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# Mark Scheme (Results)

## Summer 2015

## 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.

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>1 a</td><td><table><tr><td>Number of protons</td><td>6</td></tr><tr><td>Number of neutrons</td><td>6</td></tr><tr><td>Number of electrons</td><td>6</td></tr></table></td><td>M1 protons and electrons correct<br><br>M2 neutrons correct</td><td>2</td></tr>
<tr><td>b i</td><td>3</td><td></td><td>1</td></tr>
<tr><td>ii</td><td>M1 33<br><br>M2 Z is two places/columns/groups/positions after X<br>OR<br>Z is in Group 5 and X is in Group 3</td><td>Accept has 2 more protons (than X)<br><br>Ignore references to atomic number increasing by 2<br>Ignore number of protons increases with group number<br>Ignore references to elements being arranged according to number of protons<br><br>31 + 5 – 3 = 33 scores 2 marks</td><td>2</td></tr>
<tr><td>iii</td><td>2.8 / 2,8 / 2 and 8 separated by other mark<br>eg : or / or ) or space</td><td>Do not accept 28 (ie no space)<br>Accept correct sp notation</td><td>1</td></tr>
</table>

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 1 b iv | M1 (similarity)<br>one electron/same number of electrons in outer shell<br><br>M2 (difference)<br>different number of (electron) shells<br>/ T has (one) more (electron) shell<br>/ J has (one) less (electron) shell<br>/J has 2 shells and T has 3<br>/J is 2.8.1 | Accept rings and energy levels in place of shells in M1 and M2<br><br>Accept valence electrons in place of outer shell electrons<br>Accept configuration ends in 1<br>Accept same outer shell<br>Accept 2 electrons in first/inner shell<br><br>Accept going down the column there is 1 more shell<br>Ignore T has an extra number<br>Ignore T has 8 more electrons | 2 |
| | | | |
| | | | **Total 8 marks** |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 2 a i | C ($C_2H_4$) | | 1 |
| ii | B (colourless) | | 1 |
| iii | A (dehydration) | | 1 |
| b i | cracking | | 1 |
| ii | (to act as a) catalyst<br>OR<br>to increase rate / speed up reaction | Accept (to provide an alternative route with) lower activation energy<br>Accept decomposition / cracking in place of reaction | 1 |
| iii | cracking produces 2 or more products<br>OR<br>other products are formed<br>OR<br>identified possible product<br>OR<br>not all decane decomposed<br>OR<br>water vapour present (not just water) | Accept molecules / hydrocarbons /alkanes / alkenes in place of products<br>Accept any hydrogen and any hydrocarbon with 8 or fewer carbon atoms (name or formula)<br>Ignore decane decomposes / decane contains impurities<br>Ignore references to air / oxygen / nitrogen / carbon dioxide<br>Accept equation for cracking of decane showing two or more possible products (even if unbalanced) | 1 |
| | | | **Total 6 marks** |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 3 a | white | | 1 |
| b | white | | 1 |
| | | | |
| c | M1 $\frac{1000 \times 21}{100}$ / 210<br><br>M2 (1000 – 210) = 790 ($cm^3$)<br><br>OR<br><br>M1 100 – 21 = 79<br><br>M2 $\frac{1000 \times 79}{100}$ = 790 ($cm^3$) | Accept calculation based on any value in range 20 - 21 %<br><br>M2 CQ on incorrect percentage of oxygen, but this must be stated<br><br>Correct final answer with no working scores 2 marks | 2 |
| d | M1 n(Mg) = 0.12 ÷ 24 / 0.0050 (mol)<br><br>M2 (0.0050 x 40 =) 0.2(0) (g)<br><br>OR<br><br>M1 m(MgO) = $\frac{40 \times 0.12}{24}$ or $\frac{80 \times 0.12}{48}$<br><br>M2 = 0.2(0) (g) | Accept fraction 1/200<br><br>Correct final answer scores 2 marks | 2 |
| | | | **Total 6 marks** |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 4 a i | correct statement about connection between number of electrons<br>and moles/molecules/amounts (of both gases)<br>OR<br>reference to number of moles/molecules being equal (in both equations) | eg same number of electrons give same numbers of moles<br><br>eg equal moles of gases have equal volumes / volumes are proportional to numbers of moles | 1 |
| ii | (some/chlorine/it) is soluble / dissolves (in water / in the solution)<br>OR<br>(some/chlorine/it) reacts with water | Accept (some) oxygen also collected<br>Reject chlorine reacts with graphite<br>Ignore chlorine gas escapes<br>Reject reacts with sodium chloride / reacts with sodium hydroxide | 1 |
| iii | M1 (solution) alkaline / pH greater than 7<br><br>M2 (because) hydroxide ions / $OH^-$ (formed) | Mark M1 and M2 independently<br>Ignore basic<br>Accept any value above 7 up to 14<br><br>Accept sodium hydroxide formed | 2 |
| b | M1 (result of litmus test)<br>bleaches / goes white<br><br>M2 (result of KI test)<br>brown (solution) / black precipitate or equivalent | <br>Ignore red as intermediate colour<br>Accept decolourises / colourless<br><br>Accept yellow and orange in place of brown<br>Accept grey in place of black<br><br>Ignore shades such as pale / dark<br>Reject red / red-brown / purple / blue-black | 2 |

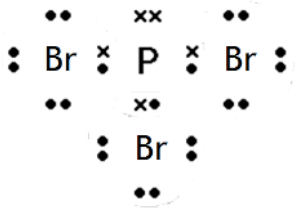
| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 4 c i | to sterilise / disinfect (the water)<br>OR<br>to make it safe to drink | Accept kill bacteria / microbes / pathogens / microorganisms / (harmful) organisms / germs / viruses<br>Ignore references to cleaning / purifying / bleaching / changing pH | 1 |
| ii | $H_2 + Cl_2 \rightarrow 2HCl$ | Ignore state symbols | 1 |
| iii | dissolve in / add to water | Accept mixing with water / bubbling through water / react with water / make aqueous<br>Ignore adding to liquid | 1 |
| | | | **Total 9 marks** |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 5 a | Any two of:<br>• (same) volume of acid<br>• (same) concentration of acid<br>• (same) concentration of alkali<br>• (same) rate of stirring / stir for the same time<br>• (same) starting temperature / temperature of acid/alkali/solutions/room | Reject volume(s) of solutions<br>Accept amount of acid as alternative to either of first two bullet points | 2 |
| b | M1 correct reference to accuracy / temperature rise | eg accuracy improved or increased / temperature rise greater or more accurate or closer to correct value(s) / final temperatures higher<br>Accept temperatures more accurate<br>Ignore just higher temperatures<br>Ignore results more reliable / valid | 2 |
| | M2 correct reference to insulation / heat loss | eg polystyrene is a (better) insulator / poorer conductor (than glass) / reduces heat loss / more heat trapped<br>Ignore no heat loss<br>Accept reverse argument for glass | |

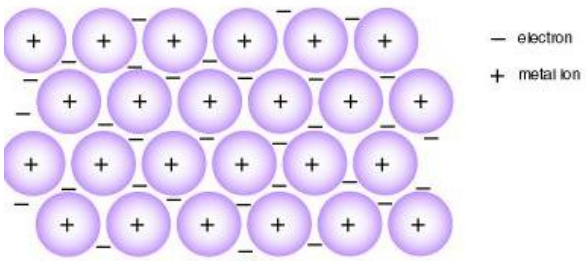
| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 5 c i | M1 (final) 39(.0)<br><br>M2 (initial) 17(.0)<br><br>M3(change) (+)22(.0) | Both values correct but in wrong order scores 1 mark (of M1 and M2)<br><br>M3 CQ on final and initial values | 3 |
| ii | <u>exothermic</u><br>AND<br>temperature has increased<br>/ temperature change is positive<br>/ final temperature higher than initial temperature | Accept heat / thermal energy given out or transferred to the surroundings<br><br>Reject just energy has been given out | 1 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 5 d | Any two of:<br>• correct statement about first part of graph, identified as positive gradient / positive correlation / temperature increase / temperatures up to 30 or 32.5 °C / volumes up to 20 or 22 $cm^3$ / experiments 1-4<br><br>• correct statement about top of graph, identified as where lines cross / intersection / peak / maximum<br><br>• correct statement about second part of graph, identified as negative gradient / negative correlation / temperature decrease / temperatures after 30 or 32.5 °C / volumes after 20 or 22 $cm^3$ or up to 40 $cm^3$ / experiments 5-8 | eg reaction continuing<br>or acid being neutralised<br>or some acid still unreacted<br>or heat being produced<br><br>eg reaction complete<br>or all acid neutralised<br>or neutralisation point reached<br>or shows volume of alkali needed to neutralise acid<br><br>eg further alkali causes cooling<br>or sodium hydroxide absorbs heat<br>or no reaction occurs<br>or no acid left<br>or alkali in excess<br>Reject reaction becomes endothermic<br><br>Ignore references to direct proportion / particle collisions / limiting reagents / rate of reaction | 2 |
| | | | |
| | | | **Total 10 marks** |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 6 a i | carbon monoxide | | 1 |
| ii | decreases capacity of blood (cells) to carry oxygen<br>OR<br>stops blood (cells) from carrying oxygen | Accept CO combines with haemoglobin / forms carboxyhaemoglobin<br>Accept CO displaces/replaces oxygen in haemoglobin<br>Ignore CO combines with red blood cells<br>Ignore references to suffocation / lack of oxygen in lungs stopping breathing / gas exchange<br>Ignore just affects haemoglobin<br>Reject destroys haemoglobin | 1 |
| b i | $6KClO_3 + S + P_4S_3 \rightarrow \mathbf{6}KCl + \mathbf{4}SO_2 + P_4O_{10}$ | M1 coefficient of 6 for KCl<br>M2 coefficient of 4 for $SO_2$<br><br>Max 1 mark if equation unbalanced<br>Ignore 1 for other coefficients<br>0 for other coefficients loses M2 | 2 |
| ii | activation (energy) | | 1 |
| | | | **Total 5 marks** |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 7 a | <table><tr><th>Halogen</th><th>Colour</th><th>Physical state</th></tr><tr><td>bromine</td><td></td><td>liquid</td></tr><tr><td>iodine</td><td>black</td><td></td></tr></table> | M1 (bromine) liquid / (l)<br><br>M2 (iodine) black<br>allow (dark) grey | 2 |
| b |  | M1 three bonding pairs of electrons correct<br><br>M2 rest of electrons correct<br><br>Accept any combination of dots and crosses<br>Ignore circles | 2 |
| c | $PBr_3 + 3H_2O \rightarrow 3HBr + H_3PO_3$ | M1 all formulae correct<br><br>M2 balanced<br>M2 DEP on M1 | 2<br><br>**Total 6 marks** |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 8 a i | Ni/nickel has lost oxygen (atoms / ions)<br>OR<br>nickel ions gain electrons | Accept NiO/nickel oxide has lost oxygen<br>Accept nickel(II) loses oxygen<br>Ignore it loses oxygen / gains electrons<br>Reject nickel oxide gains electrons<br>Reject nickel loses oxygen molecules<br>Reject any answer that does not refer to Ni or NiO | 1 |
| ii | M1 equilibrium (position) shifts to right<br><br>M2 (forward) reaction is exothermic | Mark independently<br>Ignore forward reaction favoured/occurs more readily/is faster / more product formed<br><br>Accept heat / thermal energy given out<br>Ignore just gives out energy<br><br>Ignore because stage 3 is decomposition which is endothermic/takes in heat<br><br>Ignore references to bond breaking and making and Le Chatelier's principle and different numbers of (gas) moles on each side and rate of reaction | 2 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 8 b i | diagram showing:<br>M1 minimum of 5 circles in regular pattern in 2 rows<br><br>M2 +/2+ charges in each circle / appropriate key<br><br><br><br>M3 some indication of electrons between ions / appropriate key | <br><br><br>Accept labelled as cations/positive ions<br>not just ions<br>Reject atoms / protons / nuclei<br><br>eg e / $e^-$ / – / (shaded) area labelled electrons<br>Do not award M3 if electrons shown in circles more than half the size of the ions<br>Ignore lines between circles<br>Max 1 if negative ions shown<br>Reject electrons shown in pairs between nickel particles for M3<br>Ignore intermolecular forces label<br>Example:<br>  <br> | 3 |

| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 8 b ii | malleability (2 marks):<br><br>M1 layers / sheets / planes / rows<br>AND<br>(positive) ions / atoms / particles<br><br>M2 slide (over each other)<br><br>conductivity (2 marks):<br><br>M3 – delocalised electrons<br><br>M4 – that flow (when a potential difference is applied) | <br><br><br>Reject molecules / protons / electrons<br><br>M2 needs reference to either layers or equivalent OR ions/particles/atoms<br>Allow OWTTE, eg slip / flow / shift / roll / move<br>M2 DEP on mention of EITHER layers or equivalent<br>OR mention of ions or equivalent<br><br>Do not award M2 if protons / electrons / nuclei / molecules in place of ions, etc<br>If reference to ionic bonding / covalent bonding / molecules / intermolecular forces, no M1 or M2<br><br>Accept sea of electrons<br>Ignore free electrons<br><br>Accept move / mobile in place of flow<br>M4 DEP on mention of electrons<br>Ignore reference to intermolecular forces for M3 and M4 | 4<br><br>**Total 10 marks** |

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