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

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Exam Preparation and Free Resources

Name of the Student:_____
Max. Marks : 28 Marks **Time : 28 Minutes**

Mark Schemes

Q1.

D

[1]

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Q2.

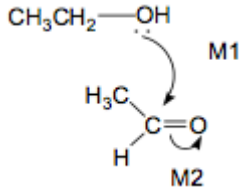
(a) (i) Nucleophilic addition

Any extra loses the mark

Allow minor spelling errors e.g. nucleophyllic

1

(ii)



M1 for arrow from lone pair on oxygen in ethanol to C of C=O (or to space half way between O and C)

M2 for arrow from C=O bond to oxygen in ethanal

Do not allow M2 as first step without nucleophilic attack, but can allow M1 for attack on C+ produced

+ rather than δ+ on C=O loses M2

Ignore any further steps

Mark independently

1
1

(b) (i) Equal mixture of enantiomers/optical isomers OWTTE

1

(ii) (Non-superimposable) mirror images

Ignore rotates light in opposite directions

Ignore stereoisomers

1

(c) (i) Ethan**al** 0.33

1

Ethan**ol** 4.16

Allow 4.2 for ethanol

1

(ii) $K_c = \frac{[acetal][H_2O]}{[CH_3CHO][CH_3CH_2OH]^2}$ or with names

$\frac{(0.37/0.31)(0.65/0.31)}{(0.58/0.31)(3.76/0.31)^2}$ **OR** $\frac{(0.37)(0.65)}{(0.58)(3.76)^2} \times 0.31$

Ignore slips in acetal structure or formula $C_6H_{14}O_2$

If K_c wrong, allow M4 only for units conseq to their K_c

If volume omitted (gives 2.93×10^{-2}) may only score M1 and M4

If volume used = 310 cm^3 allow M2 then award M3 for 9.08 – 9.23 only and M4 for mol^{-1} cm^3 only

Treat error in converting 310 cm^3 to dm^3 as AE

M1
M2

9.1×10^{-3}

Allow range 9.08×10^{-3} – 9.23×10^{-3}

M3

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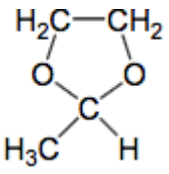
$mol^{-1}dm^3$

Not $moles^{-1}dm^3$

M4

(d) 

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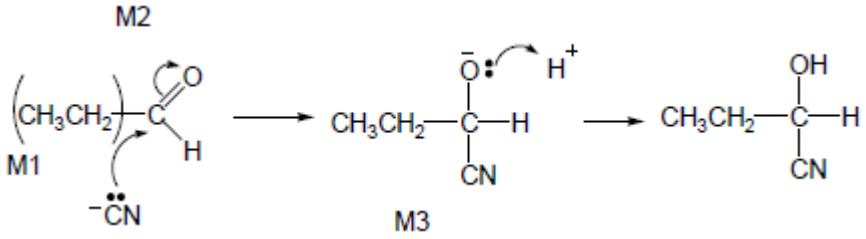
Q3.

(a) Nucleophilic addition

1

M4 for lp, arrow and H+

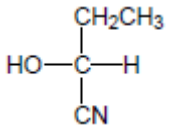


Allow $C_2H_5^-$ for $CH_3CH_2^-$

- *M1 and M4 include lone pair and curly arrow.*
- *Allow: CN^- but arrow must start at lone pair on C.*
- *M2 not allowed independent of M1, but allow M1 for correct attack on C+.*
- *+ rather than δ+ on C=O loses M2.*
- *Penalise incorrect partial charges.*
- *M3 is for correct structure including minus sign but lone pair is part of M4.*
- *Penalise extra curly arrows in M4.*

4

(b) (i) M1



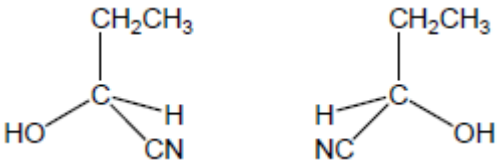
M1 for correct structure of product of part (a).

Allow $C_2H_5^-$ for $CH_3CH_2^-$.

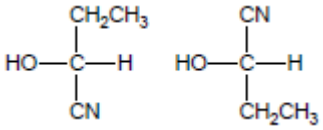
Penalise wrongly bonded, OH or CN or CH_2CH_3 once only in clip.

1

M2



M2 cannot be gained by simply swapping two or more groups with no attempt to show a mirror image., e.g. do not allow M2 for



because these do not <u>show</u> the enantiomers as mirror images.

Students must <u>show</u> an attempt at mirror images, eg allow

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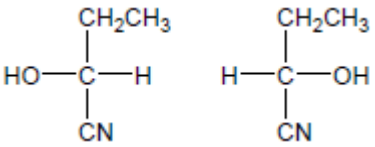
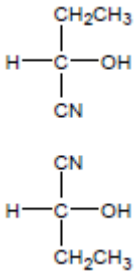


ie vertical groups same and horizontal swapped as if there was a mirror between them

No mirror need be shown

Do not penalize wedge bond when wedge comes into contact with both C & N

However these two could score M2 if placed as below as if with a "mirror" horizontally between them.



1

(ii) M1 (Plane) <u>polarized light</u>

M2 only scores following correct M1

1

M2 or <u>Rotated</u> in <u>opposite</u> directions (equally) (only allow if M1 correct close)

Not just in different directions but allow one rotates light to the left and one to the right.

Not molecules rotate.

1

(c) <u>2-hydroxybutane(-1-)nitrile</u>

1

(d) Weak acid / (acid) only slightly / partially dissociated / ionised

Ignore rate of dissociation.

1

$[CN^-]$ very low

Allow (very) few cyanide ions.

Mark independently.

1

(e) (i) $H_2C{=}CH{-}CH_3 + NH_3 + \frac{3}{2}O_2 \longrightarrow H_2C{=}CH{-}CN + 3H_2O$

OR

$H_2C{=}CH{-}CH_3 + NH_3 + 3O_2 \longrightarrow H_2C{=}CH{-}CN + 3H_2O_2$

OR doubled.

Allow C_3H_6 and CH_2CHCN or C_3H_3N on this occasion only.

1

(ii)

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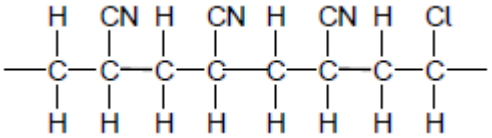
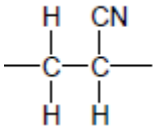
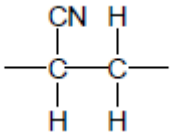
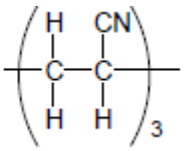


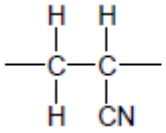
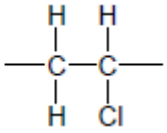
Ignore n.

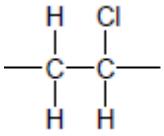
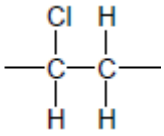
Must show trailing bonds.

Do not penalise C–NC bond here on this occasion.

Must contain, in any order,

3 of  or 3 of  or 

Allow  or 

and one of  or 

Allow –$CH_2CH(CN)CH_2CHCl$– etc.

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(iii) Addition (polymerization)

Allow self-addition.

Do not allow additional.

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