Mark Scheme (Results)

October 2017

Pearson Edexcel International
Advanced Level In Chemistry (WCH03)
Paper 01 Chemistry Laboratory Skills I

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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.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication
Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of 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.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Acceptable Answers	Reject	Mark
1(a)(i)	Ammonia/NH_3 (g) ALLOW Amonia If name and formula are given then **both** must be correct	Ammonium NH_4^+	**(1)**

Question Number	Acceptable Answers	Reject	Mark
1(a)(ii)	Ammonium chloride/ NH_4Cl (s) If name and formula are given then **both** must be correct	Ammonia chloride NH_3Cl HCl	**(1)**

Question Number	Acceptable Answers	Reject	Mark
1(b)(i)	Barium chloride / $BaCl_2$ ALLOW Barium nitrate /$Ba(NO_3)_2$ IGNORE State symbols / nitric acid 'to follow' above	BaCl / Ba^{2+}(aq) $BaNO_3$	**(1)**

Question Number	Acceptable Answers	Reject	Mark
1(b)(ii)	White precipitate ALLOW white crystals /solid / ppt / ppte Understandable misspellings such as "percipitate" IGNORE Equation even if incorrect	Just 'turns cloudy'/ White smoke/ White fumes	**(1)**

Question Number	Acceptable Answers	Reject	Mark
1(c)	$(NH_4)_2SO_4$ IGNORE ammonium sulfate	Ammonia sulfate / $(NH_3)_2SO_4$ / NH_3SO_4/ $NH_4(SO_4)_2$/ NH_4SO_4 Ammonium sulfite / $(NH_4)SO_3$	**(1)**

Question Number	Acceptable Answers	Reject	Mark
1(d)	More than one / two / three / four (different) cations give a red colour in the flame test **(1)** These cations could be Lithium/Li^+ **(1)** Strontium/Sr^{2+} **(1)** ALLOW Calcium/Ca^{2+} Rubidium/Rb^+ Penalise element symbols without charge, even if cations are mentioned, once only	Reference to bromine Li/Li^{2+} Sr/Sr^+ Ca/Ca^+ Rb/Rb^{2+}	**(3)**

Question Number	Acceptable Answers	Reject	Mark
1(e)(i)	Solid **Y** contains either bromide / Br^- or chloride / Cl^- (ions) / ppt is either AgBr or AgCl/ AgBr and AgCl both dissolve (in conc. ammonia) ALLOW Solid **Y** does not contain iodide / I^- (ions)	Bromine or chlorine Br / Cl	**(1)**

Question Number	Acceptable Answers	Reject	Mark
1(e)(ii)	The anion is chloride/Cl^- IGNORE AgCl	Chlorine / Cl	**(1)**

Question Number	Acceptable Answers	Reject	Mark
1(e)(iii)	$LiCl$ /$SrCl_2$ ALLOW $CaCl_2$/$RbCl_2$ IGNORE names TE on incorrect cation in (d) TE on incorrect anion in (e)(i) or (e)(ii)		**(1)**

(Total for Question 1 = 11 marks)

Question Number	Acceptable Answers	Reject	Mark
2(a)	The concentration would be less (because the mass of sodium hydroxide would include the water absorbed)	The volume increases Borax absorbs moisture and concentration decreases	**(1)**

Question Number	Acceptable Answers	Reject	Mark
2(b)(i)	9.51 – 9.55 (g) / 9.55 – 9.51 (g) ALLOW 9.53 ± 0.02 (g) / ±0.02 (g)	9.52 – 9.54 (g)	**(1)**

Question Number	Acceptable Answers	Reject	Mark
2(b)(ii)	(n (Borax) = 9.53 ÷ 381.2 =) 0.025 / 2.5 x 10^{-2} (mol) **(1)** c (= 0.025 ÷ 0.5 =) 0.05(00) / 5 x 10^{-2} (mol dm^{-3}) ALLOW TE from incorrect number of moles **(1)** Correct answer with no working scores **(2)** IGNORE SF		**(1)**

Question Number	Acceptable Answers	Reject	Mark
2(b)(iii)	n=(0.05 x 25 / 1 000 =) 1.25 x 10^{-3}/0.00125 (mol) ALLOW TE on (b)(ii) Correct answer with no working scores (1) IGNORE SF		**(1)**

Question Number	Acceptable Answers	Reject	Mark
2(c)(i)	From yellow to orange **Both** colours needed	Yellow to red / Yellow to pink	**(1)**

Question Number	Acceptable Answers	Reject	Mark
2(c)(ii)	Red Accept pink IGNORE shades	Orange Purple Brown Any combination of colours, e.g. red-brown	**(1)**

Question Number	Acceptable Answers	Reject	Mark
2(c)(iii)	**Marking point 1** **(**Multiplication of number of moles by 2) n(NaOH) = 1.25 x 10^{-3} x 2 = 2.50 x 10^{-3} ans to (b)(iii) x 2 **(1)** Method 1 **Marking point 2** **(**Division of number of moles by average titre) (n(NaOH) = n(HCl) so) c=(2.50 x 10^{-3} ÷ 0.01630=) 0.153(374……) mol dm^{-3} **(1)** **Marking point 3** **(**Multiplication of molar concentration by 36.5 and final answer given to 3SF) c= (0.153… x 36.5= 5.5981595….=) = 5.60 (g dm^{-3}) Answer must be to three significant figures **(1)** Method 2 **Marking point 2** **(**Multiplication of number of moles by 36.5) (n(NaOH) = n(HCl) so) m=(2.50 x 10^{-3} x 36.5 =) 0.09125 (g) **(1)** **Marking point 3** **(**Division of mass of moles by average titre and final answer given to 3SF) c= (0.09125 ÷ 0.01630 = 5.5981595….=) = 5.60 (g dm^{-3}) Answer must be to three significant figures **(1)** ALLOW TE on each step Correct answer with no working scores (3)		**(3)**

(Total for Question 2 = 10 marks)

Question Number	Acceptable Answers	Reject	Mark
3(a)(i)	(Wear rubber/plastic/protective) gloves ALLOW Fume cupboard / draught cupboard / (face) masks / fume chamber	Keep windows of lab open Just 'take some nose/mouth protection'	**(1)**

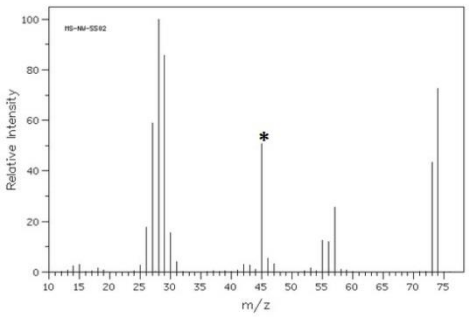
Question Number	Acceptable Answers	Reject	Mark
3(a)(ii)	Solids can be **corrosive** ALLOW Description of **corrosive** nature such as 'burn the skin' IGNORE It is irritant/toxic/poisonous/hazardous OR There is only one **corrosive** hazard label OR **Corrosive** fumes produced on contact with moisture ALLOW HCl is produced on contact with moisture which is **corrosive**	 Just 'HCl is produced' Corrosive HCl produced on contact with W and Z	**(1)**

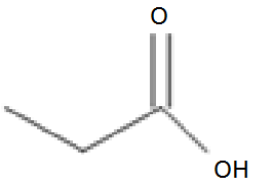
Question Number	Acceptable Answers	Reject	Mark
3(a)(iii)	Steamy/misty fumes ALLOW white fumes IGNORE fizzing/bubbles/effervescence HCl given off	Smoke/ Steamy gas	**(1)**

Question Number	Acceptable Answers	Reject	Mark
3(a)(iv)	Observation mark dependent on correct reagent or near-miss, e.g. penalise Na_2 but then award bubbles (Reagent) sodium / Na **(1)** (Observation) bubble(s)/fizzing/ effervescence IGNORE Hydrogen/gas given off / Na dissolves/ Na disappears/white solid **(1)** OR (Reagent) thionyl chloride / $SOCl_2$ **(1)** (Observation) Steamy/misty fumes ALLOW white fumes IGNORE fizzing/bubbles/effervescence **(1)**	Acidified dichromate(VI) OR Esterification test scores zero PCl_3 / PBr_3 / PI_3 White smoke	**(2)**

Question Number	Acceptable Answers	Reject	Mark
3(b)	Alcohol IGNORE Hydroxy/hydroxyl Primary/secondary/tertiary —OH/ OH	Hydroxide/ OH^-	**(1)**

Question Number	Acceptable Answers	Reject	Mark
3(c)	(2-)methylpropan-2-ol OR $CH_3C(CH_3)(OH)CH_3$ / $(CH_3)_3COH$ Skeletal / displayed formula ALLOW (2-)methylpropane-2-ol IGNORE Punctuation/missing 'l' in methyl If name and formula given then **both** must be correct unless the formula is clearly working by not being on the answer line	(2-)methylprop-2-ol $CH_3CH_3CH_3COH$ C_4H_9OH $C_4H_{10}O$	**(1)**

Question Number	Acceptable Answers	Reject	Mark
3(d)(i)	 ALLOW Any clear indication of the correct peak		**(1)**

Question Number	Acceptable Answers	Reject	Mark
3(d)(ii)	 ACCEPT the OH group to be displayed IGNORE Displayed or structural formula / name Point of attachment of OH Different bond lengths/ orientations	—OOH Missing H on the OH	**(1)**

(Total for Question 3 = 9 marks)

Question Number	Acceptable Answers	Reject	Mark
4(a)	(mass of methanol burned =) 1.6(0) AND (temperature change =) 50.5(0) Ignore sign	 51	**(1)**

Question Number	Acceptable Answers	Reject	Mark
4(b)	(150 x 4.18 x 50.5 =) 31663.5 (J) ALLOW 31.6635 **kJ** IGNORE Sign and SF except 1SF TE on answer to (a)		**(1)**

Question Number	Acceptable Answers	Reject	Mark
4(c)	n(methanol) = (1.6 ÷ 32=) 0.05(0) (mol)		**(1)**

Question Number	Acceptable Answers	Reject	Mark
4(d)	ΔH_c= (31663.5 ÷ 0.05=) 633 270(J) /633.27(kJ) **(1)** $\Delta H_c = -633$ (kJ mol^{-1}) Value must be to the nearest whole number and have the negative sign **(1)** IGNORE SF except 1SF TE on answer to (b) and (c)		**(2)**

Question Number	Acceptable Answers	Reject	Mark
4(e)	Any two from Improvement – Use screens **(1)** Justification – To reduce heat loss **(1)** Improvement – Use a copper calorimeter **(1)** Justification to improve heat conduction (to the water) **(1)** Improvement – Lid (on beaker) ALLOW container or similar for beaker **(1)** Justification - To reduce heat loss ALLOW To prevent evaporation of water **(1)** Improvement – Cap/lid for spirit burner **(1)** Justification - Reduce evaporation (of methanol) **(1)** Improvement – Reweigh spirit burner immediately **(1)** Justification - Reduce evaporation (of methanol) **(1)** No TE for justification on incorrect improvement IGNORE Reference to distance between flame and beaker Reference to frequency of temperature measurements/extrapolation of graphical data Use of magnetic stirrer	Use of flammable material Use insulation / a poly cup e.g. Thermocol to reduce heat loss To reduce heat loss Use less water/ Use oil instead of water Combustion in oxygen	**(4)**

Question Number	Acceptable Answers	Reject	Mark
4(f)	Temperature at the bottom of the beaker would be higher if not stirred and so the enthalpy change would be more negative ALLOW 'The enthalpy change will be greater/larger' for 'enthalpy change would be more negative'	Enthalpy change will be less negative/accurate	**(1)**

Question Number	Acceptable Answers	Reject	Mark
4(g)	Soot/black solid/black powder (deposited on the underside of the beaker) ALLOW Carbon It goes black/the (underside of the) beaker goes black IGNORE Dark solid	Black fumes/ Black smoke/ Black precipitate Black CO	**(1)**

(Total for Question 4 = 11 marks)

Question Number	Acceptable Answers	Reject	Mark
5(a)	Anti-bumping granules/pieces of porcelain or ceramic / boiling stones / glass beads **(1)** Prevents flash boiling/sudden boiling/uncontrolled boiling/ violent boiling/ super heating / localised heating OR Helps to distribute heat/energy more evenly/ help the temperature to be more even/uniform OR Promotes smooth boiling/ promotes even boiling/ OR Promotes small bubble formation/ Prevent large bubbles from forming OR Prevents the liquid mixture shooting out/ splattering/ spurting/ spitting **(1)** IGNORE Prevent bumping/absorb heat / reference to the number of bubbles produced	 Prevent boiling/ Prevent explosion Any reference to affecting rate of reaction Prevent frothing	**(2)**

Question Number	Acceptable Answers	Reject	Mark
5(b)	It is exothermic ALLOW Vigorous IGNORE Violent/Quick reaction	Explosive	**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(c)	The 1-bromobutane / butan-1-ol can escape if the tap is not closed ALLOW Product/reactant/vapour/gas can escape if the tap is not closed IGNORE Entry of air or similar	SO_2 escape/loss HBr escape/loss	**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(d)	Removes acid /reacts with acid /neutralises (acid) ALLOW H^+ for acid/ HBr for acid/ Removes excess acid IGNORE reference to impurities	Neutralise the 1-bromobutane	**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(e)	Use of a separating funnel (to separate off the organic 1-bromobutane layer) ALLOW Diagram of separating funnel **(1)** 1-bromobutane is immiscible (with water)/doesn't dissolve ALLOW Forms two layers/ reference to an upper or lower layer IGNORE References to whether the aqueous layer is the upper or the lower layer/ 1-bromobutane and water have different densities **(1)**	References to filtering	**(2)**

Question Number	Acceptable Answers	Reject	Mark
5(f)	Goes clear/less cloudy IGNORE Colourless		**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(g)	(Re-) distillation / distil (again) ALLOW Fractional distillation	Additional processes such as filtering	**(1)**

(Total for Question 5 = 9 marks)

TOTAL FOR PAPER = 50 MARKS