any additional arrow(s) to/from the Cl to/from anything else*
*penalise **M4** for any additional arrow(s) on KOH*

1

(e) C as C=C 1620-1680 cm^{-1} OR no O-H 3230-3550 cm^{-1}

need the correct compound and an explanation

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full wavenumber range or value(s) within the range

on this occasion candidates do not need to refer to the O-H bond being O-H alcohol as opposed to O-H acid – just reference to O-H with wavenumbers is required

1

(f) C–Br is weaker than C–Cl or

C–Br has lower bond enthalpy than C–Cl or

C–Br breaks more easily C–Cl

Must compare the C–Br and C–Cl bonds specifically

Ignore references to bond length, size of atoms, shielding, electronegativity and polarity

Penalise idea that bromine is more reactive than chlorine

1

[15]

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