GradeMax



Mark Scheme (Results)

Summer 2026

Pearson Edexcel International Advanced Level In Chemistry
WCH16/01

GradeMax

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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.

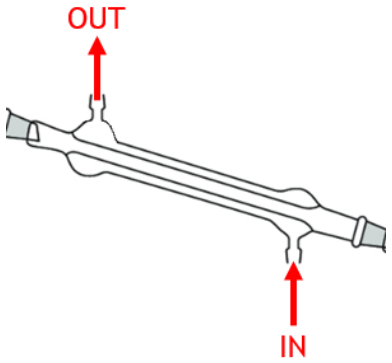
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

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	Answer	Additional Guidance	Mark
1(a)(i)	An answer that makes reference to the following point: • correct arrows in and out	 Accept entering and leaving for labels Allow unlabelled arrows Allow an arrow pointing to outlet rather than showing direction of flow Allow correct labels without arrows Allow one continuous arrow Extra arrows negate the mark	(1)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	An answer that makes reference to the following point: • water / H_2O	Ignore distilled / deionised Do not award steam Do not award additional compounds	(1)

Question Number	Answer	Additional Guidance	Mark
1(a)(iii)	An answer that makes reference to two of the following points: • add sodium carbonate / Na_2CO_3 **(1)** • test gas given off with limewater (it will turn cloudy/milky/white) **(1)**	Accept sodium hydrogen carbonate / $NaHCO_3$ Allow other carbonates/hydrogencarbonates as solids or solutions, by name or formula, but if name and formula given then both must be correct Do not award PCl_5, no TE for M2 Accept effervescence / fizzing / bubbles Accept correct chemical tests such as the addition of zinc/magnesium **(1)** and effervescence / test gas given off with lighted splint (it will give a squeaky pop) **(1)** M2 dependent on M1 or a near miss e.g. unnamed metal, fizzes and gas produces a squeaky pop scores M2 but not M1	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(a)(iv)	An answer that makes reference to the following points: • calculation of M_r and moles of calcium hydroxide **(1)** • calculation of moles of valeric acid **(1)** • calculation of M_r valeric acid **(1)** • calculation of mass of valeric acid **(1)** • calculation of volume of valeric acid **(1)**	<u>Example of calculation:</u> M_r $Ca(OH)_2$ 74.1 n = 2.00 ÷ 74.1 = 0.02699 (mol) n = 0.02699 × 2 = 0.05398 (mol) M_r valeric acid 102 m = 0.05398 × 102 = 5.5061 (g) V = 5.5061 ÷ 0.939 = 5.8638 / 5.9 (cm^3) M5 Do not award 5.8 (cm^3) Ignore SF except 1 SF TE throughout Units when given for the final answer must be correct Correct final answer scores 5	**(5)**

Question Number	Answer	Additional Guidance	Mark
1(a)(v)	An answer that makes reference to the following point: • pentanoic acid	Do not award pentoic acid / pentenoic acid /pentaneoic acid	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	An answer that makes reference to the following points: • bromine (water) / Br_2 **(1)** • decolourises for valerenic acid **and** does not decolourise / no change for valeric acid **(1)**	Apply the list principle for further tests or conditions Ignore $KMnO_4$ Allow turns colourless for valerenic acid Do not award "clear" Stays yellow / orange / brown Allow no reaction M2 is dependent on M1 or a near miss, e.g. Br	**(2)**

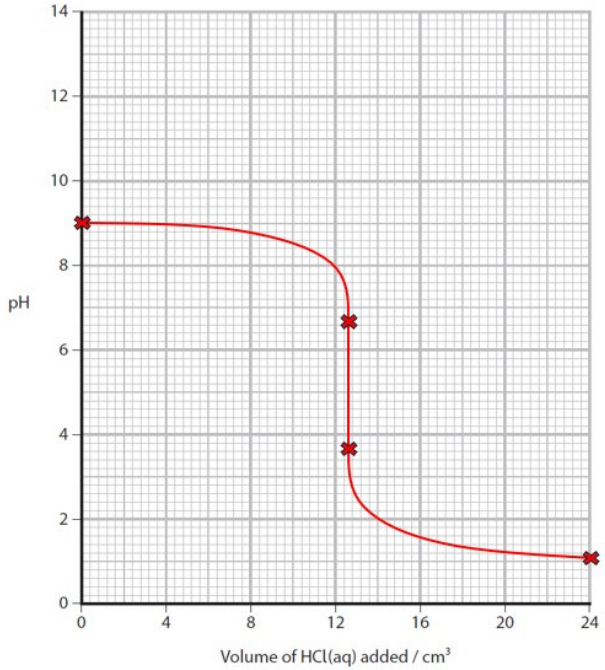
Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	An answer that makes reference to the following points: • lower **(1)** • over a range (of temperatures) **(1)**	Allow reference to a specific value $(120 \leq T\ (°C) < 139)$ Allow over a wider range Allow range will increase Allow "not sharp" Reference to a range of specific temperatures from 120ºC to 138ºC alone scores **(2)** Marks are independent Ignore references to speed of melting Ignore explanations even if incorrect	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	A description that makes reference to the following points: • dissolve in minimum volume of **hot** solvent **(1)** • hot filter to remove insoluble impurities **(1)** • cool **and** recrystallise / crystals form **(1)** • filter with Büchner funnel to remove soluble impurities **(1)** • wash with small volume (and dry) **(1)** **or** wash with cold solvent (and dry)	Marks must be in order Accept ethanol Allow other organic solvents Allow small volume of **hot** solvent Allow minimum amount of **hot** solvent Do not award use of water in M1 only Reference to 'hot' may be given in M1 Award filtering alone if Büchner funnel is mentioned earlier Allow Buchner / Hirsch Allow filter under reduced pressure Ignore extra steps before dissolving in hot solvent No M5 for additional practical steps e.g. add a drying agent (after filtration) or redistillation Ignore drying methods	**(5)**

(Total for Question 1 = 19 marks)

Question Number	Answer	Additional Guidance	Mark
2(a)	• 12.65	Example of calculation (12.70 + 12.60) ÷ 2 = 12.65 (cm^3) Do not award 12.7	**(1)**

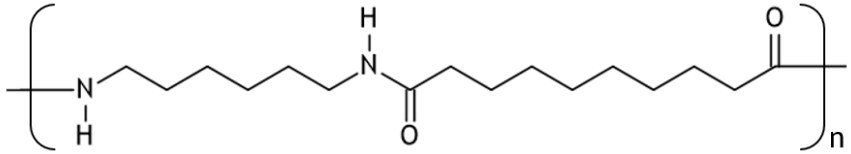
Question Number	Answer	Additional Guidance	Mark
2(b)	An answer that makes reference to the following point: • bromocresol green / methyl red	Allow indicator 5 / 6	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(c)	An answer that makes reference to the following points: • starting pH value of 9 **and** vertical section includes 6.5 to 3.5 **(1)** • vertical line drawn at 12.65 **(1)** • pH 0.7 **(1)** • correct shape of curve **(1)**	Allow tolerance of one small square Allow TE on 2(a) (pH = −log [0.2]) Allow credit for correct calculation if no curve drawn Allow a gently sloping first part that becomes much steeper and then becomes more horizontal – there should be no obvious corners M4 can be awarded independently 	**(4)**

Question Number	Answer	Additional Guidance	Mark
2(d)	An explanation that makes reference to the following points: • the (forward) reaction is endothermic **and** the mean titre/volume is lower (at 4ºC) **(1)** • (because) the equilibrium (position) has moved to the left **(1)**	Accept Δ*H*+ for endothermic Allow backward reaction is exothermic Allow equilibrium moves/shifts left Allow "in the exothermic direction" if M1 is awarded.	**(2)**

(Total for Question 2 = 8 marks)

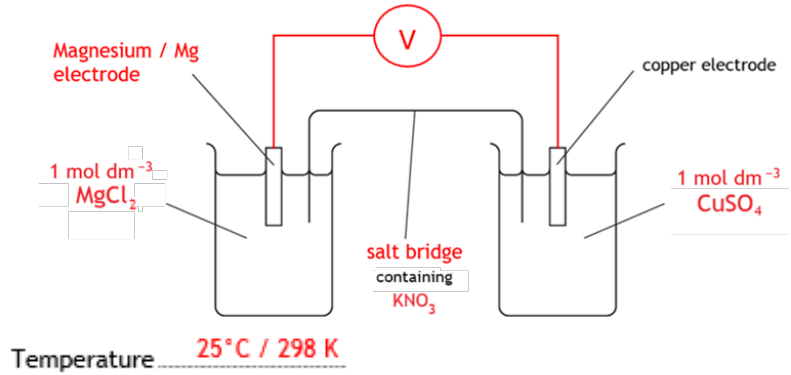
Question Number	Answer	Additional Guidance	Mark
3(a)(i)	An answer that makes reference to the following point: • B / dioyl chloride **and** organic layer is less dense	Accept A **and** the organic layer is more dense Accept B **and** the water is more dense Ignore references to explain density / intermolecular forces even if incorrect	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	An answer that makes reference to the following point: • repeat unit	<u>Example of a diagram:</u>  Accept any type of formula: displayed, shortened structural or skeletal Accept monomers in any order Allow answers without brackets Allow answers without n Ignore bond angles and lengths	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(b)	An answer that makes reference to the following points: • hydrogen chloride is toxic **and** a fume cupboard should be used **(1)** • organic solvent (containing the dioyl chloride) is flammable **and** keep away from sources of ignition **(1)**	Ignore carcinogenic Ignore fumes are toxic Allow use a well-ventilated room Ignore face mask Allow dioyl chloride is flammable Allow gloves should be worn **and** dioyl chloride / diamine is corrosive / reactants/products are corrosive **(1)** Ignore solutions/compounds are corrosive Ignore references to nylon and glass Two precautions without reference to compounds scores 1 Ignore references to toxicity of dioyl chloride / diamine	**(2)**

(Total for Question 3 = 4 marks)

Question Number	Answer	Additional Guidance	Mark
4(a)	An answer that makes reference to the following point: • (+) 2.71 (V)	<u>Example of calculation</u> (+) 0.34 − (−2.37) = (+) 2.71 Ignore working, even if incorrect	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(b)	An answer that makes reference to the following points: • magnesium electrode • 1.00 mol dm^{-3} • $MgSO_4$ • $CuSO_4$ • salt bridge • (containing) KNO_3 • wires connecting electrodes • (high resistance) voltmeter (on wire) • standard temperature 9 points for 6 marks, 8 points for 5 marks, 7 points for 4 marks, 6 points for 3 marks, 4–5 points for 2 marks, 2–3 points for 1 mark, 1 point scores 0	Only needs to be seen once Accept solution of any soluble Mg salt Accept solution of any soluble Cu salt Allow NaCl / $NaNO_3$ Example of diagram:  	**(6)**

Question Number	Answer	Additional Guidance	Mark
4(c)	An answer that makes reference to three of the following points: • Cu^{2+} solution becomes paler / less blue (and no change to the Mg^{2+} solution) **(1)** • copper electrode is larger **(1)** • magnesium electrode is smaller / brighter **(1)** • the voltage will decrease **(1)**	Allow becomes colourless Allow pink layer on Cu electrode Allow build up of solid on Cu electrode Ignore increase in mass Allow gets eroded/pitted Ignore decrease in mass Allow E^{θ}_{cell} / emf decreases Apply the list principle for 3 observations, a 4th observation that is incorrect negates 1 mark (e.g. bubbles, ppts, changes in volume)	**(3)**

(Total for Question 4 = 10 marks)

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr>
<td>5(a)</td>
<td>An answer that makes reference to the following points:

• formula of 3 metal ions

and

each with correct observation (3)</td>
<td>
<table>
<tr><th>Flame colour</th><th>Observation with a few drops of NaOH(aq)</th><th>Formula of metal ion</th><th>Observation with excess NaOH(aq)</th></tr>
<tr><td>lilac</td><td>no reaction</td><td>K^+</td><td>no change</td></tr>
<tr><td>orange-red</td><td>faint white precipitate</td><td>Ca^{2+}</td><td>no visible change / precipitate remains</td></tr>
<tr><td>no colour</td><td>blue precipitate, turning pink on standing</td><td>Co^{2+}</td><td>no visible change / precipitate remains</td></tr>
</table>
Penalise reference to the metal not ion once only

Three correct ions scores 1

Allow “no reaction” for no change
Ignore “no observation”

No change for all three observations alone does not score 1
</td>
<td>(3)</td>
</tr>
</table>

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	An answer that makes reference to the following points: • chromium III / Cr^{3+} **(1)** • nickel II / Ni^{2+} **(1)** • iron II / Fe^{2+} **(1)**	Allow $[Cr(H_2O)_6]^{3+}$ Allow $[Ni(H_2O)_6]^{2+}$ Allow $[Fe(H_2O)_6]^{2+}$ Allow three correct compounds for 2 marks Allow three correct metals with no charges for 1 mark	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	An answer that makes reference to the following points: • Cr^{3+} (ppt) dissolves to give a violet / purple solution **(1)** • Ni^{2+} (ppt) dissolves to give a blue solution **(1)** • Fe^{2+} (ppt) is insoluble **(1)**	Allow TE on correct metals from (b)(i) with incorrect charges or no charges Ignore any precipitate formulae Ignore modifiers of colours Allow no change (but goes brown on standing) Ignore green precipitate (formed) Ignore transition metal complex formulae even if incorrect	**(3)**

(Total for Question 5 = 9 marks)

TOTAL FOR PAPER = 50 MARKS