Pearson Edexcel

Mark Scheme FINAL

Summer 2019

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

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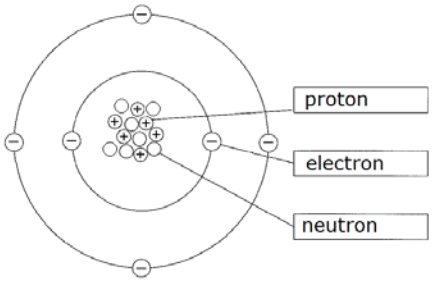
General Marking Guidance

- 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.

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**

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>
<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>
</td><td>ALLOW black
ALLOW any combination of grey and black eg grey-black</td><td>2</td></tr>
<tr><td>(b)</td><td>M1 (35 × 77.78) + (37 × 22.22)
OR 3544.44

M2 3544.44 ÷ 100 OR 35.4444 OR M1 ÷ 100

M3 35.4</td><td>(35 × 0.7778) + (37 × 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</td><td>3</td></tr>
</table>

(c)	An explanation that links together the following four points: **M1** add chlorine (solution) to potassium bromide (solution) **M2** (solution) turns orange **M3** bromine/Br_2 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/Br_2 is produced/formed **IGNORE** state of bromine **REJECT** bromide **IGNORE** a displacement reaction occurs **M3** can be scored by Br_2 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) ÷3 **M2 =** 62	 **ALLOW** 62.3 62/62.3 with no working scores 2 **ALLOW** 69/69.25/69.3 for 1 mark	2
(ii)	An explanation including the following two points: **M1** methanol/CH_3OH (evaporates most easily) **M2** because the time taken is the shortest	 **ACCEPT** because has lowest (mean) time	2

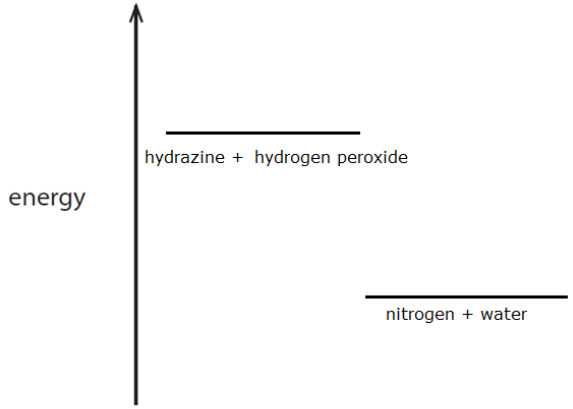
Question Number	**Answer**	**Additional Guidance**	**Marks**
(iii)	**M1** as the number of carbon atoms increases **M2** the ease of evaporation decreases/the less easily the alcohol evaporates	 **ALLOW** the less volatile the alcohol **IGNORE** the slower the alcohol evaporates **IGNORE** references 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/lightweight/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	**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**

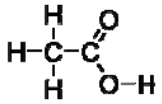
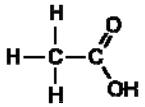
Question number	Answer	Additional guidance	Marks
5 (a) (i)	(bonds broken) 3861 (kJ)		1
(ii)	(bonds made) 4649 (kJ)		1
(iii)	**M1** subtraction of Σ(bonds made) made and Σ(bonds broken)	In (iii) ECF from (i) and (ii) must be applied Subtraction can be in any order	3
	M2 correct evaluation of the calculation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

(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)	 **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 *reactants* (on left) and *products* (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 / CO_2 and H_2O 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)	**M1** (temperature) 300 °C	**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	2
	M2 60 – 70 atm	**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	
(d) (i)	(from) orange (to) green		1
(ii)		**IGNORE** bond angles  scores 1 mark	2
(iii)	$CH_3COONa + \frac{1}{2}H$ **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)	$2\,NO + 2\,CO \rightarrow N_2 + 2\,CO_2$	**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 ÷ 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 ÷ 4.00) × 1000 **M2** 0.625 (mol/dm^3)	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**