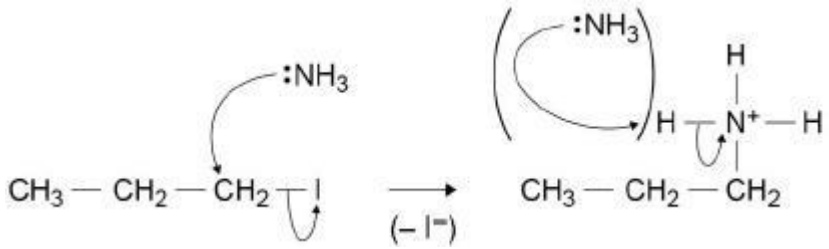
Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Introduction To Organic Chemistry

Name of the Student:_____
Max. Marks : 24 Marks **Time : 24 Minutes**

Mark Schemes

Q1.

(a) **M1** nucleophilic substitution



1

M2 attack by NH_3: arrow from lone pair on N of NH_3 towards C of C-I bond

1

M3 breaking of C-I bond: arrow from C-I bond to I

1

M4 structure of intermediate

1

M5 loss of H^+: arrow from N-H bond to N

1

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

***M4** is independent*

*For **M5** there is no need to show attack by a second NH_3 molecule, but if it is shown, it must be correct (but, if the NH_3 is charged and has been penalised in **M2** (or **M3** for SN1), then do not penalise the same error again in **M5**); penalise removal of H^+ by attack with I^-*

For SN2:

*penalise **M2** for any additional arrow or charge on NH_3;*

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

If SN1 mechanism given (loss of I first followed by attack by NH_3):
***M2** curly arrow from C-I bond to the I*
***M3** curly arrow from lone pair on N of NH_3 to positive C atom of correct carbocation*
*penalise **M2** for any additional arrow(s) to / from the I to / from anything else*
*penalise **M3** for any additional arrow or charge on NH_3*

(b) **M1** amount of 1-iodopropane = $\frac{5.0 \times 1.75}{}$ (= 0.0515 mol)

*Allow ECF from **M1** to **M2** based on an attempt to find the amount of 1-iodopropane in moles using the M_r*

1

M2 number of molecules = **M1** × 6.022×10^{23}

= $3.1(0) - 3.13(144) \times 10^{22}$

***M2** Answer should be standard form (and be at least 2sf)*

1

(c) **M1** amount of propylamine = $\frac{2.3}{59.0}$ (= 0.0390 mol)

AND amount of 1-iodopropane = $\frac{10.3}{169.9}$ (= 0.0606 mol)

*Allow ECF from **M1** to **M2***

1

M2 % yield = $\frac{0.0390}{0.0606} x\ 100$ = 63.9 to 64(.4 %)

Alternative method

***M1** mass of 1-iodopropane = $\frac{10.3 \times 59.0}{169.9}$ (= 3.58 g)*

***M2** % yield = $\frac{2.3}{M1} x\ 100$ = 63.9 to 64(.4 %)*

1

Correct answer scores 2 marks

[9]

Q2.

(a) (for alkenes) elimination

Allow *base elimination*

Not *nucleophilic elimination*

1

(for alcohols) nucleophilic substitution

1

(b) (Different molecules/compounds with the) same (molecular and) structural formula

1

Different spatial arrangement of atoms

Allow *different spatial arrangement of bonds/groups*

1

(c) **A** = but-1-ene

Not *butene*

1

two groups/atoms/Hs the same on one of the C=C carbons

Allow *two groups/atoms/Hs the same on first C*

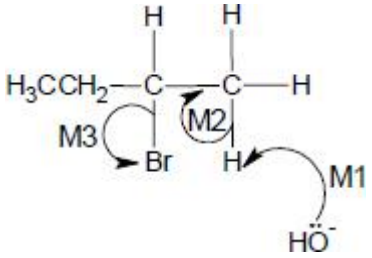
Not *two groups the same on one <u>side</u> of C=C*

Ignore *references to no chiral carbon*

Ignore *'priority' i.e. 2 groups with the same priority… gets M2 for '2 groups the same…'*

1

(d)



If wrong halogenoalkane used then max 2/3

M1 *lone pair on O, negative charge (anywhere) and curly arrow from lone pair to H on carbon 1*

Not *if (covalent) NaOH / additional arrows to or from NaOH / additional arrows to or from Na^+*

1

M2 *curly arrow from C(1)−H to C(1)−C(2)*

M2 *is standalone from* ***M1***

Allow *ecf if H on carbon 3 attacked in* ***M1*** *for curly arrow from C(3)−H to C(2)−C(3)*

Not *as ecf if H on carbon 2 attacked in M1 for curly arrow from C(2)−H*

1

M3 *Curly arrow from C−Br to Br (mark is independent)*

Not *if any additional arrows / incorrect polarity or formal charges on C−Br*

1

Allow *ecf for mechanism to form but-2-ene from (c)*

Allow *E1 mechanism*
M1 curly arrow from C−Br bond to the Br
M2 curly arrow from lone pair on O of OH^- to a correct H on the correct

C adjacent to C^+ on the carbocation
M3 curly arrow from a correct C−H bond to a correct C−C bond
penalise M1 for any additional arrow(s) to/from the Br to/from anything else
penalise M2 for any additional arrow(s) on NaOH

(e) *Z*-but-2-ene **AND** *E*-but-2-ene

Allow *'cis'/'trans' and* ***B*** *and* ***C*** *either way round*

Allow *E/Z but-2-ene, cis/trans but-2-ene*

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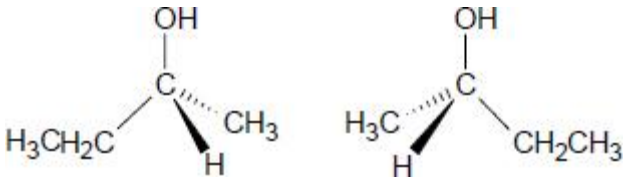
lack of/restricted/no (free) rotation around C=C/double bond

Allow *C=C/double bond cannot rotate*

1

(f)



M1 *any correct 2D or 3D structure of butan-2-ol*

Allow C_2H_5

1

M2 *must show at least one wedge bond and one dash bond in each structure from the chiral C and any bonds* ***in the plane*** *cannot be at 180° to each other*

1

second structure could be drawn as mirror image of first ***or*** *with same orientation of bonds and two groups swapped round*

Allow *ECF for second structure from incorrect first structure, providing molecule is chiral*

(g) Silver iodide then silver bromide then silver chloride

Allow *yellow then cream then white*

Allow *iodide/AgI then bromide/AgBr then chloride/AgCl*

Allow *iodo(butane) then bromo(butane) then chloro(butane)*

Ignore *iodine then bromine then chlorine*

1

bond strength C−I < C−Br < C−Cl

Ignore *incorrect formulae*

Allow *carbon-halogen bond strength decreases down the group / from Cl to I*

1

[15]