Pearson Edexcel

Mark Scheme (Results)

Summer 2018

Pearson Edexcel International Advance Level In Chemistry (WCH03) Paper 01 Chemistry Laboratory Skill 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)	**Cations** Any **two** from: (1) mark each Calcium / Ca^{2+} / Strontium / Sr^{2+} / Barium / Ba^{2+} ALLOW Charges written as +2 (2) IGNORE Radium / Ra^{2+} Max (1) if **additional** incorrect species **Anion** Nitrate(V) / NO_3^- ALLOW nitrate (1)	For all marks in (a): If formulae are given, penalise incorrect / missing charges once only in (a)(i) or (a)(iii) If name and formulae are given both must be correct, but just penalise one incorrect answer once only in (a)(i) to (a)(iii)	**(3)**

Question Number	Acceptable Answers	Reject	Mark
1(a)(ii)	(Gas **C**) nitrogen dioxide / nitrogen(IV) oxide / NO_2 ALLOW dinitrogen tetroxide / N_2O_4 (1) (Gas **D**) oxygen / O_2 (1) ALLOW (1) for two correct gases in the wrong order		**(2)**

Question Number	Acceptable Answers	Reject	Mark
1(a)(iii)	Mark independently Flame test ALLOW Description of a flame test (1) **Any two from:** (1) mark each Calcium / Ca^{2+}: brick-red / orange-red / yellow-red ALLOW Just 'red' for calcium if crimson or scarlet used for strontium or if strontium is not identified Strontium / Sr^{2+}: red / crimson /scarlet Barium / Ba^{2+}: (apple) green (2) **Note** If other Group 2 cations identified in (i): ALLOW Magnesium / Mg^{2+} / beryllium / Be^{2+}: no colour Radium / Ra^{2+}: carmine / red IGNORE Shades of colours e.g. pale / bright No TE on ions from other groups	Just 'orange' Yellow-green / blue-green	**(3)**

Question Number	Acceptable Answers	Reject	Mark
1(b)(i)	Anion **B**: Br^- IGNORE bromide	Br / Br_2 / Br_2^- just 'bromine' Iodide / I^- / I	**(1)**

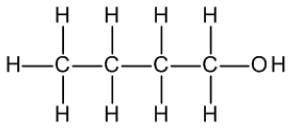
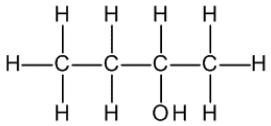
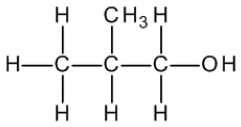
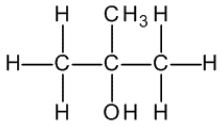
Question Number	Acceptable Answers	Reject	Mark
1(b)(ii)	Gas **E**: Bromine / Br_2	If name and formulae are given penalise one incorrect answer once only in (b)(ii) to (iv) Bromide / Br^- /Br Iodine / I_2 Nitrogen dioxide / NO_2	**(1)**

Question Number	Acceptable Answers	Reject	Mark
1(b)(iii)	Hydrogen bromide / HBr **Note** If iodide identified in (i), ALLOW hydrogen iodide / HI	Hydrogen chloride / HCl	**(1)**

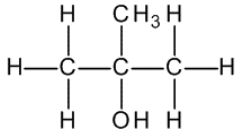
Question Number	Acceptable Answers	Reject	Mark
1(b)(iv)	Sulfur dioxide / sulfur(IV) oxide / SO_2 **Note** If iodide identified in (i), ALLOW hydrogen sulfide / H_2S	Sulphurous acid	**(1)**

(Total for Question 1 = 12 marks)

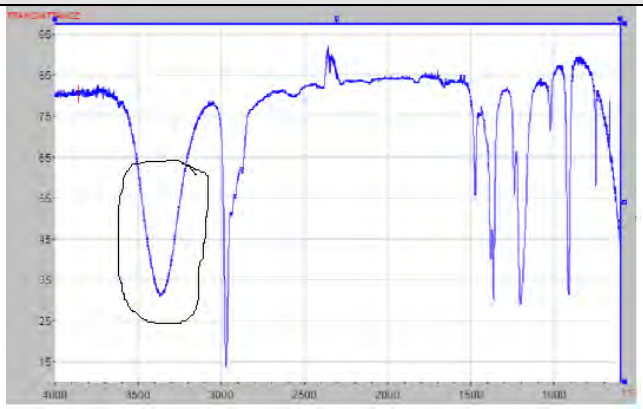
Question Number	Acceptable Answers	Reject	Mark
2(a)(i)	Alcohol ALLOW −OH / OH / O−H / −O−H / hydroxyl / hydroxy IGNORE Alkyl / butanol	OH^- / hydroxide / hydroxylic / carboxylic acid / any other functional group	**(1)**

Question Number	Acceptable Answers	Reject	Mark
2(a)(ii)	 (1)  (1)  (1)  (1) ALLOW Alcohols in any order ALLOW Displayed or structural formulae or any combination of these / skeletal formulae but if more than one type of structure is given, all must be correct IGNORE C−OH connectivity with vertical bonds IGNORE Names even if incorrect	Penalise OH−C on left side of structure / C−HO on right side of structure once only in (a)(ii) and (c) Penalise missing H in C−H bonds once only in (a)(ii) and (c) Penalise missing bond once only in (a)(ii) and (c)	**(4)**

Question Number	Acceptable Answers	Reject	Mark
2(b)	Tertiary (alcohol / hydroxyl) ALLOW 3^{o} / 3^{y} (alcohol / hydroxyl) IGNORE Not primary or secondary alcohol / the OH is attached to a carbon that is attached to 3 other carbon atoms		**(1)**

Question Number	Acceptable Answers	Reject	Mark
2(c)	Stand alone mark  ALLOW Displayed or structural formulae or any combination of these / skeletal formulae ALLOW (2-)methylpropan-2-ol ALLOW Any reference to correct structure drawn in (a)(ii) IGNORE C–OH connectivity with vertical bonds No TE on wrong type of alcohol identified in (b)	Penalise OH–C on left side of structure / C–HO on right side of structure once only in (a)(ii) and (c)	**(1)**

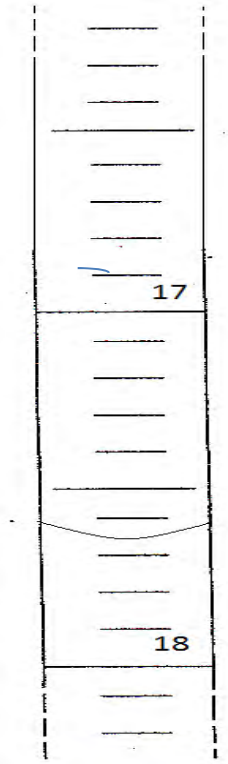
Question Number	Acceptable Answers	Reject	Mark
2(d)(i)	$(CH_3)_3COH + PCl_5 \rightarrow (CH_3)_3CCl + HCl + POCl_3$ ALLOW Displayed, structural or skeletal formulae or any combination of these ALLOW $C(CH_3)_3OH$ / PCl_3O ALLOW $C_4H_9OH + PCl_5 \rightarrow C_4H_9Cl + HCl + POCl_3$ OR $C_4H_{10}O + PCl_5 \rightarrow C_4H_9Cl + HCl + POCl_3$ TE on alcohol in 2(c) IGNORE State symbols even if incorrect	Equation with ROH	**(1)**

Question Number	Acceptable Answers	Reject	Mark
2(d)(ii)	 Correct absorbance circled ALLOW Other ways of identifying the absorbance e.g. label with OH ALLOW All or any part of the absorbance circled	Additional absorbances circled or labelled	**(1)**

(Total for Question 2 = 9 marks)

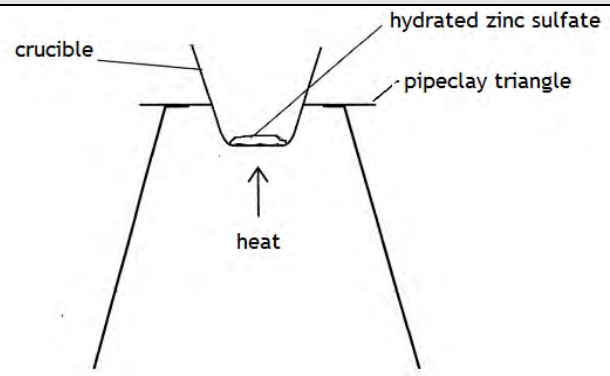
Question Number	Acceptable Answers	Reject	Mark
3(a)(i)	**Pipette** Use of a (25.0 cm^3) pipette (and pipette filler) to transfer sodium hydroxide to a conical flask ALLOW Beaker / flask for conical flask (1) **Mixing** (Add acid to the alkali while) swirling / mixing ALLOW Stirring / shaking (1) **Dropwise** Add (sulfuric) acid drop-by-drop / slowly (until indicator just changes colour) (1) IGNORE Slowly open the tap **End-point** Use of methyl orange/ indicator **and** colour change yellow to peach/orange/ (and read the burette volume) (1) IGNORE Red / pink **Technique - Any one from:** Rinse flask with distilled / deionised water OR Touch tip of pipette onto surface of solution OR Use of white tile / paper OR Add (sulfuric) acid to the sodium hydroxide / alkali / conical flask until a specified volume between 15 and 17.5 cm^3 is added (before adding dropwise) OR Wash drops of solution into flask with distilled / deionised water (1)	Volumetric / standard flask Use of any other indicator Wash flask with NaOH negates any point from the technique mark	**(5)**

Question Number	Acceptable Answers	Reject	Mark
3(a)(ii)	Boxes ticked under 17.55 and 17.65 cm^3 **and** mean titre is 17.60 (cm^3) ALLOW 17.6 (cm^3)		**(1)**

Question Number	Acceptable Answers	Reject	Mark
3(a)(iii)	 Mark independently Bottom of meniscus anywhere between 17.6 and 17.7 (cm^3) ALLOW Any indication of value between 17.6 and 17.7 (cm^3) e.g. an arrow (1) Shape of meniscus ALLOW Any values for top of curve (1)		**(2)**

Question Number	Acceptable Answers	Reject	Mark
3(b)	Stand alone marks **First mark** Repeat the titration using the mean titre but no indicator OR Add 17.6(0) cm^3 / mean titre of (sulfuric) acid to 25(.0) cm^3 of sodium hydroxide / alkali (with no mention of indicator added) ALLOW Quoted value of 17.7 cm^3 (1) **Second mark** (Transfer the mixture to an evaporating basin and) heat the solution to evaporate some / most of the water OR Heat to crystallisation point / saturation point / concentrate the solution OR Leave the solution for the water to evaporate ALLOW Heat the solution until (some) crystals form (1) IGNORE Any reference to filtering / washing crystals / drying by **any** method	Evaporate all water / to dryness	**(2)**

(Total for Question 3 = 10 marks)

Question Number	Acceptable Answers	Reject	Mark
4(a)	 **First mark** Crucible **and** indication of solid in the bottom with labels ALLOW Lid on crucible / Any suitable label for the solid e.g. (zinc sulfate) crystals / (hydrated) zinc sulfate / $ZnSO_4.nH_2O$ / solid ALLOW One missing label e.g. layer of solid drawn in crucible but not labelled (1) **Second mark** Some method of supporting crucible e.g. tripod **and** pipeclay triangle / tripod **and** gauze / retort ring / tongs **and** arrow / heat / Bunsen burner / alcohol burner ALLOW Crucible on a labelled electric heater / hotplate (1)	Distillation apparatus scores (0) Labelled evaporating basin	(2)

Question Number	Acceptable Answers	Reject	Mark
4(b)	(mass of contents after heating / g) 2.04 **and** (mass of water lost / g) 1.41 IGNORE g by numbers		**(1)**

Question Number	Acceptable Answers	Reject	Mark
4(c)(i)	(amount of anhydrous zinc sulfate left) $= \frac{2.04}{161.5}$ = 0.012632 / 0.01263 / 0.0126 / 0.013 (mol) ALLOW 0.0127 from use of 161 TE on mass of contents after heating IGNORE SF except 1SF Correct answer with no working scores (1)	Penalise 1SF in (c)(i)and (c)(ii) once only	**(1)**

Question Number	Acceptable Answers	Reject	Mark
4(c)(ii)	(amount of water lost) $= \frac{1.41}{18}$ = 0.078333/0.07833/0.0783/0.078 (mol) TE on mass of water lost IGNORE SF except 1SF Correct answer with no working scores (1)	Penalise 1SF in (c)(i) and (c)(ii) once only	**(1)**

Question Number	Acceptable Answers	Reject	Mark
4(c)(iii)	(Value of n) $= \frac{0.078333}{0.012632}$ = 6.2014/6.201/6.20/6.2/6 ALLOW other answers based on rounded values used in (c)(i) and (c)(ii) TE on (c)(i) and (c)(ii) IGNORE SF, including 1 SF Correct answer with no working scores (1)	n = 7	**(1)**

Question Number	Acceptable Answers	Reject	Mark
4(d)(i)	Error 1 (Effect on measured mass of water lost) increases / more **and** (Effect on value of n) increases / more (1) Error 2 (Effect on measured mass of water lost) decreases / less **and** (Effect on value of n) decreases / less (1)		**(2)**

Question Number	Acceptable Answers	Reject	Mark
4(d)(ii)	Put a lid on the crucible / use a lid OR Heat more gently / slowly (at start followed by stronger heating) ALLOW Use of a cover (for the crucible) IGNORE Electrical heating / Lift the lid (at intervals) / Use larger crucible / larger crystals / Use fewer crystals / Just 'add a top' Small holes in the lid	Use a stopper on the crucible / seal the crucible Use an evaporating basin / boiling tube / beaker / any other container Add anti-bumping granules	**(1)**

Question Number	Acceptable Answers	Reject	Mark
4(d)(iii)	Heat to constant mass OR Description of heating to constant mass ALLOW Heat to constant weight / do the reaction to constant mass IGNORE Just 'until measurements are the same'/ Heat for a long time / Use of cobalt chloride paper / anhydrous copper sulfate (to test for water vapour)	Add a drying agent	**(1)**

(Total for Question 4 = 10 marks)

Question Number	Acceptable Answers	Reject	Mark
5(a)	Any one from: Promotes smooth boiling/uniform heating OR Prevents localised / uneven / uncontrolled / violent / flash boiling / heating OR Promotes the formation or small bubbles OR Prevents the formation of large bubbles OR Provides nucleation centres / rough surface (for bubble formation) OR Prevents superheating IGNORE Prevents bumping / spitting / explosion / liquid splashing out So the reaction occurs smoothly Prevents vigorous reaction / boiling		**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(b)	An exothermic reaction occurs / reaction releases heat (energy) IGNORE Vigorous/violent reaction / Just 'the temperature increases during the reaction / addition' / Reagents are volatile / Sulfuric acid is corrosive	Reference to explosion / explosive	**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(c)	Ethanol / alcohol is (highly) flammable ALLOW Ethyl ethanoate/ ethanoic acid / organic compounds (highly) flammable OR The flask contains **some** flammable liquids OR To keep the temperature of the flask below 100^{o}C IGNORE To ensure even heating / Just 'it is volatile' Just 'the reactants / products / contents are flammable' / Just 'it / the solution / liquid / mixture is flammable'	Sulfuric acid is flammable Reference to explosion	**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(d)	To prevent the loss / escape of any volatile substances / volatile reactants / volatile products / organic compounds / named organic compound OR To make sure that vapour(s) condense / to prevent vapour escaping ALLOW Gas for vapour ALLOW To increase the yield ALLOW So that the reaction goes to completion IGNORE Answers related to safety / flammability / slow rate of reaction	To prevent evaporation / boiling Any reference to oxidation	**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(e)(i)	Carbon dioxide / CO_2 (gas / (g))		**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(e)(ii)	Hold separating funnel upside down **and** open the tap OR Remove / open the stopper / bung / cork / lid / top of the funnel(from time to time) IGNORE Use of finger instead of stopper	Open the tap without inverting the funnel Remove the stopper while the funnel is inverted	**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(f)(i)	As a drying agent / to dry it ALLOW To remove / absorb water / moisture IGNORE To absorb (unreacted) ethanol	Dehydrating agent	**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(f)(ii)	(Anhydrous) sodium sulfate / Na_2SO_4 / magnesium sulfate / $MgSO_4$ / calcium sulfate / $CaSO_4$ ALLOW Silica gel If name and formula are given, both must be correct IGNORE Mention of dehydrating agent	Copper(II) sulfate Cobalt chloride Sodium / potassium carbonate / Sulfuric acid	**(1)**

Question Number	Acceptable Answers	Reject	Mark
5(g)	Lower number 74 or 75 or 76(ºC) **and** Higher number 78 or 79 or 80(ºC) ALLOW numbers in reverse order e.g. 79-75(ºC)	Any single number	**(1)**

(Total for Question 5 = 9 marks)

TOTAL FOR PAPER = 50 MARKS