



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.

Question number	Answer	Notes	Marks						
1 a	<table border="1" data-bbox="389 264 831 437"> <tr> <td data-bbox="389 264 663 320">Number of protons</td> <td data-bbox="663 264 831 320">6</td> </tr> <tr> <td data-bbox="389 320 663 376">Number of neutrons</td> <td data-bbox="663 320 831 376">6</td> </tr> <tr> <td data-bbox="389 376 663 437">Number of electrons</td> <td data-bbox="663 376 831 437">6</td> </tr> </table>	Number of protons	6	Number of neutrons	6	Number of electrons	6	<p>M1 protons and electrons correct</p> <p>M2 neutrons correct</p>	2
Number of protons	6								
Number of neutrons	6								
Number of electrons	6								
b	<p>i 3</p> <p>ii M1 33</p> <p>M2 Z is two places/columns/groups/positions after X OR Z is in Group 5 and X is in Group 3</p> <p>iii 2.8 / 2,8 / 2 and 8 separated by other mark eg : or / or ) or space</p>	<p>Accept has 2 more protons (than X)</p> <p>Ignore references to atomic number increasing by 2</p> <p>Ignore number of protons increases with group number</p> <p>Ignore references to elements being arranged according to number of protons</p> <p><math>31 + 5 - 3 = 33</math> scores 2 marks</p> <p>Do not accept 28 (ie no space)</p> <p>Accept correct sp notation</p>	<p>1</p> <p>2</p> <p>1</p>						

Question number	Answer	Notes	Marks
1 b iv	<p>M1 (similarity) one electron/same number of electrons in outer shell</p> <p>M2 (difference) different number of (electron) shells / T has (one) more (electron) shell / J has (one) less (electron) shell /J has 2 shells and T has 3 /J is 2.1 and T is 2.8.1</p>	<p>Accept rings and energy levels in place of shells in M1 and M2</p> <p>Accept valence electrons in place of outer shell electrons Accept configuration ends in 1 Accept same outer shell Accept 2 electrons in first/inner shell</p> <p>Accept going down the column there is 1 more shell Ignore T has an extra number Ignore T has 8 more electrons</p>	2
		<b>Total 8 marks</b>	

Question number	Answer	Notes	Marks
2 a i	C (C <sub>2</sub> H <sub>4</sub> )		1
	ii B (colourless)		1
	iii A (dehydration)		1
b i	cracking	<p>Accept (to provide an alternative route with) lower activation energy Accept decomposition / cracking in place of reaction</p> <p>Accept molecules / hydrocarbons / alkanes / alkenes in place of products</p> <p>Accept any hydrogen and any hydrocarbon with 8 or fewer carbon atoms (name or formula)</p> <p>Ignore decane decomposes / decane contains impurities Ignore references to air / oxygen / nitrogen / carbon dioxide Accept equation for cracking of decane showing two or more possible products (even if unbalanced)</p>	1
ii	(to act as a) catalyst OR to increase rate / speed up reaction		1
iii	cracking produces 2 or more products OR other products are formed OR identified possible product OR not all decane decomposed OR water vapour present (not just water)		1
			<b>Total 6 marks</b>

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

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



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

Question number	Answer	Notes	Marks
5 a	Any two of: <ul style="list-style-type: none"> <li>• (same) volume of acid</li> <li>• (same) concentration of acid</li> <li>• (same) concentration of alkali</li> <li>• (same) rate of stirring / stir for the same time</li> <li>• (same) starting temperature / temperature of acid/alkali/solutions/room</li> </ul>	Reject volume(s) of solutions Accept amount of acid as alternative to either of first two bullet points	2
b	M1 correct reference to accuracy / temperature rise  M2 correct reference to insulation / heat loss	eg accuracy improved or increased / temperature rise greater or more accurate or closer to correct value(s) / final temperatures higher Accept temperatures more accurate Ignore just higher temperatures Ignore results more reliable / valid  eg polystyrene is a (better) insulator / poorer conductor (than glass) / reduces heat loss / more heat trapped Ignore <u>no</u> heat loss Accept reverse argument for glass	2

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

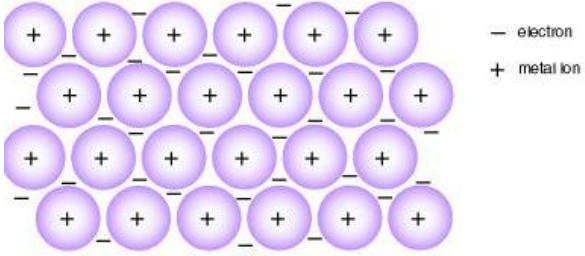
Question number	Answer	Notes	Marks
5 d	<p>Any two of:</p> <ul style="list-style-type: none"> <li>• correct statement about first part of graph, identified as positive gradient / positive correlation / temperature increase / temperatures up to 30 or 32.5 °C / volumes up to 20 or 22 cm<sup>3</sup> / experiments 1-4</li> <li>• correct statement about top of graph, identified as where lines cross / intersection / peak / maximum</li> <li>• 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<sup>3</sup> or up to 40 cm<sup>3</sup> / experiments 5-8</li> </ul>	<p>eg reaction continuing or acid being neutralised or some acid still unreacted or heat being produced</p> <p>eg reaction complete or all acid neutralised or neutralisation point reached or shows volume of alkali needed to neutralise acid</p> <p>eg further alkali causes cooling or sodium hydroxide absorbs heat or no reaction occurs or no acid left or alkali in excess Reject reaction becomes endothermic</p> <p>Ignore references to direct proportion / particle collisions / limiting reagents / rate of reaction</p>	2
		<b>Total 10 marks</b>	

Question number	Answer	Notes	Marks
6 a i	carbon monoxide		1
ii	decreases capacity of blood (cells) to carry oxygen OR stops blood (cells) from carrying oxygen	Accept CO combines with haemoglobin / forms carboxyhaemoglobin Accept CO displaces/replaces oxygen in haemoglobin Ignore CO combines with red blood cells Ignore references to suffocation / lack of oxygen in lungs stopping breathing / gas exchange Ignore just affects haemoglobin Reject destroys haemoglobin	1
b i	$6\text{KClO}_3 + \text{S} + \text{P}_4\text{S}_3 \rightarrow \mathbf{6}\text{KCl} + \mathbf{4}\text{SO}_2 + \text{P}_4\text{O}_{10}$	M1 coefficient of 6 for KCl M2 coefficient of 4 for SO <sub>2</sub>  Max 1 mark if equation unbalanced Ignore 1 for other coefficients 0 for other coefficients loses M2	2
ii	activation (energy)		1
<b>Total 5 marks</b>			

Question number	Answer	Notes	Marks									
7 a	<table border="1"> <thead> <tr> <th data-bbox="367 384 584 443">Halogen</th> <th data-bbox="584 384 797 443">Colour</th> <th data-bbox="797 384 1043 443">Physical state</th> </tr> </thead> <tbody> <tr> <td data-bbox="367 443 584 502">bromine</td> <td data-bbox="584 443 797 502"></td> <td data-bbox="797 443 1043 502">liquid</td> </tr> <tr> <td data-bbox="367 502 584 561">iodine</td> <td data-bbox="584 502 797 561">black</td> <td data-bbox="797 502 1043 561"></td> </tr> </tbody> </table>	Halogen	Colour	Physical state	bromine		liquid	iodine	black		M1 (bromine) liquid / (l) M2 (iodine) black allow (dark) grey	2
Halogen	Colour	Physical state										
bromine		liquid										
iodine	black											
b	<pre>       ••   xx   ••      : Br x P x Br :      ••   x•   ••        : Br :        •• </pre>	M1 three bonding pairs of electrons correct M2 rest of electrons correct Accept any combination of dots and crosses Ignore circles	2									
c	$\text{PBr}_3 + 3\text{H}_2\text{O} \rightarrow 3\text{HBr} + \text{H}_3\text{PO}_3$	M1 all formulae correct M2 balanced M2 DEP on M1	2									

**Total 6 marks**

Question number	Answer	Notes	Marks
8 a i	Ni/nickel has lost oxygen (atoms / ions) OR nickel <u>ions</u> gain electrons	Accept NiO/nickel oxide has lost oxygen Accept nickel(II) loses oxygen Ignore <u>it</u> loses oxygen / gains electrons Reject nickel oxide gains electrons Reject nickel loses oxygen molecules Reject any answer that does not refer to Ni or NiO	1
ii	M1 equilibrium (position) shifts to right  M2 (forward) reaction is exothermic	Mark independently Ignore forward reaction favoured/occurs more readily/is faster / more product formed  Accept heat / thermal energy given out Ignore just gives out energy  Ignore because stage 3 is decomposition which is endothermic/takes in heat  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: M1 minimum of 5 circles in regular pattern in 2 rows  M2 +/2+ charges in each circle / appropriate key  M3 some indication of electrons between ions / appropriate key	Accept labelled as cations/positive ions not just ions Reject atoms / protons / nuclei  eg e / e <sup>-</sup> / - / (shaded) area labelled electrons Do not award M3 if electrons shown in circles more than half the size of the ions Ignore lines between circles Max 1 if negative ions shown Reject electrons shown in pairs between nickel particles for M3 Ignore intermolecular forces label Example: 	3



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

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