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# Mark Scheme (Results)

# Summer 2016

Pearson Edexcel International GCSE
in Chemistry (4CH0) Paper 2CR

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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.

| Question number | | | Answer | Notes | Marks |
|---|---|---|---|---|---|
| 1 | a | | A    (the crystal dissolves) | | 1 |
| | b | | A    (it is all blue) | | 1 |
| | c | i | 4 | | 1 |
| | | ii | 21 | | 1 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 2 a | **M1** oxygen / air<br><br>**M2** water (vapour) / moisture | **ACCEPT** $O_2$ but not O<br><br>**ACCEPT** $H_2O$<br>**IGNORE** steam | 2 |
| b | (hydrated) iron(III) oxide | **ACCEPT** iron oxide / ferric oxide<br>**REJECT** ferrous oxide and iron with other oxidation numbers<br>**IGNORE** iron trioxide<br><br>**ACCEPT** $Fe_2O_3(.xH_2O)$<br>**IGNORE** all other formulae<br><br>If both name and formula given mark name only | 1 |
| c | **M1** (galvanising) — bucket / car body / railway bridge<br><br>**M2** (oiling) — bicycle chain / car engine<br><br>**M3** (painting) — car body / railway bridge | **DO NOT AWARD M3** for car body/railway bridge if already scored for **M1** | 3 |
| d | **M1** zinc corrodes/oxidises/reacts in preference to iron<br><br>**M2** (because) zinc is more reactive than iron / zinc (atoms) lose electrons more readily (than do iron atoms) | **REJECT** zinc rusts<br>**IGNORE** reference to sacrificial protection<br>**ACCEPT** for **M1** zinc atoms react with iron(II) ions<br><br>**ACCEPT** for **M2** iron(II) ions are converted to iron atoms | 2 |

| Question number | | | Answer | Notes | Marks |
|---|---|---|---|---|---|
| 3 | a | | C      (nitrogen) | | 1 |
| | b | | A      (argon) | | 1 |
| | c | | **M1** (formula)   CuO <br><br> **M2** (colour)    black | **ACCEPT** correct formula as a **product** of an equation. The equation need not be balanced <br>**IGNORE** names <br><br> **IGNORE** brown <br>**REJECT** all other colours | 2 |
| | d | i | C      (dilute hydrochloric acid) | | 1 |
| | | ii | A      (calcium carbonate) | | 1 |
| | | iii | in a (gas) syringe / downward delivery in air | **ALLOW** downward delivery | 1 |
| | e | i | $CO_2(\mathbf{g}) + Ca(OH)_2(\mathbf{aq}) \rightarrow CaCO_3(\mathbf{s}) + H_2O(\mathbf{l})$ | **ACCEPT** upper case letters <br>**IGNORE** words | 1 |
| | e | ii | white precipitate forms / liquid goes milky/cloudy | **ACCEPT** usual alternatives for precipitate | 1 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 4 a |  | **M1** both bungs inserted AND electrodes connected to battery<br><br>**M2** both tubes inverted over electrodes<br><br>**M3** solution placed in the voltameter and labelled as potassium chloride / KCl(aq)<br><br>For **M3**, ignore all three liquid levels, except that the level in the voltameter must be above the bottoms of both tubes if present | 3 |
| b | <table><tr><th>Polarity</th><th>Equation</th></tr><tr><td>–(ve)</td><td>(2H₂O + 2e⁻ → H₂ + 2OH⁻)</td></tr><tr><td>+(ve)</td><td>2Cl⁻ → Cl₂ + 2e⁽⁻⁾</td></tr></table> | **M1** for $2Cl^- \rightarrow Cl_2 + 2e^{(-)}$<br><br>**ACCEPT** $2Cl^- - 2e^{(-)} \rightarrow Cl_2$<br><br>**M2** for –(ve) in top row **AND** +(ve) in bottom row<br>**ACCEPT** negative and positive<br>**IGNORE** cathode and anode | 2 |
| c | burns with a pop / squeak<br><br>OR<br><br>use burning/lit spill / use flame to see if pop/squeak | Must be reference to test and result<br>Reference to spill/match with no indication of flame is not enough<br>**ACCEPT** splint for spill<br>**REJECT** reference to glowing spill/splint<br>Ignore flame extinguished<br>'Squeaky pop test' alone is not sufficient | 1 |

| Question number | Answer | | | | | Notes | Marks |
|---|---|---|---|---|---|---|---|
| 5 a i | | | | | | **M1** for 19 protons in top row AND atomic number of 19 | 3 |
| | Atomic number | Mass number | Number of protons | Number of neutrons | | **M2** for 20 neutrons in top row | |
| | | | 19 | 20 | | **M3** for mass number of 41 | |
| | 19 | 41 | | | | | |
| ii | **M1** $(6 \times 0.074) + (7 \times 0.926)$ | | | | | **ACCEPT** $\dfrac{(6 \times 7.4) + (7 \times 92.6)}{100}$ | 2 |
| | **M2** $= 6.9$ | | | | | Answer must be to 1 dp<br>Correct final answer without working scores 2 marks | |
| b | any two from<br><br>• effervescence/fizzing/bubbles<br><br><br>• potassium moves/darts/floats<br><br>• potassium leaves white trail<br><br>• potassium forms into a ball<br><br>• potassium becomes smaller/disappears<br><br>• (lilac) flame | | | | | **ACCEPT** (hydrogen) gas given off/evolved/formed/produced<br>**IGNORE** name of gas<br><br><br><br><br>**ACCEPT** melts<br><br>**ACCEPT** dissolves<br><br>**IGNOR**E colour of flame / explodes | 2 |

| Question number | | | Answer | Notes | Marks |
|---|---|---|---|---|---|
| 5 | c | i | pink | **ALLOW** red<br>**IGNORE** purple | 1 |
| | | ii | OH⁻ / HO⁻ | | 1 |
| | d | | **M1** potassium loses its outer/valence electron more easily/readily<br><br>**M2** because it is further from (the attraction of) nucleus (and therefore less strongly attracted to the nucleus) | **IGNORE** references to more shells / larger atomic radius / more shielding / more screening<br><br>**ACCEPT** reverse arguments as long as it is clear that lithium is being considered | 2 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 6  a | **M1**  twice as much/more carbon dioxide removed (per mole reacted)<br><br>**M2**  produces oxygen (for breathing) | <br><br>**ACCEPT** reverse arguments for both **M1** and **M2** eg lithium hydroxide removes less $CO_2$<br>    and does not produce oxygen scores 2<br><br>**IGNORE** references to the need to remove water in reaction 1 | 2 |
| b  i | **M1**  $n(CO_2) = \dfrac{100}{44}$ OR 2.27(27....) (mol)<br><br>**M2**  $n(LiOH)$ = answer to **M1** x 2 OR 4.54(54.....) (mol)<br><br>**M3**  $m(LiOH)$ = (answer to **M3** x 24) = 110 (g)<br><br>**OR**<br><br>**M1**  48 (g) reacts with 44 (g)<br><br>**M2**  x (g) reacts with 100 (g)<br><br>**M3**  x = 110 (g) | **ACCEPT** any number of sig figs except one eg 109 / 109.1 / 109.09 / 109.0909........<br><br>Award 3 marks for correct final answer without working<br><br>108.96 (from 2.27) scores 3 marks<br>110.4 (from 2.3) scores 3 marks | 3 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 6 b ii | **M1** $n(Li_2O_2) = \dfrac{100}{46} = 2.17(3913.....)$ mol $(= nCO_2)$<br><br>**M2** volume of $CO_2$ = answer to **M1** × 24 000<br><br>**M3** = 52 000 (cm$^3$) | **ACCEPT** any number of sig figs except one eg 52 170, 52 174, 52 173.9, etc<br><br>Award 3 marks for correct final answer without working<br><br>52 080 (from 2.17) scores 3 marks<br>52 800/53 000 (from 2.2) scores 3 marks | 3 |

| Question number | | | Answer | Notes | Marks |
|---|---|---|---|---|---|
| 7 | a | | **M1** (step 1) nitric acid<br><br>**M2** (step 2) magnesium carbonate is insoluble / magnesium carbonate does not form a solution<br><br><br><br>**M3** (step 3) boiling off all the water (will not produce a hydrated salt) | **ACCEPT** sulfuric acid should be used<br><br>**REJECT** the use of reagents that would not work, eg magnesium chloride | 3 |
| 7 | b | i | | **M1** (after) | 23.80 | | If both readings are correct but in the wrong order, award 1 mark for **M1** and **M2**<br><br>**M3** CQ on the values given for **M1** and **M2**<br><br>Penalise missing trailing zeros once only | **3** |

| | | | **M1** (after) | 23.80 |
| | | | **M2** (before) | 2.15 |
| | | | **M3** (volume added) | 21.65 |

| Question number | | | Answer | Notes | Marks |
|---|---|---|---|---|---|
| | b | ii | **M1** (the calculated) volume will be higher<br><br>**M2** because it includes the air (contained in the tip of the burette)<br><br>**M2** dep on **M1** | | **2** |

| | | | | | |
|---|---|---|---|---|---|
| c | i | ticks in columns 2 and 4 | | | 1 |
| | ii | **M1**    $\dfrac{26.45 + 26.25}{2}$ | CQ on any combination of ticked results<br><br>If no results are ticked then **M1** can only be awarded if the values from columns 2 and 4 are averaged<br><br>If only one column ticked then no marks can be awarded in (c)(ii) | 2 | |
| | | **M2**    26.35 (cm$^3$) | CQ on results averaged<br>Answers should be to 2dp, except trailing zero not needed<br><br>Correct final answer without working scores 2 | | |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 7 d | **M1** heat/boil until crystals form in a sample of solution that has been removed (and cooled) | **ACCEPT** heat/boil to produce a (hot) saturated/concentrated solution<br>**ACCEPT** heat until crystals start/begin to form<br>**ALLOW** (heat/boil to) evaporate some of the water<br>**ALLOW** heat/boil to crystallisation point<br>**IGNORE** references to filtering before heating | 3 |
| | **M2** leave (the solution) to cool (so that crystals form) | **M2** dep on **M1** | |
| | **M3** filter (to obtain crystals)<br><br>**AND**<br><br>suitable method of drying crystals | **ACCEPT** decant/pour off the liquid/(excess)solution for filter<br><br>eg place in (warm) oven / leave to dry (in warm place) / use filter paper / use kitchen towel<br>**REJECT** any reference to heating directly with a flame, eg with a Bunsen<br>**IGNORE** reference to washing crystals<br><br>**M3** dep on **M1**<br><br>If **M1** not scored then award 1 mark out of 3 for leaving the solution until the water evaporates fully | |