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Mark Scheme (Results)

January 2015

Pearson Edexcel International Advanced Subsidiary in Chemistry (WCH03) 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.
- 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.

Question Number	Acceptable Answers	Reject	Mark
1(a)(i)	Ammonia / NH_3	Ammonium / NH_4^+	1

Question Number	Acceptable Answers	Reject	Mark
1(a)(ii)	Bromide / Br^- If name and formula are given **both** must be correct	Bromine, Br_2, Br Iodide, I^-, Chloride, Cl^-	1

Question Number	Acceptable Answers	Reject	Mark
1(a)(iii)	Precipitate does **not** dissolve / no change / remains ALLOW Precipitate insoluble/ Precipitate is partially soluble /sparingly soluble TE from (a)(ii) for chloride dissolves / iodide does **not** dissolve	"Resolved" for "dissolved" Precipitate becomes paler/ colour does not change	1

Question Number	Acceptable Answers	Reject	Mark
1(a)(iv)	NH_4Br / $NH_4^+Br^-$ ALLOW correct formula even if charge missing on ion in (ii) TE on incorrect halide anion or halide ion with incorrect negative charge if formula otherwise correct No TE on a formula with a metal cation Ignore name even if incorrect	NH_3Br	1

Question Number	Acceptable Answers	Reject	Mark
1(b)(i)	C=C bonds absent / alkene absent IGNORE "it is an alkane"/ contains C-C/ It is saturated/ is a saturated hydrocarbon	Just "double bonds absent"	1

Question Number	Acceptable Answers	Reject	Mark
1(b)(ii)	(Fumes are)HCl/ hydrogen chloride ALLOW Hydrochloric acid **(1)** (Formula) (-) OH /O-H ALLOW C-OH **(1)**	 OH^- /alcohol/ (-) CH_2OH COOH $C_nH_{2n+1}OH$	2

Question Number	Acceptable Answers	Reject	Mark
1(b)(iii)	Fizzing/ bubbles/ effervescence (of colourless gas)/ (sodium/ it) dissolves/ (sodium/ it) disappears/ **white** solid forms ALLOW **White** precipitate forms **Gas** evolved which pops with a lighted splint/ which ignites IGNORE Gets warmer/ Heat is evolved/ temperature rises/ vigorous reaction Vapour forms Sodium sinks/floats	References to coloured gas or coloured fumes **white** solid disappears / dissolves Just “solution is colourless”	1

Question Number	Acceptable Answers	Reject	Mark
1(b)(iv)	(Identity) Methanol / CH_3OH OR Displayed/skeletal formula **(1)** (Justification) (only) alcohol with M_r = 32 / methanol has M_r = 32 / CH_3OH = 32/ right hand peak has mass 32/ right hand peak has M_r of methanol NOTE Allow mark for any mention of 32 in conjunction with methanol. OR Other use of mass spec data: Peak at *m/e* 15 is for $CH_3(^+)$ **and** 32-15=$OH^{(+)}$ OR 32 – (mass of) OH = $CH_3(^+)$ OR Peak at 31 is for $CH_3O(^+)$/ $CH_2OH(^+)$ IGNORE Negative or missing charges on peaks **(1)** Second mark depends on identification of methanol.	Correct name with wrong formula or vice versa. Highest peak has M_r of methanol Just "Peak at *m/e* 15 is for $CH_3(^+)$ " Peak at 29 is for COH / CHO	2

Total for Question 1 = 10 marks

Question Number	Acceptable Answers	Reject	Mark
2(a)	(Bubble into) lime water / calcium hydroxide (solution) / $Ca(OH)_2$((aq)) **and** Goes cloudy / white precipitate forms / turns milky / turns chalky IGNORE extinguishes a lighted splint	 Goes muddy Turns misty	1

Question Number	Acceptable Answers	Reject	Mark
2(b)	Flask stoppered with connection to apparatus in which gas can be collected. ALLOW Either bung in neck or side arm sealed IGNORE Small gaps between bung and mouth of flask Heater under flask **(1)** Syringe OR inverted burette/ inverted measuring cylinder in trough of water ALLOW Tubes without graduation marks shown if labelled as burette, syringe or measuring cylinder **(1)**	Large gaps in connection to flask / unstoppered flask Delivery tube through wall of trough Burette or measuring cylinder without water (Test) tube without graduation marks	2

Question Number	Acceptable Answers	Reject	Mark
2(c)	(Mol gas = 41/24000 =) 1.7083×10^{-3} / 0.0017083 (mol) Ignore sf except 1sf Ignore lack of units	 Incorrect units	1

Question Number	Acceptable Answers	Reject	Mark
2(d)	Correct answer of **87.8** without working scores 2 Mol XCO_3 = 1.7083 x 10^{-3} **(1)** Mass of 1 mol = (0.15/1.7083 x 10^{-3}) = 87.8 (Use of 1.7 gives mass 88.2 use of 1.71 gives 87.7) Ignore sf except 1 sf **(1)** TE from 2c Ignore lack of units	Incorrect units but do not penalise if already penalised in (c).	2

Question Number	Acceptable Answers	Reject	Mark
2(e)	Relative atomic mass X = (87.8-(12+48)) = 27.8 X = Mg ALLOW Mg^{2+} No mark for identification of Mg **without** relative atomic mass or some working. ALLOW Calculation of atomic mass shown in (d) TE from 2d	Element with no justification. Identification as Sr because 2(d) gives 88	1

Question Number	Acceptable Answers	Reject	Mark
2(f)	(Some) carbon dioxide dissolved in the dilute hydrochloric acid / water ALLOW CO_2 reacts with water Ignore references to standard conditions and faulty apparatus	CO_2 reacts with hydrochloric acid. Impure carbonate Impure acid Incomplete reaction Side reactions	1

Question Number	Acceptable Answers	Reject	Mark
2(g)	No colour/ no change (to flame) ALLOW Colourless flame TE from incorrect Group 2 metal in 2(e): Ca (brick) red/ yellow-red Sr crimson/ (dark) red Ba green	White/ bright light Answers about Mg metal No flame More than one colour given	1

Question Number	Acceptable Answers	Reject	Mark
2(h)	Some sulfates are insoluble/ $BaSO_4$ is insoluble/ Sulfates become less soluble going down group ALLOW A precipitate of the **sulfate** would form IGNORE All group II sulfates are insoluble **(1)** Reaction with acid will be incomplete **(1)** Mark independently.	Carbonates become less soluble going down group Element is insoluble in sulfuric acid. Gases other than carbon dioxide form e.g SO_2. Just "**it** would form a precipitate"	2

Total for Question 2 = 11 marks

Question Number	Acceptable Answers	Reject	Mark
3(a)	(250 cm^3) Volumetric flask / graduated flask	Flat bottom flask Titration flask Measuring flask Measuring cylinder Conical flask Pipette Burette Beaker	1

Question Number	Acceptable Answers	Reject	Mark
3(b)(i)	(From) colourless **(1)** (to) pink **(1)** ALLOW (to) red (to) Combination of pink and red/ permanent pink From pink to colourless scores **(1)**	 to purple Blue to red **loses both marks**	2

Question Number	Acceptable Answers	Reject	Mark
3(b)(ii)	As an indication of when to add drop by drop OR Add slowly when approaching rough value OR Add a significant volume /a stated volume in region 18-23.0 cm^3 of alkali/a volume approaching range finder volume (quickly) **and** then slow down ALLOW It is an indication of when to slow down IGNORE To prevent overshooting Don't use in calculating mean titre The answer should show how the rough titration value is used when carrying out the accurate titration	Just "to get an estimate" It gives an idea of where the end-point is Use as a control Add slowly when reaches rough value	1

Question Number	Acceptable Answers	Reject	Mark
3(b)(iii)	$\frac{(2 \times 0.050 \times 100)}{23.30}$ = (±)0.42918/ 0.4292/0.429 / 0.43/ 0.4 (%)		1

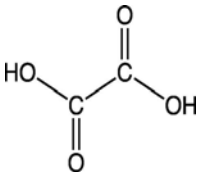
Question Number	Acceptable Answers	Reject	Mark
3(b)(iv)	23.3(0) (cm^3)		1

Question Number	Acceptable Answers	Reject	Mark
3(b)(v)	Mol NaOH = $(23.3 \times 0.1 \times 10^{-3})$ $= 2.33 \times 10^{-3}$ **(1)** Mol H_2A = $\frac{(23.3 \times 0.1 \times 10^{-3})}{2}$ $=1.165 \times 10^{-3}$ / 1.17×10^{-3} **(1)** Ignore sf except 1 sf TE on 3b(iv) Correct answer with no working scores 2		2

Question Number	Acceptable Answers	Reject	Mark
3(b)(vi)	mol acid in 250 cm^3 = 1.165×10^{-2} /0.01165 **(1)** $M_r = 1.05/1.165 \times 10^{-2}$ = 90.129/ 90.1 / 90 Ignore sf **(1)** Give both marks for final answer if some working is shown, even if first marking point is not shown separately. TE from 3b(v) Final answer of **901** because mol acid in 25 cm^3 is used **scores (1)** Using 1.17×10^{-3} gives M_r = 89.7 Using 1.2×10^{-2} gives M_r = 87.5 Using 1.15×10^{-2} gives M_r = 91.3	90 with no working (just deduced from (c)(i))	2

Question Number	Acceptable Answers	Reject	Mark
3(c)(i)	Potassium/ sodium dichromate((VI))/ $K_2Cr_2O_7$ / $Na_2Cr_2O_7$ **and** sulfuric acid/ H_2SO_4 **(1)** IGNORE concentration of acid alcoholic potassium/ sodium dichromate((VI)) (Heat under) reflux **(1)** Mark independently.	Potassium manganate(VII)/ potassium permanganate hydrochloric acid nitric acid Just "heat"	2

Question Number	Acceptable Answers	Reject	Mark
3(c)(ii)	Orange to (dark)green / blue / brown TE if one of the reagents in c(i) is potassium dichromate and the other is not coloured. TE on use of potassium manganate(VII) and sulfuric acid: Purple to colourless No TE on other incorrect reagents		1

Question Number	Acceptable Answers	Reject	Mark
3(c)(iii)	 Allow undisplayed O-H as above or O-H bonds shown. Ignore orientation/ bond angles		1

Total for Question 3 = 14 marks

Question Number	Acceptable Answers	Reject	Mark
4(a)	Bromine / Br_2 **(1)** Redox/ oxidation **(1)** OR sulfur dioxide / SO_2 **(1)** Redox/ reduction **(1)** ALLOW Redox but no product given scores 1 mark Butanal/ butanoic acid and redox / oxidation scores 1 mark	HBr and redox scores 0. Oxidation/ reduction if no product given	2

Question Number	Acceptable Answers	Reject	Mark
4(b)(i)	To ensure condenser is full of water / to prevent an airlock forming/ to stop air bubbles forming / to stop hot spots forming ALLOW To ensure that all of the condenser surface is covered with cold water/ So that (hot) vapour is next to the coolest water first / So the lower region (of the condenser) is colder / Makes cooling more efficient	To prevent back flow of water Just "So that nothing escapes" Just explanation that condensation occurs Makes cooling faster	1

Question Number	Acceptable Answers	Reject	Mark
4(b)(ii)	There would be **escape** of flammable liquid / corrosive spray / corrosive acid (spray) /poisonous gas/ toxic gas/ harmful gas IGNORE Prevents boiling over Very exothermic Any **named** toxic gas is only allowed if it would condense.	Named substance e.g. Br_2 / sulfuric acid without reference to hazard Eg bromine could escape Escape of HBr /SO_2 which are toxic (because they do not condense) Risk of explosion Just "escape of product"	1

Question Number	Acceptable Answers	Reject	Mark
4(c)(i)	(teat) pipette/ syringe (to remove upper aqueous layer) ALLOW decant / description of decanting	To remove lower aqueous layer Add drying agent Add dehydrating agent Just "Use separating funnel" Use a siphon	1

Question Number	Acceptable Answers	Reject	Mark
4(c)(ii)	Separating funnel / tap funnel **(1)** Run off lower layer **(1)** ALLOW pipette off upper layer	Run off lower **aqueous** layer BUT do not penalise if mark in (c)(i) lost for wrong layers. Answers showing candidate is unaware that lower layer is the product	2

Question Number	Acceptable Answers	Reject	Mark
4(d)	To remove / neutralize (excess) acid OR to neutralize unreacted acid OR to remove / neutralize HCl ALLOW To neutralise the solution To remove all the HCl To wash out unreacted acid IGNORE To remove impurities	To **eliminate** HCl Just "to react with acid" To remove/ neutralise H_2SO_4 (and HCl) To remove HBr	1

Question Number	Acceptable Answers	Reject	Mark
4(e)	**Step 8** Dry/ remove water from the bromobutane **(1)** With (anhydrous) calcium chloride / (anhydrous) magnesium sulfate / sodium sulfate/ silica gel ALLOW $CaCl_2$ / $MgSO_4$ / Na_2SO_4 If name and formula are given both must be correct **(1)** **Step 9** (Filter / decant and then) redistil / distil **(1)** If only one step is given accept the answer in **Step 8** or **Step 9** ALLOW Description of drying carried out **after** redistillation max (2)	Dry in an oven/ evaporate to half volume scores 0 for this step. Copper sulfate Concentrated sulphuric acid Calcium hydroxide Metal carbonates Calcium sulfate recondense	3

Question Number	Acceptable Answers	Reject	Mark
4(f)(i)	(7.5 x 0.81) = 6.075 / 6.08 (g) Ignore sf except 1sf	6.07 Wrong units	1

Question Number	Acceptable Answers	Reject	Mark
4(f)(ii)	**Look at final answer.** **67% scores 3 marks; answers with 3sf rounding to 67 score 2 marks.** If this is incorrect follow this scheme: **METHOD 1** Mol butan-1-ol = (6.075/74) = 0.0820945 **(1)** maximum mass 1-bromobutane = (0.0820945 x 137) = 11.246959 g **(1)** % yield = ((7.5/11.24659)x100 = 66.85) =67% to 2 sf **(1)** **OR METHOD 2** 7.5/137 = 0.0547445 mol (bromobutane) **(1)** 6.075/74 = 0.0820945 mol butan-1-ol **(1)** % yield = ((0.05474455)x100/0.0820945) = 66.85) =67% to 2 sf **(1)** Also TE from one step of the calculation to the next and TE on 4f(i) unless yield > 100%. Use of 6.08 gives 0.082161 mol, 11.256216 g bromobutane, final answer 67% 11.3g bromobutane gives 66%.	Percentages calculated from volumes with no conversion to mol or mass. 6.075/7.5 x 100 =81% scores 0 67.0 (This is 3sf)	3

Total for Question 4 = 15 marks

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