

Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Mark Schemes

Q1.

M1 HCl added = 0.050 mol and
 NaOH used in titration = 3.99×10^{-3} mol

1

M2 So moles that would be needed to neutralise total excess
 HCl = $3.99 \times 10^{-3} \times 10 = 3.99 \times 10^{-2}$ mol

Alternative: divide moles HCl by 10 = 0.005 and $0.005 - 3.99 \times 10^{-3} = 0.00101$

1

M3 Therefore the moles of HCl reacted with the $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O} =$
 $0.050 - 3.99 \times 10^{-2} = 0.0101$ mol

Alternative: 0.00101×10 to produce 0.0101

1

M4 So moles $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$ reacted with the HCl = $0.0101 / 2 = 5.05 \times 10^{-3}$ mol

1

M5 Conversion of mg to g = 0.627 (g) or 627×10^{-3} (g)

1

M6 $x\text{H}_2\text{O} = 0.627 / 5.05 \times 10^{-3} - 106.0 = 18$ (.16)

Alternative: mass Na_2CO_3 that reacted with the HCl $5.05 \times 10^{-3} \times 106.0 = 0.5353$ g and mass $\text{H}_2\text{O} = 0.627 - 0.5353 = 0.0917$ g

1

M7 so $x = \underline{1}$

*Alternative: $0.0917 / 18.0 = 5.094 \times 10^{-3}$ so ratio
 Na_2CO_3 to $\text{H}_2\text{O} = 1:1.009$ ie 1:1 so $x = 1$*

1

[7]

Q2.

- (a) **M1** Moles of cyclohexanol = $(10 \times 0.96)/100.0 = 0.096$
Correct answer scores all 3 marks 1
- M2** Max mass of cyclohexene = $0.096 \times 82.0 = 7.87(2)$
 $= M1 \times 82.0$ (process mark) 1
- M3** % yield = $(5.97 / 7.87) \times 100 = 76\%$ (Allow range 75.8 – 76)
 $= (5.97 / M2) \times 100$ (process mark) 1
- Alternative method
- M1** Moles of cyclohexanol = $(10 \times 0.96)/100.0 = 0.096$
- M2** Moles of cyclohexene = $5.97/82.0 = 0.0728$
- M3** % yield = $0.0728 / 0.096 \times 100 = 76\%$ (allow range 75.8 – 76)
 $= (M2 / M1) \times 100$
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/ $\text{H}_3\text{PO}_4/\text{H}^+$ 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
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 cyclohexanol and silica

1

(h) Would be no peak at $3230 - 3550 \text{ cm}^{-1}$ 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

[13]