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

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

Mark Schemes

Q1.

(a) **M1** Moles of cyclohexanol = (10 × 0.96)/100.0 = 0.096
Correct answer scores all 3 marks
1

M2 Max mass of cyclohexene = 0.096 × 82.0 = 7.87(2)
= *M1 × 82.0 (process mark)*
1

M3 % yield = (5.97 / 7.87) × 100 = 76% (Allow range 75.8 – 76)
= *(5.97 / M2) × 100 (process mark)*
1

Alternative method

M1 Moles of cyclohexanol = (10 × 0.96)/100.0 = 0.096

M2 Moles of cyclohexene = 5.97/82.0 = 0.0728

M3 % yield = 0.0728 / 0.096 × 100 = 76% (allow range 75.8 – 76)
= *(M2 / M1) × 100*
Allow 1/3 for 62(.2)%

(b) Add bromine (water)
If M1 not correct then only allow M2 if reagent involves bromine (water)
1

Would turn (from orange to) colourless / decolourise
Do not allow incorrect starting colour, but allow brown/red/yellow
Not discolour.
Ignore clear
1

(c) Na_2CO_3 would neutralise/react with/remove (phosphoric) acid/H_3PO_4/H^+
1

(d) avoid pressure build-up / release pressure / release CO_2/air/gas / prevent stopper blowing out
Ignore explosion
Do not allow an incorrect named gas
Allow idea that build-up of gas/CO_2 would lead to increased pressure/stated effect of increased pressure
1

(e) Does not dissolve in/react with the cyclohexene

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Allow remains a solid/is inert in cyclohexene

Allow organic product/organic compound formed/ organic layer/distillate instead of cyclohexene

Do not allow if answer implies cyclohexanol

Do not allow if answer says does not react with products

Ignore references to filtration

Do not allow insoluble/unreactive unless qualified by implied reference to cyclohexene

1

(f) If diagram drawn:

M1 diagram of basic set up to include flask or tube with side-arm/Buchner flask, flat-bottomed funnel/Buchner funnel, filter paper

M2 apparatus should work, flow through, air-tight connection between flask and funnel, arrow/label/description (to vacuum pump)

Do not allow "standard" Y-shaped funnel

1

If description given:

M1 Buchner funnel/flat-bottomed funnel containing filter paper

M2 Buchner flask/side-arm flask connected to vacuum pump

Do not allow just "funnel"

Penalise M2 if described apparatus would not actually work.

1

(g) Cyclohexene is less polar than cyclohexanol / cyclohexanol is more polar than cyclohexene

It = cyclohexene

Allow cyclohexene is non-polar and cyclohexanol is polar

1

Cyclohexene has a greater affinity/attraction for the mobile phase/hexane / cyclohexanol has a greater affinity/attraction for the stationary phase/silica

Allow cyclohexanol held in the stationary phase for longer

Allow cyclohexene is more soluble in the mobile phase/hexane or converse for cyclohexanol

Allow references to hydrogen bonds between cylcohexanol and silica

1

(h) Would be no peak at 3230 – 3550 cm^{-1} due to O—H((alcohol))

OR

There would be no additional peaks in the fingerprint region compared to a pure sample / fingerprint region exactly matches cyclohexene

Need wavenumber and bond for mark

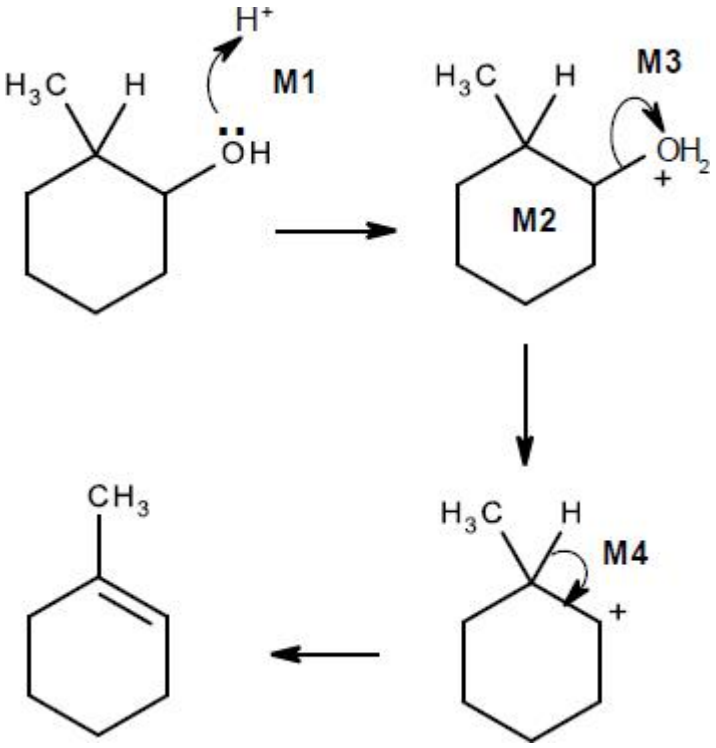
1

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Q2.

(a)



M1 curly arrow from lone pair on O to H^+

1

M2 correct structure of intermediate with + on O

1

M3 curly arrow from C-O bond to O

1

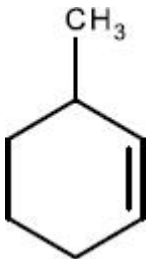
M4 curly arrow from correct C-H bond towards correct C-C <u>bond</u>

1

*Ignore other species that are drawn, but penalise any curly arrows to/from other species for **M1/3/4** as relevant (but allow attack by an anion of phosphoric acid on the H that is lost in **M4** in addition to the arrow specified)*

*for **M2**, the O of the $^+OH_2$ group must be bonded to the ring*

(b)



Any correct structural representation

1

(c) **M1** more stable (carbocation formed)

*For **M1** penalise more stable product*

1

M2 changes from secondary to tertiary (carbocation)

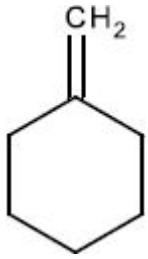
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*For **M2** allow explanation via inductive effect with more alkyl / C groups attached or inductive effect from methyl group as alternatives*

Allow 2^o or 2^y for secondary and 3^o or 3^y for tertiary

1

(d)



Any correct structural representation

1

(e) **M1** cyclohexene : van der Waals' <u>forces</u> (between molecules)

1

M2 cyclohexanol : hydrogen bonds (between molecules)

1

M3 phosphoric acid: hydrogen bonds (between molecules)

1

M4 idea that cyclohexene has weakest forces

1

M5 separated by (simple / fractional) <u>distillation</u>

1

M6 cyclohexene has lowest boiling point / boils off first

Extended response

Maximum of 5 marks for answers which do not refer to the van der Waals forces or hydrogen bonds being between molecules in some way

***M1** penalise reference to presence of other intermolecular forces*

***M1** allow vdW forces (on this occasion)*

***M1/2/3** penalise reference to breaking covalent bonds*

***M2 & M3** ignore reference to van der Waals and/or (permanent) dipole-dipole forces*

***M2** allow use of term H bonds (on this occasion)*

***M4** allow converse argument*

***M4 & M6** – allow correct comparison of cyclohexene forces and boiling point to one of the other two compounds if only one of cyclohexanol or phosphoric acid discussed*

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