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Mark Scheme (Results)

Summer 2013

GCSE Chemistry (5CH3H)
Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	B H^+ and Na^+ ions		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	An explanation linking • electron(s) (1) • (have been) lost/removed (1) conditional on electrons	ignore reference to number of electrons do not allow negative charge chlorine gains electrons (0) allow chlorine loses electrons (1)	**(2)**

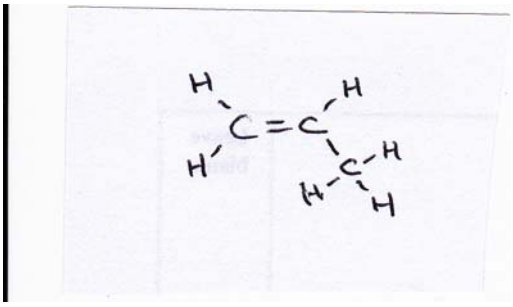
Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	Any one from • it contains (excess) {hydroxide/OH^-} ions (1) • {sodium/Na^+} ions and {hydroxide/ OH^-} ions remain (1) • it is sodium hydroxide/NaOH (1) • {hydrogen/H^+} ions have been removed (at the cathode) (1)	ignore solution has pH greater than 7 allow no hydrogen ions left/acidic **ions** removed	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iv)	use {molten/liquid} {sodium chloride /electrolyte} / melt {it/sodium chloride/electrolyte}	ignore just liquid/liquid sodium	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	An explanation linking Marking point 1 • {hydroxide/OH^-} ions (from water) (1) Marking point 2 • (ions) lose electrons /are oxidised (1)	half equation, even unbalanced, showing hydroxide ions losing electrons (2) do not allow marking point 1 if only {oxygen/sulfate} ions mentioned	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	1.27 / 63.5 (1) (= 0.02)	0.02 with no working (1) correct working with incorrect answer (1)	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	D C_4H_{10}		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	 **one** C=C in a molecule with three consecutive carbon atoms (1) rest of structure correct, ignore bond angles, conditional on first marking point(1)	allow -CH_3 do not allow two C=C in a molecule allow (1) for completely correct dot and cross diagram	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	C oxidised		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	A description including two from • effervescence / fizzing / bubbles of gas (1) • solid {disappears/clears} /(colourless)solution formed (1)	ignore {cloudy/white ppt} /'gas formed'/colour change /name of gas / changes to a liquid (solid/sodium carbonate/it) dissolves (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	$CH_3COOC_2H_5$/$CH_3COOCH_2CH_3$ / $CH_3CO_2C_2H_5$ / $CH_3CO_2CH_2CH_3$ / $C_2H_5O_2CCH_3$ / $CH_3CH_2OOCCH_3$ (1) H_2O (1)	allow displayed formulae/ $C_4H_8O_2$ do not allow formulae ending in –COOH/-COO or any formula that does not show an ester do not allow H2O / H^2O /lower case h/HOH maximum (1) if additional incorrect balancing ignore state symbols	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	$C_2H_4 + H_2O \rightarrow C_2H_5OH$ C_2H_4 as **reactant** (1) rest of equation correct conditional on C_2H_4 as a reactant (1)	do not allow H2O / H^2O /lower case h/HOH allow C_2H_6O for ethanol ignore state symbols	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)	A description including any two from • dissolve sugar in water /sugar solution (1) • (add) yeast (1) • warm / any temperature or range within 15 to 40°C (1) • anaerobic / {no/little} {air/oxygen} can enter the apparatus (1)	allow glucose solution ignore carbohydrate allow room temperature ignore heat unless specified temperature ignore optimum temperature do not allow just 'sealed container' ignore fractional distillation	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation linking Marking point 1 – sugar- one from • sugar obtained from {plants /crops/specific crop} (1) • (plenty of) land available to grow {plants /crops/specific crop} (for fermentation)(1) Marking point 2 - ethene • ethene obtained from {crude oil / fractional distillation /cracking} (1) Marking point 3 – cost/energy – one from • cannot afford to buy crude oil (1) • crude oil is too expensive (1) • more expensive to {use/buy/produce} ethene (1) • cheaper to use fermentation (1)	ignore answers that just repeat the information in the question ignore vague answers such as carbon neutral/environmentally friendly for marking point 1 **OR** 2, allow plants renewable/{crude oil/ethene} non-renewable (1) allow {little/no} {heat/energy} required for fermentation (1) allow {high temperature /high pressure} required for hydration of ethene (1)	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(d)	An explanation including any two from • formulae differ by CH_2 • same general formula • all have {OH/hydroxyl group}	general formula is $C_nH_{2n+1}OH$ (2) allow increase by {CH_2/1 carbon **and** 2 hydrogens} do not allow incorrect general formula allow have similar **chemical** {reactions /properties}/same functional group/OH from an incorrect general formula ignore 'hydroxide'/all end in (an)ol /all alcohols ignore physical properties maximum (1) if hydroxide ions /carboxyl group	**(2)**

Question Number	Answer	Acceptable answers	**Mark**
4 (a)	An explanation linking Marking point 1 – one from • forward and back reactions take place (at the same time) (1) • rate of the forward and back reactions is the same (1) Marking point 2 – one from • no (overall) change in the {amount/concentration/mass/ volume} of each {substance / reactant / product} (1) • no observable change (1)	assume 'both reactions' implies the forward and back reaction allow reversible reaction with the same rate (1) allow reversible reaction in a closed system (1) do not allow the forward reaction equals the reverse reaction allow overall effect is nil (1) allow reactants and products reach a balance (1) ignore forward reaction cancels out back reaction do not allow {amount / concentration /mass/volume} of reactants and products are equal	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	An explanation linking two of • higher pressure favours forward reaction/equilibrium shifts to the right (1) • because decrease in {volume / number of molecules}/side with lower volume (1) • yield increases (1)	ignore answers related to rate/collisions maximum (1) if 3 statements given, but 1 is incorrect	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	An explanation linking any two of • lower temperature favours forward reaction/equilibrium shifts to the right (1) • because (forward) reaction is exothermic (1) • yield increases (1)	ignore answers related to rate/collisions if answer refers to increasing temperature, maximum (1) for (forward) reaction is exothermic / reverse reaction is endothermic maximum (1) if 3 statements given, but 1 is incorrect	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	catalyst	iron	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	3 x 1000 (1) (= 3000)		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	marks are for the working Method 1 14 + (3 x 1) (1) g of NH_3 makes 14 + (4 x 1) + 14 + (3 x 16) (1) g NH_4NO_3 34 g of NH_3 makes $\frac{(14 + (4 \times 1) + 14 + (3 \times 16)) \times 34}{17}$ or $\frac{80 \times 34}{17}$ or 2(14 + (4 x 1) + 14 + (3 x 16)) g NH_4NO_3 (1) = 160 g Method 2 moles of NH_3 = $\frac{34}{17}$ (1) = 2 moles of NH_4NO_3 = moles of NH_3 or relative formula mass NH_4NO_3 = 80 (1) mass NH_4NO_3 = 2 x 80 (1) = 160 g	full marks awarded for an answer of 160 g with or without any working allow ecf on incorrect M_r s for either method allow ecf for incorrect moles eg if moles of NH_3 = 0.5 relative formula mass NH_4NO_3 = 80 (1) mass NH_4NO_3 = 0.5 x 80 (1) = 40 g	**(3)**

Question Number	Answer	Acceptable answers	Mark
5(a)	A neutralisation		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(b)	Any one from • no {sharp/clear/distinct} change in colour • gradual colour change • there are too many different colours	ignore not as accurate/reliable allow too difficult to see when it is {neutral/reaction is complete} ignore speed of colour change	**(1)**

Question Number		Indicative Content	Mark
QWC	***5(c)**	A description including some of the following points **titration experiment** • rinse pipette with alkali and burette with acid • measure alkali using a pipette • into suitable container e.g. flask/beaker • add a few drops of indicator / suitable named indicator (eg methyl orange/phenolphthalein) • flask on a white tile • fill burette with acid • read level/volume (of acid) in burette • add acid from burette to the flask slowly / swirl the flask • until {indicator just changes colour/correct colour change for named indicator (eg methyl orange yellow to peach/orange, phenolphthalein pink to colourless)/solution is neutral} • read level/volume (of acid) in burette • repeat experiment • until concordant results **salt preparation** • mix the same volume of alkali with the volume of acid determined from the first experiment but do not add indicator (or add (activated) charcoal to remove indicator, then filter) • pour solution into an evaporating basin • {heat solution/leave the water to evaporate} until pure salt crystals are left	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of titration and/or salt preparation e.g. add hydrochloric acid to sodium hydroxide solution in a flask, then evaporate the water from solution. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description of titration and/or salt preparation e.g. pipette sodium hydroxide solution into flask, add indicator, place hydrochloric acid in burette, add acid to alkali until colour change. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description including titration **and** salt preparation e.g. pipette sodium hydroxide solution into flask, add indicator, hydrochloric acid in burette, add acid to alkali until colour change, repeat until concordant results, evaporate water. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
5(d)(i)	$\frac{22.6 + 22.8}{2}$ (1) (= 22.7)		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(d)(ii)	marks are for the working no. moles HCl = $\frac{23.2 \times 0.1}{1000}$ (1) (= 2.32×10^{-3}) no. moles NaOH = no. moles HCl (1) conc NaOH = $\frac{2.32 \times 10^{-3} \times 1000}{25.0}$ (1) (= 0.0928 mol dm^{-3}) mark consequentially OR $\frac{\text{no. moles NaOH reacting}}{\text{no. moles HCl reacting}} = \frac{1}{1}$ (1) $\frac{25.0 \times \text{conc}}{23.2 \times 0.1} = \frac{1}{1}$ (1) conc NaOH = $\frac{0.1 \times 23.2}{25.0}$ (1) (= 0.0928) mol dm^{-3} OR use of $c_1v_1 = c_2v_2$ (1) 0.1x 23.2 = conc x 25.0 (1) conc NaOH = $\frac{0.1 \times 23.2}{25.0}$ (1) (= 0.0928) mol dm^{-3}	0.0928/0.093 with or without working (3) 0.09 with no working (2) common incorrect answers with working 0.108/0.1077 (2) – used 1:1 ratio but 25x0.1/23.2 0.928 (2) – used 1:1 ratio but missed out 0.1	**(3)**

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	A carbonate ion CO_3^{2-}		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(a)(ii)	A description including warm / heat / boil (1) {**gas/ammonia**} turns (damp red/pink) litmus blue / (damp red/pink) litmus turns blue when held above (the mixture)(1)	maximum (1) if additional reagents added ignore any ppt allow pungent smell / smell of {ammonia/wet nappies} /alkaline **gas /** effect of ammonia on other named indicators /dense white fumes with conc hydrochloric acid ignore litmus turns blue in ammonium ions/sodium hydroxide/mixture do not allow gas/ammonia if blue litmus turns red/pink	**(2)**

Question Number	Answer	Acceptable answers	Mark
6(b)	$Al^{3+} + 3OH^- \rightarrow Al(OH)_3$ OH^- (1) $Al(OH)_3$ (1) balancing 3, conditional on correct formulae (1)	allow multiples allow HO^- (1) allow $Al(HO)_3$ (1) do not allow $Al(HO)^3$/lower case h ignore state symbols/$3Na^+$ on both sides	**(3)**

Question Number		Indicative Content	Mark
QWC	***6(c)**	An explanation including some of the following points **test for cation** • flame test • if the flame is yellow/not lilac, sodium ions are present • if the flame is lilac/not yellow, potassium ions are present **test for iodide ions** • make a solution of the crystals in water • add dilute nitric acid • add silver nitrate solution • if there is a yellow precipitate, iodide ions are present • if there is no precipitate, sulfate ions are present • $Ag^+ + I^- \rightarrow AgI$ OR • make a solution of the crystals in water • add chlorine water • then cyclohexane • if the cyclohexane/top layer turns purple, iodide ions were present • if there is no colour change, sulfate ions are present • $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$ **test for sulfate ions** • make a solution of the crystals in water • add dilute {hydrochloric/nitric} acid • add barium {chloride/nitrate} solution • if there is a white precipitate, sulfate ions are present • if there is no precipitate, iodide ions are present • $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of test for any 1 ion e.g. flame test, yellow flame, sodium ions are present. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description to identify a cation and an anion e.g. if the substance is sodium sulfate, it will give a yellow flame in a flame test and a white precipitate with barium chloride solution. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description to identify at least 3 ions e.g. carry out a flame test, yellow flame, sodium ions present, lilac flame, potassium ions present, add silver nitrate solution to solution of substance, yellow precipitate, iodide ion. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

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