



Mark Scheme FINAL

Summer 2019

Pearson Edexcel International GCSE in
Chemistry (4CH1)
Paper 2C

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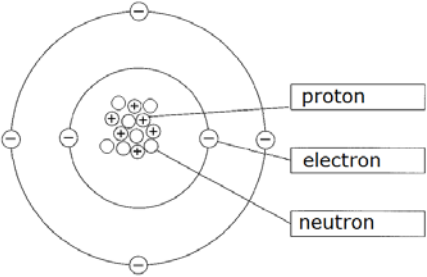
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General Marking Guidance

- 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	Additional guidance	Marks
1 (a)		1 mark for each correct answer	3
(b)	13		1
(c)	M1 protons M2 neutrons	IGNORE electrons	2
		Total	6

Question number	Answer	Additional guidance	Marks												
2 (a)	<table border="1" data-bbox="421 276 1160 507"> <thead> <tr> <th data-bbox="421 276 629 347">Name of halogen</th> <th data-bbox="629 276 898 347">Physical state at room temperature</th> <th data-bbox="898 276 1160 347">Colour</th> </tr> </thead> <tbody> <tr> <td data-bbox="421 347 629 395">chlorine</td> <td data-bbox="629 347 898 395">gas</td> <td data-bbox="898 347 1160 395">pale green</td> </tr> <tr> <td data-bbox="421 395 629 451">bromine</td> <td data-bbox="629 395 898 451">liquid</td> <td data-bbox="898 395 1160 451">red-brown</td> </tr> <tr> <td data-bbox="421 451 629 507">iodine</td> <td data-bbox="629 451 898 507">solid</td> <td data-bbox="898 451 1160 507">(dark) grey</td> </tr> </tbody> </table>	Name of halogen	Physical state at room temperature	Colour	chlorine	gas	pale green	bromine	liquid	red-brown	iodine	solid	(dark) grey	<p>ALLOW black ALLOW any combination of grey and black eg grey-black</p>	2
Name of halogen	Physical state at room temperature	Colour													
chlorine	gas	pale green													
bromine	liquid	red-brown													
iodine	solid	(dark) grey													
(b)	<p>M1 $(35 \times 77.78) + (37 \times 22.22)$ OR 3544.44</p> <p>M2 $3544.44 \div 100$ OR 35.4444 OR M1 $\div 100$</p> <p>M3 35.4</p>	<p>$(35 \times 0.7778) + (37 \times 0.2222)$ OR 35.4444/35.444/35.44 with no working scores 2</p> <p>35.4 with no working scores 3</p> <p>M3 can be ECF from an incorrect M2</p>	3												

(c)	<p>An explanation that links together the following four points:</p> <p>M1 add chlorine (solution) to potassium bromide (solution)</p> <p>M2 (solution) turns orange</p> <p>M3 bromine/Br₂ is displaced</p> <p>M4 (therefore) chlorine is more reactive (than bromine)</p>	<p>ACCEPT mix the two solutions</p> <p>ALLOW any combination of orange/yellow/brown IGNORE other observations eg bubbles</p> <p>ALLOW bromine/Br₂ is produced/formed</p> <p>IGNORE state of bromine REJECT bromide IGNORE a displacement reaction occurs M3 can be scored by Br₂ as a product in an equation</p> <p>ACCEPT reverse argument</p> <p>"If a reaction occurs then chlorine is more reactive than bromine" scores M4</p>	<p>4</p>
		Total	9

Question number	Answer	Additional guidance	Marks
3 (a)	<p>M1 the volume of liquid/alcohol</p> <p>M2 the temperature of the water</p>	<p>ALLOW amount of liquid/alcohol IGNORE mass IGNORE volume of water</p> <p>ALLOW temperature of surroundings</p> <p>IGNORE references to temperature of the alcohol</p>	2
(b)	alcohols/the liquids are flammable/catch fire easily	<p>ALLOW alcohols/the liquids can be easily ignited ALLOW any named alcohol from the table</p>	1
(c)	<p>(i) M1 $(64 + 63 + 60) \div 3$</p> <p>M2 = 62</p> <p>(ii) An explanation including the following two points:</p> <p>M1 methanol/CH₃OH (evaporates most easily)</p> <p>M2 because the time taken is the shortest</p>	<p>ALLOW 62.3</p> <p>62/62.3 with no working scores 2</p> <p>ALLOW 69/69.25/69.3 for 1 mark</p> <p>ACCEPT because has lowest (mean) time</p>	2

Question Number	Answer	Additional Guidance	Marks
(iii)	M1 as the number of carbon atoms increases M2 the ease of evaporation decreases/the less easily the alcohol evaporates	ALLOW the less volatile the alcohol IGNORE the slower the alcohol evaporates IGNORE references to time taken ALLOW correct reverse argument	2
		Total	9

Question number	Answer	Additional guidance	Marks
4 (a)	<p>C (electrostatic attraction between positively charged particles and delocalised electrons) is correct as it describes metallic bonding</p> <p>A is incorrect since it describes ionic bonding not metallic bonding</p> <p>B is incorrect since it describes covalent bonding not metallic bonding</p> <p>D is incorrect since it describes interatomic or intermolecular forces not metallic bonding</p>		1
(b)	<p>Any two from the following:</p> <p>M1 good conductor of heat/thermal energy</p> <p>M2 does not react with food/affect flavour of food</p> <p>M3 resistant to corrosion</p> <p>M4 high melting point</p> <p>M5 low density/lightweight/strong</p>	<p>IGNORE non-toxic</p> <p>ALLOW does not corrode/rust</p> <p>IGNORE unreactive/inert</p> <p>IGNORE references to recycling</p> <p>IGNORE light</p>	2

Question number	Answer	Additional guidance	Marks
4 (c) (i)	a mixture of (two or more) elements, one of which is a metal	ACCEPT a mixture of (two or more) metals ALLOW combination for mixture REJECT compound or references to chemical bonding	1
	(ii)	An explanation that links together the following three points:	
	M1 the regular arrangement of atoms is distorted/disrupted OWTTE	ALLOW lattice/layers/rows of atoms are disrupted/distorted ALLOW lattice/layers/rows of atoms less regular	3
	M2 because magnesium atoms are larger than aluminium atoms	ALLOW magnesium and aluminium atoms are of different sizes	
	M3 and therefore it is more difficult for the layers to slide over one another	ALLOW layers cannot (as easily) slide over one another IGNORE references to strength of metallic bonds	
		Total	7

Question number	Answer	Additional guidance	Marks
5 (a) (i)	(bonds broken) 3861 (kJ)		1
(ii)	(bonds made) 4649 (kJ)		1
(iii)	<p>M1 subtraction of $\Sigma(\text{bonds made})$ made and $\Sigma(\text{bonds broken})$</p> <p>M2 correct evaluation of the calculation shown in M1</p> <p>M3 If $\Sigma(\text{bonds made}) > \Sigma(\text{bonds broken})$ final answer must be negative If $\Sigma(\text{bonds made}) < \Sigma(\text{bonds broken})$ final answer must be positive (and + sign given)</p>	<p>In (iii) ECF from (i) and (ii) must be applied Subtraction can be in any order</p> <p>IGNORE sign</p> <p>Expected final answer is -788 (kJ/mol)</p> <p>-788 with no working scores 3 (+) 788 scores 2</p>	3

(b) An explanation that links together the following two points:

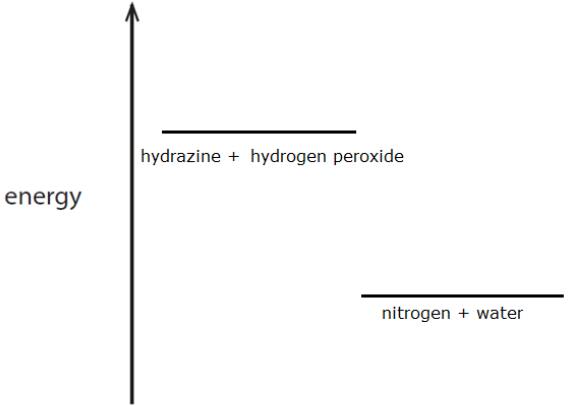
M1 more energy is given out when the bonds are made

M2 than is taken in when the bonds are broken

If state/imply that energy required to make bonds
OR
If state/imply that energy released when bonds are broken scores 0/2

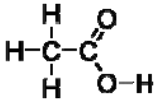
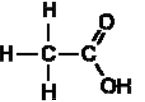
ACCEPT correct reverse argument

2

Question number	Answer	Additional guidance	Marks
5 (c)	 <p>M1 right hand line below left hand line</p> <p>M2 correct names/formulae of both reactants</p> <p>M3 correct names/formulae of both products</p>	<p>IGNORE horizontal axis drawn</p> <p>IGNORE enthalpy change shown</p> <p>IGNORE activation energy shown</p> <p>If only use words <i>reactants</i> (on left) and <i>products</i> (on right) award 1 mark from M2 and M3</p>	3
		Total	10

Question number	Answer	Additional guidance	Marks
6 (a) (i)	yeast	IGNORE zymase	1
	(ii) C (30 °C) is correct as it is the most suitable temperature for fermentation A is incorrect as at 0°C the enzymes would not be active so not the most suitable temperature for fermentation B is incorrect as at 10°C the enzymes would not be very active so not the most suitable temperature for fermentation D is incorrect as at 80°C the enzymes would be denatured so not the most suitable temperature for fermentation		1
	(iii) An explanation using either of the following linked pairs: M1 oxygen in the air would react with ethanol M2 to form ethanoic acid OR M1 the fermentation/reaction/respiration needs to be anaerobic M2 ethanol would not be formed /CO ₂ and H ₂ O would form	ACCEPT ethanol would be oxidised ALLOW to form carboxylic acid ALLOW to form vinegar	2

(b) (i)	a substance that releases thermal energy/heat (energy) when burned/combusted	IGNORE energy on its own	1
(ii)	$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ M1 all formulae correct M2 correctly balanced	ACCEPT multiples M2 DEP M1	2

Question number	Answer	Additional guidance	Marks
6 (c)	<p>M1 (temperature) 300 °C</p> <p>M2 60 – 70 atm</p>	<p>ACCEPT any value or range of values between 250 and 350 °C If no unit given assume it is Celsius</p> <p>ACCEPT equivalent temperatures in other units provided the unit is given</p> <p>ACCEPT any value or range of values between 60 and 70 atm If no unit given assume it is atm</p> <p>ACCEPT equivalent pressures in other units provided the unit is given</p>	2
(d) (i)	(from) orange (to) green		1
(ii)		<p>IGNORE bond angles</p>  <p>scores 1 mark</p>	2
(iii)	<p>CH₃COONa + ½H₂</p> <p>M1 for both products correct</p> <p>M2 for correctly balanced</p>	<p>ALLOW NaCH₃COO</p> <p>ACCEPT multiples</p> <p>M2 DEP M1</p>	2
Total			14

Question number	Answer	Additional guidance	Marks
7 (a)	<p>An explanation that links together the following two points:</p> <p>M1 reaction is taking place in both directions (at same time)</p> <p>M2 at equal rate</p>	<p>ACCEPT both forward and backward reactions are taking place (at same time) IGNORE it is a reversible reaction</p> <p>M2 DEP M1</p> <p>rate of the forward reaction is equal to the rate of the backward reaction scores 2 marks</p> <p>REJECT both forward and backward reactions occur at constant rate for M2</p> <p>ALLOW the concentrations of the reactants and products remains constant scores 1 mark independently of M1 but REJECT concentrations of the reactants and products are equal/the same</p>	2

(b) (i)	<p>An explanation that links together the following two points:</p> <p>M1 (the position of) equilibrium has moved to the left</p>	<p>ALLOW (position of) equilibrium has shifted in backwards direction</p> <p>ALLOW (position of) equilibrium has shifted towards the N_2O_4 /reactants (side)</p> <p>ALLOW increasing pressure shifts (position of) equilibrium in direction that produces fewer moles (of gas)</p> <p>IGNORE references to Le Chatelier's Principle eg increasing pressure favours the side that has fewer moles of gas / increasing pressure favours the backwards reaction</p>	2
	<p>M2 because there are fewer moles/molecules (of gas) on the left</p>	<p>ALLOW particles REJECT atoms</p> <p>ALLOW because there are fewer moles of N_2O_4 (than NO_2) ALLOW because there are fewer moles of reactant (than product)</p> <p>ACCEPT reverse argument</p>	
(ii)	<p>the concentration of NO_2 has increased</p>	<p>ALLOW molecules/particles of NO_2 are closer together ALLOW molecules/particles of NO_2 are in a smaller volume REJECT more NO_2 produced</p>	1

Question number	Answer	Additional guidance	Marks
7 (c) (i)	nitrogen/N ₂ reacts with oxygen/O ₂ (both from the air)	IGNORE nitrogen burns/combusts in oxygen IGNORE nitrogen is oxidised	1
(ii)	(they form) acid rain	ACCEPT references to respiratory problems ALLOW a specified harmful effect of acid rain ALLOW references to smog ALLOW references to greenhouse gases/global warming/climate change	1
(iii)	$2\text{NO} + 2\text{CO} \rightarrow \text{N}_2 + 2\text{CO}_2$	ACCEPT multiples and fractions	1
		Total	8

Question number	Answer	Additional guidance	Marks
8 (a)	<p>An explanation using either of the following linked pairs:</p> <p>M1 use a fume cupboard</p> <p>M2 because chlorine is toxic/poisonous</p> <p>OR</p> <p>M1 wear goggles/safety glasses/gloves</p> <p>M2 because acid/bleach (may be) irritant/corrosive</p>	<p>IGNORE chlorine is dangerous/harmful/irritant</p> <p>IGNORE laboratory coats</p>	2
(b) (i)	<p>M1 $60 \div 24\,000$</p> <p>M2 0.0025 (mol)</p>	<p>0.0025 with no working scores 2 marks</p> <p>REJECT 0.003 for M2</p>	2
(ii)	0.0025 OR answer to M2 from (i)		1
(iii)	<p>M1 $(0.0025 \div 4.00) \times 1000$</p> <p>M2 0.625 (mol/dm³)</p>	<p>Mark CSQ on (b)(ii)</p> <p>ACCEPT any number of sig fig except 1 (unless ECF answer is exactly 1 sig fig)</p> <p>correct answer with no working throughout (b) scores 2 marks</p>	2
		Total	7

