CAMBRIDGE
International Education

# Cambridge O Level

**CHEMISTRY** **5070/42**

Paper 4 Alternative to Practical **May/June 2026**

MARK SCHEME

Maximum Mark: 40

**Published**

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **13** printed pages.

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**[Turn over**

**General marking principles**

All examiners must apply these marking principles when marking candidate responses.

| | |
|---|---|
| 1 | Examiners must award marks for each response in line with:<br><br>• the specific **content** defined in the mark scheme<br>• the specific **skills** defined in the mark scheme or in the level descriptions<br>• the **standard of response** required as exemplified by the standardisation scripts. |
| 2 | Examiners must award **whole marks** (not half marks, or other fractions). |
| 3 | Examiners must award marks **positively**. This means that:<br><br>• marks are not deducted for errors or omissions<br>• marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate<br>• the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous. |
| 4 | Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly. |
| 5 | Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen. |
| 6 | Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions in mind. |

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**Science-Specific Marking Principles**

| | |
|---|---|
| 1 | Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly. |
| 2 | The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored. |
| 3 | Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection). |
| 4 | The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted. |
| 5 | <u>'List rule' guidance</u><br><br>For questions that require ***n*** responses (e.g. State **two** reasons …):<br><br>• The response should be read as continuous prose, even when numbered answer spaces are provided.<br>• Any response marked *ignore* in the mark scheme should not count towards ***n***.<br>• Incorrect responses should not be awarded credit but will still count towards ***n***.<br>• Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response.<br>• Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science. |

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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient ($a$) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

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## Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

## Annotations

| Annotation | Meaning |
|---|---|
|  | correct point or mark awarded |
|  | incorrect point or mark not awarded |
| A | information missing or insufficient for credit |
| I | incorrect or insufficient point ignored while marking the rest of the response |
| CON | contradiction in response, mark not awarded |
| BOD | benefit of the doubt given |
| ECF | error carried forward applied |
| R | incorrect point or mark not awarded |
| RE | rounding error |

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| Annotation | Meaning |
|---|---|
| SEEN | point has been noted, but no credit has been given<br>or<br>blank page seen |
| SF | error in number of significant figures |
| ✓ 1 | correct awarding one mark from marking point or marking group 1.<br>similar numbered ticks are used for marking point or marking groups 2, 3, 4 etc. |
|  | pages are linked together |
|  | used to highlight part of the response |
|  | key point attempted / working towards marking point / incomplete answer / response seen but not credited / blank page seen |
|  | unclear response |

**Abbreviations used within Mark Scheme**

| Abbreviation | Meaning |
|---|---|
| ECF | error carried forward |
| ORA | Or reverse argument |
| CON | contradiction in response, mark not awarded |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| | Throughout the paper where appropriate an incorrect formula CONS a correct name and vice versa. | | |
| 1(a)(i) | (Liebig) condenser | **1** | **ALLOW** Water condenser<br>**IGNORE** Liebig tube/cooling tube/condensing column/condensation tube/condensater/jacket |
| 1(a)(ii) | (the water) cools (the gas/vapour)/reduces the temperature | **1** | **ALLOW** absorbing heat for cooling<br>**IGNORE** Turns gas into liquid/condenses the gas/vapour<br>**REJECT** Solution/liquid is cooled<br>**REJECT** cooling **water** vapour |
| 1(b) | (Different) boiling point | **1** | **REJECT** similar/same boiling points/boiling point ranges |
| 1(c) | **M1** (collect the first liquid) when the temperature becomes constant/first boiling point reached<br><br>**M2** replace the conical flask<br><br>**M3** collect the next alkane when the temperature is constant again/when its boiling point is reached | **3** | **IGNORE** irrelevant incorrect terminology e.g. collect the filtrate instead of collect the distillate<br>**IGNORE** any names of alkanes/alkenes<br>**IGNORE** fractional distillation<br><br>**M1 ALLOW** fixed temperature for temperature becomes constant/heat to the lowest boiling point/the alkane with the lowest boiling point is distilled first/One with the lowest boiling point is collected first<br><br>**ALLOW** different alkanes in different flasks<br><br>**M3 ALLOW** the process/heating is repeated for the alkane with the next boiling point<br>**M3 ALLOW** the one with the highest boiling point remains in the flask |

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2(a)(i)</td><td>Effervescence/bubbles/fizzing stops/all solid reacted/all solid disappears/no solid remains</td><td>1</td><td>ALLOW The black paper is visible/clearly seen (through the solution)<br>ALLOW calcium carbonate for solid<br>IGNORE solution turns colourless/gas production stops<br>REJECT Black paper no longer visible/precipitate is formed</td></tr>
<tr><td>2(a)(ii)</td><td>M1 both axes labelled with units<br><br>M2 Suitable scale for time using at least half of the grid.<br><br>M3 Points plotted correctly within +/– half a small square.</td><td>3</td><td>M1 ALLOW label for x-axis as volume / $cm^3$ or vol / $cm^3$<br><br>If axes labels are reversed but scales are correct then M2 and M3 can score.<br><br>If axes labels and scales are reversed only M3 can score<br><br>REJECT if each small square has decimal place e.g. 4.6 s or if scale nonlinear.<br><br>M3 ALLOW even if the scale fractional<br>M3 REJECT if scale not linear<br>M3 ALLOW if the line through the points even if the point is not visible<br><br>
<table>
<tr><th>experiment</th><th>volume of B /$cm^3$</th><th>volume of distilled water /$cm^3$</th><th>time taken /s</th></tr>
<tr><td>1</td><td>50</td><td>0</td><td>7</td></tr>
<tr><td>2</td><td>40</td><td>10</td><td>28</td></tr>
<tr><td>3</td><td>35</td><td>15</td><td>56</td></tr>
<tr><td>4</td><td>30</td><td>20</td><td>130</td></tr>
<tr><td>5</td><td>20</td><td>30</td><td>320</td></tr>
</table>
</td></tr>
</table>

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 2(a)(iii) | Appropriate curve of best fit | 1 | **ALLOW** if point at 30 s or other reasonable point is assumed to be an anomaly and not on the line<br>**ALLOW** an S shaped curve if appropriate for incorrectly plotted points<br>**REJECT** if curve goes below the lowest plotted point within +/– half a small square<br>**REJECT** multiple lines at any point on the curve<br>**REJECT** point to point straight lines |
| 2(a)(iv) | Value recorded correctly to +/– half a small square. | 1 | **ALLOW** correct value from any line they have drawn<br>**REJECT** if nonlinear scale and value cannot be determined |
| 2(b) | **Any two sources and linked improvement from:**<br><br>Source: measuring volumes (of water or acid)<br>Improvement: use pipette or burette instead of measuring cylinder<br><br>Source: judging when all solid has reacted/reaction has ended<br>Improvement: collect and measure volume of gas produced instead of solid disappearing/place experiment on a balance/scale(s) (to tell when no further change in mass)<br><br>Source: clumping of solid in flask<br>Improvement: stir/swirl/shake<br><br>Source: Temperature variation<br>Improvement: water bath/other method of ensuring constant temperatures | 4 | **IGNORE** making a mistake/doing it wrong/human error/repeat the experiment/stopwatch reaction time/mass of calcium carbonate/solid/parallax error<br>**IGNORE** where looking/not looking from the top/use of white paper (instead of black)<br><br>**ALLOW** measurement of a given volume e.g. 50 $cm^3$ / (using a) measuring cylinder/volume not precise for source mark<br>**IGNORE** the volume of a substance on its own e.g. the volume of acid there must be some indication of measurement<br><br>**ALLOW** solid/calcium carbonate has different size pieces (source) use powder/grind into a powder (improvement)<br>**IGNORE** it is not stirred for source but<br>**ALLOW** stir/swirl/shake for improvement<br>**ALLOW** insulate the flask for improvement |
| 2(c)(i) | 1.4 mol / $dm^3$ | 1 | |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 2(c)(ii) | **M1** the greater the concentration the greater the rate or reverse argument<br><br>**M2** the less volume of acid used/the more water used the lower the concentration (ORA)<br><br>**M3** the shorter the time the greater the rate (ORA) | 3 | **M1 ALLOW** (directly) proportional<br><br>**M2,M3 IGNORE** comments about collision theory/number of collisions etc<br>**M2,M3 IGNORE** time taken decreases as volume of **B** increases as this is just a statement from the table<br><br>**M2 ALLOW** rate decreases as volume of hydrochloric acid decreases (ORA)<br><br>**M3 ALLOW** time decreases as concentration increases (ORA) |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 3(a)(i) | **M1** solid spitting out of tube<br><br>**M2** keep flame moving/warm gently/pointing tube away from people/wear safety goggles | 2 | **M1 IGNORE** tube breaking<br><br>**M2 ALLOW** slowly/low intensity flame for heat gently<br>**M2 ALLOW** glass wool/cotton wool at the end of the tube<br>**M2 IGNORE** gloves/burning hands/mask/other protective clothing<br><br>**ALLOW M1** gas produced may be harmful/irritant/toxic<br>**M2** well-ventilated room/use fume cupboard<br>Goggles does not score if the hazard is toxic/harmful |
| 3(a)(ii) | Bunsen (burner) | 1 | **ALLOW** spirit burner/electric heater/heat mantle<br>**IGNORE** water bath/burner on its own |
| 3(a)(iii) | **M1** Solid/ **C** (may contain) a transition metal (ion)<br><br>**M2** Solid/ **C** (may contain) water (of crystallisation)/**C** is hydrated/**C** becomes anhydrous/**C** loses water when heated | 2 | **M1 ALLOW C** decomposes when heated/transitional metal<br>**M1 REJECT** It **is a** transition element/metal<br><br>**M2 ALLOW** an **aqueous** solution is formed/**C** becomes **aqueous** |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 3(a)(iv) | **M1** red litmus turns blue<br>**M2** blue litmus does not change /no change/stays the same<br>**M3** Solid contains ammonium/$NH_4^+$ (ions) | 3 | **M1 REJECT** bleaches<br><br>**ALLOW M3** independent of **M1** and **M2**<br>**REJECT** Ammonia/$NH_3$ ions |
| 3(b)(i) | Use universal indicator | 1 | **ALLOW** pH indicator/pH paper/pH test strip<br>**IGNORE** pH chart/pH meter/pH stick<br>**REJECT** Methyl orange/litmus etc. |
| 3(b)(ii) | Correct colour change for the indicator stated in **3(b)(i)** e.g. (Universal indicator) turns red/orange | 1 | **ECF from 3(b)(i) ALLOW** correct colour from indicator used (thymolphthalein and phenolphthalein – colourless, methyl orange - pink/red, litmus – red).<br>**ALLOW** red/orange if the indicator is not named<br><br>**REJECT** if a different indicator used in **3(b)(ii)** than in **3(b)(i)**<br>**REJECT** yellow<br>**REJECT** precipitate |
| 3(b)(iii) | **M1** Red-brown precipitate.<br><br>**M2** Insoluble in excess | 2 | **M1** Red-brown does not score unless linked to precipitate/solid<br>**REJECT** red or brown on their own<br><br>**M2 ALLOW** (Precipitate) is unchanged/does not dissolve in excess<br>**M2 ALLOW** independent of **M1** i.e. if wrong colour precipitate for **M1** then insoluble can score **M2**, if no precipitate mentioned then **M1** does not score but remains insoluble scores **M2**<br><br>**IGNORE** turning brown at the surface<br>**IGNORE** use of ammonia instead of sodium hydroxide |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 3(b)(iv) | Yellow solution makes the white precipitate look yellow | 1 | **ALLOW** the solution is yellow/aqueous **C** is yellow<br><br>Use **CON** for other incorrect answers e.g. the solution is yellow because the reaction is incomplete does not score for yellow solution |
| 3(b)(v) | Sulfate ions/$SO_4^{2-}$ | 1 | **REJECT** if more than one ion |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 4 | Apparatus<br>• Uses a burette **and** pipette.<br><br>Method<br>**Any four from:**<br>• Adds dilute hydrochloric acid to aqueous ammonia (ORA).<br>• Suggests a named suitable indicator<br>• The acid is added to the aqueous ammonia until indicator/it changes colour (ORA).<br>• Takes an initial and final burette reading.<br>• Repeats **and** takes an average (of concordant results) with **same sample** of ammonia<br>**OR**<br>adds acid dropwise **and** swirling/mixing/stirring.<br>• Repeats with the other two samples of aqueous ammonia.<br><br>Conclusion<br><br>If acid is in the burette<br>The cleaner which needs the highest volume of acid is the most effective/has the highest concentration (ORA).<br>**OR**<br>if ammonia is in the burette<br>The cleaner which needs the lowest volume of ammonia is the most effective/has the highest concentration (ORA). | **6** | **ALLOW** Do an acid-base/acid-alkali titration/titrate acid against alkali/titrate acid against base/titrate hydrochloric acid against ammonia/titrate ammonia against hydrochloric acid.<br>**ALLOW** Litmus<br>**REJECT** Universal indicator<br>If the colour changes are given, they must be correct for the chosen indicator<br>**IGNORE** end point<br>**ALLOW** records/calculates the volume of acid/ammonia used<br>**IGNORE** adding acid/alkali slowly<br>**DO NOT ALLOW** the repeat mark if it is only repeated without the indicator.<br><br>Conclusion must be linked to volume/amount not just concentration |

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