Mark Scheme (Results)

January 2019

Pearson Edexcel International GCSE

In Chemistry (4CH0) Paper 2C

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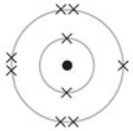
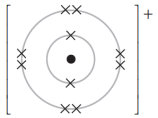
General Marking Guidance

- 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.

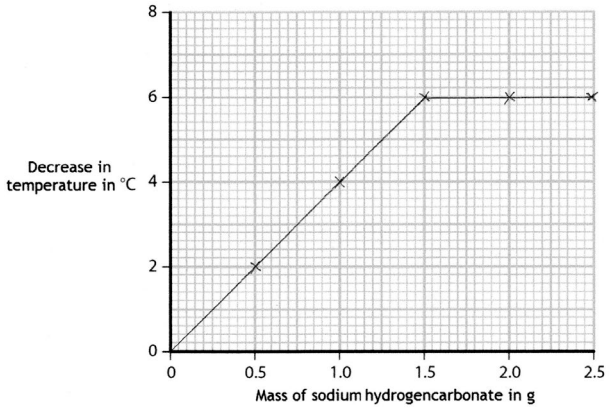
<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>1</td><td>
<table>
<tr><th>Name of apparatus</th><th>Letter</th></tr>
<tr><td>beaker</td><td>D</td></tr>
<tr><td>burette</td><td>A</td></tr>
<tr><td>measuring cylinder</td><td>C</td></tr>
<tr><td>pipette</td><td>F</td></tr>
</table>
</td><td></td><td>4</td></tr>
</table>

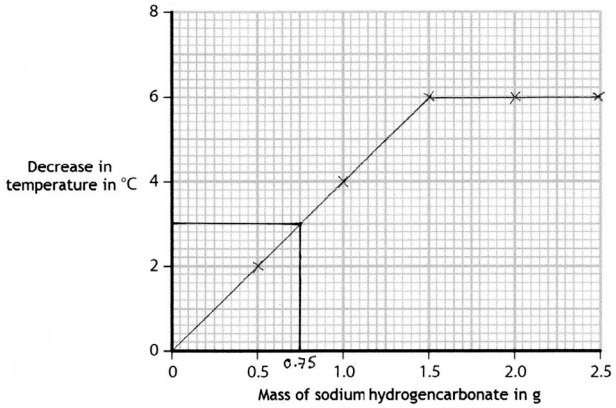
Question number	Answer	Notes	Marks
2 (a) (i)	(contain) same number of protons/37 protons	IGNORE same atomic number REJECT reference to electrons	1
(ii)	(contain) different numbers of neutrons / 87 has two more neutrons / 85 has two fewer neutrons / 85 has 48 neutrons but 87 has 50 neutrons	IGNORE reference to mass number	1
(iii)	**A** (1)		1
(b)	**M1** (0.722 x 85) + 0.278 x 87) **OR** [(72.2 x 85) + (27.8 x 87)]/100 **OR** 85.556 **M2** 85.6	85.5 scores 1 Correct answer with no working scores 2	2

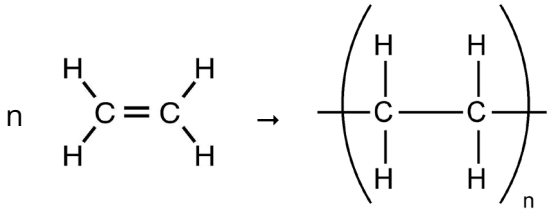
Question number	Answer	Notes	Marks
3 (a) (i)	(thermal) decomposition	IGNORE endothermic	1
(ii)	**M1** (bubble through/add to) limewater **M2** turns milky	 **ACCEPT** cloudy / turbid / <u>white</u> precipitate M2 DEP M1	2
(b) (i)	gas(es)/CO_2/H_2O/steam/water given off /formed/evolved		1
(ii)	all of the $NaHCO_3$ has decomposed/reacted	ALLOW the reaction has finished ALLOW all the CO_2 / water/ steam/H_2O /gas(es) has been given off	1

Question number	Answer	Notes	Marks
4 (a)	heat (energy) is given out/lost (to the surroundings) /heat is transferred to the surroundings	Not just energy **ACCEPT** thermal energy is given out ALLOW heat (energy) is produced/released	1
(b)	**A** 		1
(c)	**B** 		1
(d)	**M1** has giant (ionic structure)/giant (ionic lattice) **M2** strong (electrostatic) forces/strong attraction **M3** between (oppositely charged) ions **M4** large amount of (thermal/heat) <u>energy</u> required to overcome the forces/attraction	**ALLOW** strong bonds **ACCEPT** large amount of (thermal/heat) <u>energy</u> required to break the bonds **IGNORE** more energy	4

		Any reference to covalent bonds / metallic bonding / intermolecular forces max 1 mark	

Question number	Answer	Notes	Marks
5 (a)	<table><tr><th>Mass of sodium hydrogencarbonate in g</th><th>Initial temperature in °C</th><th>Lowest temperature reached in °C</th><th>Decrease in temperature in °C</th></tr><tr><td>0.5</td><td>25</td><td>22</td><td>3</td></tr><tr><td>1.0</td><td>24</td><td>20</td><td>4</td></tr><tr><td>1.5</td><td>23</td><td>18</td><td>5</td></tr><tr><td>2.0</td><td>23</td><td>18</td><td>5</td></tr></table> **M1** all four temperature readings correct **M2** all four calculations of decrease in temperature correct	Calculations in **M2** CSQ on values given in **M1**	2
(b) (i)		**M1** & **M2** All five points plotted correctly = 2 Deduct one mark for each incorrectly plotted point **M3** both lines drawn correctly with the aid of a ruler First line does not need to pass through origin and IGNORE extrapolation	3

(b) (ii)	 correct value given from candidate's plotted graph		1

Question number	Answer	Notes	Marks
6 (a)	 **M1** correct repeat unit with single bond between carbon atoms **M2** extension bonds, brackets and n included	Accept n anywhere after brackets but not before Extension bonds do not need to go out of brackets **M2** DEP on **M1**	2
(b)	the polymer is the only product (of the reaction) / no small molecule is produced (as well as the polymer)	**ALLOW** only one type of monomer	1

(c) (i)	Any two from: **M1** strong so does not break/so can be reused **M2** low density so not heavy (when it contains the shopping) **M3** non-toxic so does not poison food/safe to use with food **M4** waterproof so contents do not get wet/bag does not tear when wet **M5** flexible so fits around the shopping **M6** can be recycled so saves resources **M7** transparent so can see contents of bag	**IGNORE** light **ALLOW** odourless so does not taint food **IGNORE** references to cost **IGNORE** non-biodegradable If two correct properties with no links allow 1 mark	2

(c) (ii)	landfill: sites get filled up/takes up (more) land burning: produces toxic /poisonous / greenhouse gas	**ALLOW** accumulates (in landfill as non-biodegradable/does not breakdown/decompose) **IGNORE** can produce methane which is a greenhouse gas **IGNORE** reference to harm to wildlife /habitats/ environment/visual pollution/unpleasant smell / noise pollution/ toxic leaching **ACCEPT** produces CO_2 which is a greenhouse gas **ACCEPT** could produce CO which is poisonous/reduces blood capacity to carry oxygen **IGNORE** produces harmful gas(es) /air pollution	**2**

Question number	Answer	Notes	Marks
7	**M1** ions cannot flow/move when solid **M2** ions can flow/move when liquid/molten	**ACCEPT** ions are in fixed positions If reference to electrons cannot/can move then 0	2
	$Mg^{2+} + 2e^- \rightarrow Mg$		1
	(it/steel) reacts with chlorine	**IGNORE** not inert	1

Question number	Answer	Notes	Marks
8 (a) (i)	**M1** (total) vol(CO_2) = 480 x 140 **OR** 67 200 dm^3		2
	M2 $n[CO_2]$ = (67 200 ÷ 24) = 2800 (mol)	Mark CQ on M1	
	OR		
	M1 (per person) $n[CO_2]$ = 480 ÷ 24 **OR** 20 (mol)		
	M2 (total) $n[CO_2]$ = (20 x 140) = 2800 (mol)	Mark CQ on M1	
(ii)	**M1** mass of Na_2O_2 = 2800 × 78(.0) **OR** 218 400 (g)		2
	OR M2 from part (i) × 78(.0)		
	M2 218(.4) (kg)	Mark CQ on M1	
		ACCEPT any number of sig figs except 1	

(b)	**M1** (it/Li_2O_2) absorbs/reacts with more CO_2 (per mole/per gram) **M2** (it/Li_2O_2) produces oxygen	ORA **ACCEPT** only 1 mol Li_2O_2 needed per mol of CO_2, but 2 mol of LiOH needed per mol of CO_2 Answers in either order	2	

Question number	Answer	Notes	Marks
9 (a) (i)	**M1** (⇌) (reaction is) reversible	**IGNORE** references to equilibrium	2
	M2 (Δ*H*) enthalpy change (of reaction)	**ACCEPT** heat (energy) change **NOT** just energy change	
(ii)	phosphoric acid	**ALLOW** H_3PO_4	1
(b) (i)	**M1** (yield/it/amount of ethanol) increases	**IGNORE** equilibrium shifts to the right	2
	M2 because (forward) reaction is exothermic	**ACCEPT** backward reaction is endothermic **IGNORE** because reaction moves in exothermic direction **IGNORE** references to rate **IGNORE** references to Le Chatelier's principle, eg lower temperature favours the exothermic reaction / equilibrium position shifts to raise the temperature **M2** DEP **M1**	

(ii)	M1 (yield/it/amount of ethanol) decreases M2 because there are more moles/molecules (of gas) on the left / ORA	**IGNORE** equilibrium shifts to the left **ALLOW** particles **REJECT** atoms **ACCEPT** there are more moles/molecules of reactants **IGNORE** reaction moves to the side with the larger number of moles/molecules **IGNORE** references to rate **IGNORE** references to Le Chatelier's principle, eg lower pressure favours the reaction that produces the larger number of moles (of gas) / equilibrium position shifts to increase the pressure **M2** DEP **M1**	2	

(c) (i)	dehydration	**ALLOW** (thermal) decomposition	1
(ii)	crude oil is a finite resource / crude oil will eventually run out	**ALLOW** crude oil non-renewable **IGNORE** reference to cost	1

Question number	Answer	Notes	Marks
10 (a) (i)	**M1** lanthanum **M2** melting point is below 1030 (°C)	 **ALLOW** melting point/920 (°C) is lower than operating temperature **IGNORE** (lanthanum) has lowest melting point **M2** DEP **M1**	2
(ii)	$Sm_2O_3 + 6HCl \rightarrow 2SmCl_3 + 3H_2O$		1

(b)	**M1** (samarium) ions in layers/rows/planes/sheets **M2** slide/slip (over each other) **M3** delocalised electrons OR sea of electrons **M4** (can) flow/travel/move (through structure) / are mobile (when voltage/pd is applied)	**ACCEPT** atoms/cations/particles for ions Reject molecules Allow OWTTE, eg flow/shift/roll/move **M2** DEP on mention of **EITHER** layers or equivalent **OR** mention of ions or equivalent Do not award **M2** if molecules/protons/electrons/nuclei in place of ions etc If reference to ionic bonding / covalent bonding /molecules / intermolecular forces, no **M1** or **M2** Not just electrons **IGNORE** free electrons **IGNORE** carry charge/current **M4** DEP on **M3** or mention of electrons If reference to ions moving no **M3** or **M4**	4

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