Mark Scheme (Results)

January 2017

Pearson Edexcel
International Advanced Subsidiary 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.

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	Correct Answer	Reject	Mark
1(a)	(Observation with potassium chloride) lilac / purple / mauve / violet **(1)** (Observation with sodium chloride) yellow / orange **(1)** IGNORE 'Qualifiers' such as bright / pale / persistent	Chlorine gas in addition but only penalise once Any red	**2**

For 1(d) Mark the gases separately from the observations. Deduct a mark for incorrect information, eg in (d) hydrogen chloride and hydrogen would not score M1 (+1 – 1 = 0) but hydrogen bromide, bromine and hydrogen sulfide would score M3. (+2 – 1 = 1)

Question Number	Correct Answer	Reject	Mark
1(b)	(Observation with potassium sulfate) white precipitate / ppt ALLOW white solid / white crystals IGNORE names of precipitate even if incorrect **(1)** (Observation with potassium carbonate) fizzing / bubbles / effervescence / turns limewater cloudy **AND** carbon dioxide / CO_2 IGNORE References to **NO** white precipitate / **NO** white solid / **NO** white crystals **(1)**	**Just** 'turns white' Any bubbles / any named gas / any gas released Any precipitate	**2**

Question Number	Correct Answer	Reject	Mark
1(c)	(Observation with ammonium sulfate) (red litmus paper turns) blue **(1)** STAND ALONE MARK (due to formation of) ammonia / NH_3 **(1)** (Observation with potassium sulfate) No change / no reaction / no observation /litmus paper remains red / no gas evolved / no ammonia / no NH_3 / nothing IGNORE temperature change / dissolves **(1)**	White smoke/ any precipitate Ammonium / NH_4 SO_2/gas evolved/bubbles/ effervescence / any precipitate	**3**

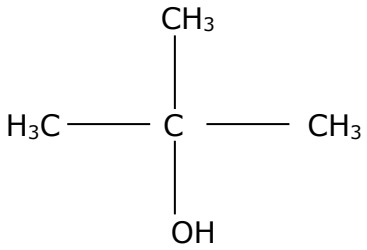
Question Number	Correct Answer	Reject	Mark
1(d)	Mark observations and gases independently (Observation with sodium chloride) **M1:** hydrogen chloride / HCl **(1)** **M2:** Misty / steamy / white fumes OR white smoke **with ammonia** OR damp blue litmus paper red **(1)** **IGNORE** Effervescence throughout (Observation with sodium bromide) **M3:** Bromine / Br_2 **(1)** **M4:** brown (fumes) / orange (fumes) ALLOW Red as a qualifier or red qualified by brown or orange, eg red-brown, orange-red **(1)** OR **M3:** hydrogen bromide / HBr **(1)** **M4:** Misty / steamy / white fumes OR white smoke **with ammonia** OR damp blue litmus paper red **(1)** OR **M3:** SO_2 / sulfur dioxide **(1)** **M4:** (acidified) $K_2Cr_2O_7$ from orange to green / damp blue litmus paper red **(1)**	Chlorine / sulfur dioxide Just white smoke Yellow / green gas Any additional incorrect products e.g. H_2S / S Just 'Red fumes/gas' Coloured fumes eg creamy Hydrogen sulfide / H_2S	**4**

(Total for Question 1 = 11 marks)

Question Number	Correct Answer	Reject	Mark
2(a)	Mark Independently (Test) (dilute) nitric acid / HNO_3 **(1)** (Inference) chlorine / Cl **(1)**	 Conc. HNO_3 Cl^- / 'chloride' / chlorine ion	**2**

Question Number	Correct Answer	Reject	Mark
2(b)	(Test any gas evolved with) (concentrated / dilute) ammonia / NH_3 / $NH_3(g)$ / $NH_3(aq)$ **(1)** (Inference) NH_4Cl **(1)**	NH_4 Ammonium Ammonium chloride NH_3Cl	**2**

Question Number	Correct Answer	Reject	Mark
2(c)	(Observation) stays orange ALLOW does not turn (from orange to) green / no visible change / no colour change **(1)** (Inference) tertiary / 3^o (alcohol) **ALLOW** Recognisable near miss-spelling **(1)**	**Just** 'no reaction' stays yellow	**2**

Question Number	Correct Answer	Reject	Mark
2(d)	 ALLOW Displayed formula / skeletal formula / $(CH_3)_3COH$ / $C(CH_3)_3OH$ / CH_3- rather than H_3C- IGNORE Position of connectivity on vertical bond to OH.	OH-C	**1**

(Total for Question 2 = 7 marks)

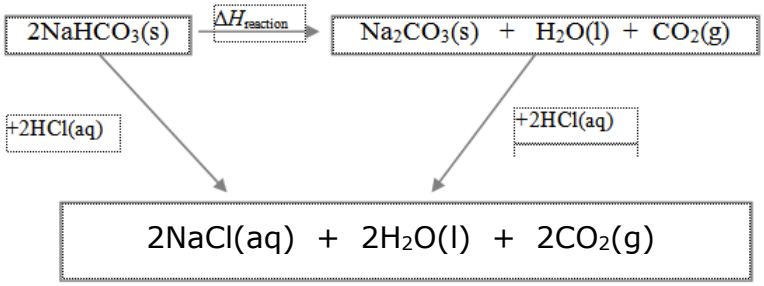
Question Number	Acceptable Answers	Reject	Mark
3(a)(i)	(4.20 ÷ 84.0 =) 0.05(00)		**1**

Question Number	Acceptable Answers	Reject	Mark
3(a)(ii)	(50.0 x 4.18 x 7.0 =) 1463 (J) IGNORE SF except 1 SF	-1463	**1**

Question Number	Acceptable Answers	Reject	Mark
3(a)(iii)	**FIRST, CHECK THE ANSWER ON ANSWER LINE** IF ΔH_1 = **+**29.3 (kJ mol^{-1}) **(3)** **1st mark:** 1463 ÷ 0.05 = 29260 (J mol^{-1}) OR 1.463 ÷ 0.05 = 29.260 (kJ mol^{-1}) TE for answer to (a)(ii) ÷ (a)(i) **(1)** **2nd mark:** Round answer to 3 SF and in kJ mol^{-1} **(1)** **3rd mark:** **+** sign needed for final answer but may be shown before the answer line **(1)**		**3**

Question Number	Acceptable Answers	Reject	Mark
3(b)(i)	Answers may be given in either order: **1st way:** Temperature decreases for $NaHCO_3$ / reaction 1 **and** Temperature increases for Na_2CO_3 / reaction 2 **(1)** **IGNORE** Endothermic (reaction 1) and exothermic (reaction 2) **2nd way:** (Magnitude of) ΔT for $NaHCO_3$ smaller than that for Na_2CO_3 **(1)**		**2**

Question Number	Acceptable Answers	Reject	Mark
3(b)(ii)	No heat / energy lost / gained (to/from the surroundings) OR Reactions go to completion OR S.H.C. of solution / HCl(aq) is the same as that of water /is 4.18 J g^{-1} $^oC^{-1}$ OR Density of solution / HCl(aq) is 1 g cm^{-3} OR Mass solution is 50 g	No transfer losses 100 % purity of chemicals No side reactions / other products formed	**1**

Question Number	Acceptable Answers	Reject	Mark
3(c)(i)	 Correct species and balancing **(1)** Correct state symbols Dependent on all correct species with no extra species **(1)**		**2**

Question Number	Acceptable Answers	Reject	Mark
3(c)(ii)	$\Delta H_{reaction}$ = **2**ΔH_1 – ΔH_2 $\Delta H_{reaction}$ = **2**ΔH_1 + (-ΔH_2)	= ΔH_1 – ΔH_2	**1**

Question Number	Acceptable Answers	Reject	Mark
3(c)(iii)	$\Delta H_{reaction}$ = (2 x +29.3) – (−36.0) = (+) 94.6 (kJ mol^{-1}) ALLOW TE on BOTH value of ΔH_1 previously calculated and the equation given in (c)(ii) If $\Delta H_{reaction}$ = ΔH_1 – ΔH_2 then (+)65.26 (kJ mol^{-1}) scores 1 If ΔH_1 = 29.26 then (+) 94.5 (kJ mol^{-1}) scores 1 IGNORE SF except 1 SF		**1**

(Total for Question 3 = 12 marks)

Question Number	Acceptable Answers	Reject	Mark
4(a)	(From) colourless **(1)** (To) (pale) pink **(1)** ALLOW **(1)** for "pink to colourless"	'clear' for colourless red / purple / magenta red-pink / purple-pink etc.	**2**

Question Number	Acceptable Answers	Reject	Mark
4(b)(i)	Ticks under titres 2 and 3 **(1)** Check answer line first 23.55 (cm^3) **(1)** Allow correct mean for any combination of at least two ticked titres for the second mark	One DP for final answer	**2**

Question Number	Acceptable Answers	Reject	Mark
4(b)(ii)	Shape of the meniscus correctly drawn. Allow any downward arc **(1)** Bottom of 'meniscus' or top of upside down 'meniscus' mid-way between 23.60 and 23.70 **(1)**	V shaped Mercury meniscus Straight line	**2**

Question Number	Acceptable Answers	Reject	Mark
4(c)(i)	$\frac{0.05(00) \times 25(.0)}{1000}$ = 0.00125 / 1.25×10^{-3} (mol) IGNORE SF except 1 SF		**1**

Question Number	Acceptable Answers	Reject	Mark
4(c)(ii)	Answer to (c)(i) x 2 = 0.0025(0)/ 2.5(0) x 10^{-3} (mol) IGNORE SF except 1 SF		**1**

Question Number	Acceptable Answers	Reject	Mark
4(c)(iii)	c(ii) x $\frac{1000}{23.55}$ = 0.106 (mol dm^{-3}) TE on mean titre IGNORE SF except 1 SF		**1**

Question Number	Acceptable Answers	Reject	Mark
4(c)(iv)	Any **TWO** from:- • use white tile or paper as background to burette readings • have eyes level with meniscus (allow any angle that implies reading perpendicular to the scale or level with the meniscus) • measure level at bottom of the meniscus • ensure that the burette is upright / vertical ALLOW • ensure that there are no air bubbles • ensure that the jet is full • remove the funnel from the top of the burette • use a white tile beneath flask • rinse with solution to be used **(2)** Eyes level with the bottom of meniscus scores 2 IGNORE Parallax error	 Just 'at eye level' / perpendicular to burette Lower meniscus Comments regarding the use of the burette during the titration.	**2**

(Total for Question 4 = 11 marks)

Question Number	Acceptable Answers	Reject	Mark
5(a)(i)	Volume = $\frac{\text{mass}}{\text{density}}$ $= \frac{6.24}{0.962}$ (=6.4865) = 6.49 **(1)** Answer **in the correct units** = 6.49 **cm³** **Allow** 6.49×10^{-3} **dm³** **(1)** IGNORE SF except 1 SF M2 dependent on M1 or near miss eg incorrect rounding	cm^{-3}	**2**

Question Number	Acceptable Answers	Reject	Mark
5(a)(ii)	**1st mark – determine moles of cyclohexanol used** M_r ($C_6H_{11}OH$) = 100 and $\frac{6.24}{100}$ = 0.0624 (mol) $C_6H_{11}OH$ **(1)** **2nd mark – maximum mass of cyclohexene that can form** M_r (C_6H_{10}) = 82 and 0.0624 x 82 (= 5.1168) = 5.12 (g) C_6H_{10} **(1)** IGNORE SF except 1 SF Correct answer, with or without working, scores **(2)**		**2**

Question Number	Acceptable Answers	Reject	Mark
5(a)(iii)	1.64 x 100% = 32(.0) / 32.1 % 5.12 (N.B.= 32.051 / 32.1% if use 5.1168 g) CQ on answer to part (a)(ii) IGNORE SF except 1 SF		**1**

Question Number	Acceptable Answers	Reject	Mark
5(b)(i)	(Step 1) (Wash with) sodium hydrogencarbonate / sodium carbonate (solution) **(1)** (Step 2) (Wash with distilled / deionised) water **(1)** (Step 3) (Dry with any suitable drying agent, such as anhydrous) $CaCl_2$ / Na_2SO_4 / $MgSO_4$ / $CaSO_4$ ALLOW Silica gel **(1)**	NaOH Alkaline solution Calcium carbonate Calcium hydroxide Copper sulfate Cobalt chloride Filter paper	**3**

Question Number	Acceptable Answers	Reject	Mark
5(b)(ii)	(Step 4) (Re-)distil(lation) ALLOW Simple distillation / fractional distillation IGNORE References to 'filter' / 'filtration'		**1**

(Total for Question 5 = 9 marks)

TOTAL FOR PAPER: 50 MARKS

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