



Mark Scheme FINAL

Summer 2019

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

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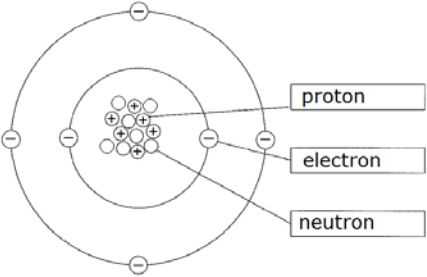
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General Marking Guidance

- 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><tr><th>Name of halogen</th><th>Physical state at room temperature</th><th>Colour</th></tr><tr><td>chlorine</td><td>gas</td><td>pale green</td></tr><tr><td>bromine</td><td>liquid</td><td>red-brown</td></tr><tr><td>iodine</td><td>solid</td><td>(dark) grey</td></tr></table>			Name of halogen	Physical state at room temperature	Colour	chlorine	gas	pale green	bromine	liquid	red-brown	iodine	solid	(dark) grey	ALLOW black ALLOW any combination of grey and black eg grey-black	2
	Name of halogen	Physical state at room temperature	Colour														
	chlorine	gas	pale green														
	bromine	liquid	red-brown														
	iodine	solid	(dark) grey														
(b)	M1 $(35 \times 77.78) + (37 \times 22.22)$ OR 3544.44 M2 $3544.44 \div 100$ OR 35.4444 M3 35.4 OR M1 $\div 100$ 4CH1 2019 May/June Paper 2 GradeMax			$(35 \times 0.7778) + (37 \times 0.2222)$ OR 35.4444/35.444/35.44 with no working scores 2 35.4 with no working scores 3 M3 can be ECF from an incorrect M2	3												

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

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

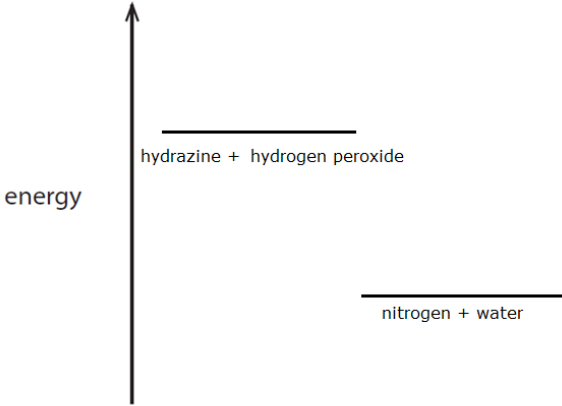
Question Number	Answer	Additional Guidance	Marks
(iii)	M1 as the number of carbon atoms increases M2 the ease of evaporation decreases/the less easily the alcohol evaporates	ALLOW the less volatile the alcohol IGNORE the slower the alcohol evaporates IGNORE references to time taken ALLOW correct reverse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

Question number	Answer	Additional guidance	Marks
4 (a)	C (electrostatic attraction between positively charged particles and delocalised electrons) is correct as it describes metallic bonding A is incorrect since it describes ionic bonding not metallic bonding B is incorrect since it describes covalent bonding not metallic bonding D is incorrect since it describes interatomic or intermolecular forces not metallic bonding		1
(b)	Any two from the following: M1 good conductor of heat/thermal energy M2 does not react with food/affect flavour of food M3 resistant to corrosion M4 high melting point M5 low density/light weight/strong	IGNORE non-toxic ALLOW does not corrode/rust IGNORE unreactive/inert IGNORE references to recycling IGNORE light	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 M2 because magnesium atoms are larger than aluminium atoms M3 and therefore is more difficult for the layers to slide over one another	ALLOW lattice/layers/rows of atoms are disrupted/distorted ALLOW lattice/layers/rows of atoms less regular ALLOW magnesium and aluminium atoms are of different sizes ALLOW layers cannot (as easily) slide over one another IGNORE references to strength of metallic bonds	3
		Total	7

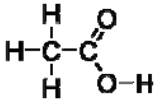
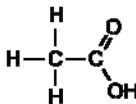
Question number	Answer	Additional guidance	Marks
5 (a)	(i) (bonds broken) 3861 (kJ)		1
	(ii) (bonds made) 4649 (kJ)		1
	(iii) M1 subtraction of $\Sigma(\text{bonds made})$ made and $\Sigma(\text{bonds broken})$ M2 correct evaluation of the calculation shown in M1 M3 If $\Sigma(\text{bonds made}) > \Sigma(\text{bonds broken})$ final answer must be negative If $\Sigma(\text{bonds made}) < \Sigma(\text{bonds broken})$ final answer must be positive (and + sign given)	In (iii) ECF from (i) and (ii) must be applied Subtraction can be in any order IGNORE sign Expected final answer is -788 (kJ/mol) -788 with no working scores 3 (+) 788 scores 2	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 4CH1 2019 May/June Paper 2 GradeMax	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
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Question number	Answer	Additional guidance	Marks
5 (c)	 M1 right hand line below left hand line M2 correct names/formulae of both reactants M3 correct names/formulae of both products	IGNORE horizontal axis drawn IGNORE enthalpy change shown IGNORE activation energy shown If only use words <i>reactants</i> (on left) and <i>products</i> (on right) award 1 mark from M2 and M3	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 /CO₂ and H₂O 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)	$\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$ M1 all formulae correct M2 correctly balanced	ACCEPT multiples M2 DEP M1	2

Question number	Answer	Additional guidance	Marks
6 (c)	M1 (temperature) 300 °C M2 60 – 70 atm	ACCEPT any value or range of values between 250 and 350 °C If no unit given assume it is Celsius ACCEPT equivalent temperatures in other units provided the unit is given ACCEPT any value or range of values between 60 and 70 atm If no unit given assume it is atm ACCEPT equivalent pressures in other units provided the unit is given	2
(d) (i)	(from) orange (to) green		1
(ii)		IGNORE bond angles  scores 1 mark	2
(iii)	$\text{CH}_3\text{COONa} + \frac{1}{2}\text{H}_2$ M1 for both products correct M2 for correctly balanced	ALLOW NaCH_3COO ACCEPT multiples M2 DEP M1	2
		Total	14

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

(b) (i)	An explanation that links together the following two points: M1 (the position of) equilibrium has moved to the left	ALLOW (position of) equilibrium has shifted in backwards direction ALLOW (position of) equilibrium has shifted towards the N_2O_4 /reactants (side) ALLOW increasing pressure shifts (position of) equilibrium in direction that produces fewer moles (of gas) 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	2
	M2 because there are fewer moles/molecules (of gas) on the left:	ALLOW particles REJECT atoms ALLOW because there are fewer moles of N_2O_4 (than NO_2) ALLOW because there are fewer moles of reactant (than product) ACCEPT reverse argument	
(ii)	the concentration of NO_2 has increased	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	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)	An explanation using either of the following linked pairs: M1 use a fume cupboard M2 because chlorine is toxic/poisonous OR M1 wear goggles/safety glasses/gloves M2 because acid/bleach (may be) irritant/corrosive	IGNORE chlorine is dangerous/harmful/irritant IGNORE laboratory coats	2
(b) (i)	M1 $60 \div 24\,000$ M2 0.0025 (mol)	0.0025 with no working scores 2 marks REJECT 0.003 for M2	2
(ii)	0.0025 OR answer to M2 from (i)		1
(iii)	M1 $(0.0025 \div 4\,000) \times 1000$ M2 0.625 (mol/dm³)	Mark CSQ on (b)(ii) ACCEPT any number of sig fig except 1 (unless ECF answer is exactly 1 sig fig) correct answer with no working throughout (b) scores 2 marks	2
		Total	7

