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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

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

M2 Z is two places/columns/groups/positions after X
OR
Z is in Group 5 and X is in Group 3</td><td>Accept has 2 more protons (than X)

Ignore references to atomic number increasing by 2
Ignore number of protons increases with group number
Ignore references to elements being arranged according to number of protons

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
eg : or / or) or space</td><td>Do not accept 28 (ie no space)
Accept correct sp notation</td><td>1</td></tr>
</table>

Question number	Answer	Notes	Marks
1 b iv	M1 (similarity) one electron/same number of electrons in outer shell 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 2.8.1	Accept rings and energy levels in place of shells in M1 and M2 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 Accept going down the column there is 1 more shell Ignore T has an extra number 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 OR to increase rate / speed up reaction	Accept (to provide an alternative route with) lower activation energy Accept decomposition / cracking in place of 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)	Accept molecules / hydrocarbons /alkanes / alkenes in place of products Accept any hydrogen and any hydrocarbon with 8 or fewer carbon atoms (name or formula) 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)	1
			Total 6 marks

Question number	Answer	Notes	Marks
3 a	white		1
b	white		1
c	M1 $\frac{1000 \times 21}{100}$ / 210 M2 (1000 – 210) = 790 (cm^3) OR M1 100 – 21 = 79 M2 $\frac{1000 \times 79}{100}$ = 790 (cm^3)	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(Mg) = 0.12 ÷ 24 / 0.0050 (mol) M2 (0.0050 x 40 =) 0.2(0) (g) OR M1 m(MgO) = $\frac{40 \times 0.12}{24}$ or $\frac{80 \times 0.12}{48}$ M2 = 0.2(0) (g)	Accept fraction 1/200 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 and moles/molecules/amounts (of both gases) OR reference to number of moles/molecules being equal (in both equations)	eg same number of electrons give same numbers of moles 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) OR (some/chlorine/it) reacts with water	Accept (some) oxygen also collected Reject chlorine reacts with graphite Ignore chlorine gas escapes Reject reacts with sodium chloride / reacts with sodium hydroxide	1
iii	M1 (solution) alkaline / pH greater than 7 M2 (because) hydroxide ions / OH^- (formed)	Mark M1 and M2 independently Ignore basic Accept any value above 7 up to 14 Accept sodium hydroxide formed	2
b	M1 (result of litmus test) bleaches / goes white M2 (result of KI test) brown (solution) / black precipitate or equivalent	 Ignore red as intermediate colour Accept decolourises / colourless Accept yellow and orange in place of brown Accept grey in place of black Ignore shades such as pale / dark Reject red / red-brown / purple / blue-black	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	$H_2 + Cl_2 \rightarrow 2HCl$	Ignore state symbols	1
iii	dissolve in / add to water	Accept mixing with water / bubbling through water / react with water / make aqueous Ignore adding to liquid	1
			Total 9 marks

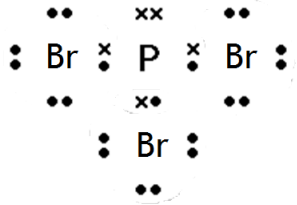
Question number	Answer	Notes	Marks
5 a	Any two of: • (same) volume of acid • (same) concentration of acid • (same) concentration of alkali • (same) rate of stirring / stir for the same time • (same) starting temperature / temperature of acid/alkali/solutions/room	Reject volume(s) of solutions Accept amount of acid as alternative to either of first two bullet points	2
b	M1 correct reference to accuracy / temperature rise	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	2
	M2 correct reference to insulation / heat loss	eg polystyrene is a (better) insulator / poorer conductor (than glass) / reduces heat loss / more heat trapped Ignore no heat loss Accept reverse argument for glass	

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	Any two of: • 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 • correct statement about top of graph, identified as where lines cross / intersection / peak / maximum • 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 or acid being neutralised or some acid still unreacted or heat being produced eg reaction complete or all acid neutralised or neutralisation point reached or shows volume of alkali needed to neutralise acid 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 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 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	$6KClO_3 + S + P_4S_3 \rightarrow \mathbf{6}KCl + \mathbf{4}SO_2 + P_4O_{10}$	M1 coefficient of 6 for KCl M2 coefficient of 4 for SO_2 Max 1 mark if equation unbalanced Ignore 1 for other coefficients 0 for other coefficients loses M2	2
ii	activation (energy)		1
			Total 5 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>7 a</td><td>
<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>
</td><td>M1 (bromine) liquid / (l)

M2 (iodine) black
allow (dark) grey</td><td>2</td></tr>
<tr><td>b</td><td>  </td><td>M1 three bonding pairs of electrons correct

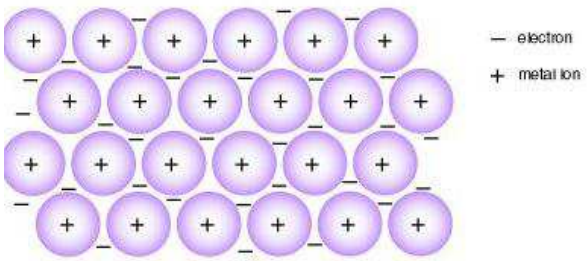
M2 rest of electrons correct

Accept any combination of dots and crosses
Ignore circles</td><td>2</td></tr>
<tr><td>c</td><td>$PBr_3 + \mathbf{3}H_2O \rightarrow \mathbf{3}HBr + H_3PO_3$</td><td>M1 all formulae correct

M2 balanced
M2 DEP on M1</td><td>2

Total 6 marks</td></tr>
</table>

Question number	Answer	Notes	Marks
8 a i	Ni/nickel has lost oxygen (atoms / ions) OR nickel ions gain electrons	Accept NiO/nickel oxide has lost oxygen Accept nickel(II) loses oxygen Ignore it 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^- / – / (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	malleability (2 marks): M1 layers / sheets / planes / rows AND (positive) ions / atoms / particles M2 slide (over each other) conductivity (2 marks): M3 – delocalised electrons M4 – that flow (when a potential difference is applied)	 Reject molecules / protons / electrons 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 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 Accept sea of electrons Ignore free electrons Accept move / mobile in place of flow M4 DEP on mention of electrons Ignore reference to intermolecular forces for M3 and M4	4 **Total 10 marks**

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