



# Mark Scheme (Results)

November 2020

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	Notes	Marks
1	<p>(a) <b>B</b> filtration is the correct answer because it will enable sand to be separated from salt solution</p> <p><b>A</b> is not correct because crystallisation will not enable sand to be separated from salt solution</p> <p><b>C</b> is not correct because fractional distillation will not enable sand to be separated from salt solution</p> <p><b>D</b> is not correct because simple distillation will not enable sand to be separated from salt solution</p> <p>(b) (i) X is a thermometer Y is a (Liebig) condenser Z is a beaker</p> <p>(ii) salt</p>		<p>1 comp</p> <p>3 cler</p> <p>1 cler</p>

Total for Q1 = 5

Question number	Answer	Notes	Marks
2 (a)	<p>A substance S is the correct answer because S only contains one dye as it produces only one spot</p> <p>B is not correct because T does not only contain one dye as it produces two spots</p> <p>C is not correct because U does not only contain one dye as it produces three spots</p> <p>D is not correct because V does not only contain one dye as it produces two spots</p>		1 comp
(b)	<p>explanation containing following points</p> <p>M1 (V contains) blue/B and red/R (dyes)</p> <p>M2 because V has spots at same height as those from blue/B and red/R OWTTE</p>		2 grad
(c) (i)	<p>M1 correct measurement of distance moved by spot Y</p> <p>M2 correct measurement of distance moved by solvent</p> <p>M3 use and evaluation of</p> $R_f = \frac{\text{distance moved by spot Y}}{\text{distance moved by solvent}}$	<p>ALLOW 5.7-6.1</p> <p>ALLOW 8.7-9.1</p> <p>ALLOW 1-4 sig fig ALLOW ECF from M1 M2 only if <math>R_f &lt; 1</math></p>	3 exp
(ii)	<p>spot from yellow food dye/Y does not move as far as spot from red food dye/R OWTTE</p>	ORA	1 exp

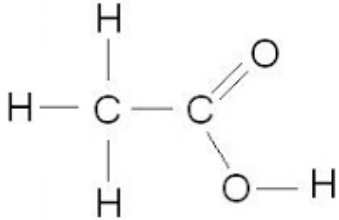
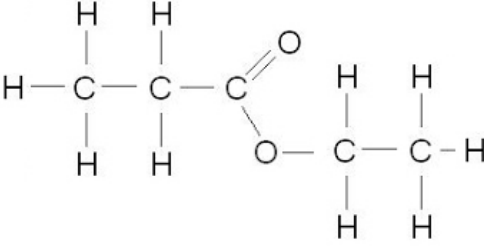
Total for Q2 = 7

Question number	Answer	Notes	Marks
3 (a) (i)	magnesium	ALLOW Mg	1 cler
	(ii) explanation including the following points M1 silver M2 because it is the least reactive (of the metals)	ALLOW it is very unreactive	2 grad
	(b) explanation including the following points: M1 Method 1/ heating the metal oxide/lead(II) oxide with carbon  M2 (because) lead is less reactive than iron (and iron is obtained from iron oxide by carbon extraction)  M3 $2\text{PbO} + \text{C} \rightarrow 2\text{Pb} + \text{CO}_2$	ALLOW carbon is more reactive than lead  ACCEPT reverse arguments  ALLOW $\text{PbO} + \text{CO} \rightarrow \text{Pb} + \text{CO}_2$ ALLOW $\text{PbO} + \text{C} \rightarrow \text{Pb} + \text{CO}$	3 exp

Question number	Answer	Notes	Marks
3 (c)	<p>Explanation containing the following points</p> <p>Pure metal:</p> <p>M1 (particles/ions/atoms are same size in a regular arrangement so) layers can easily slide over each other</p> <p>Alloy:</p> <p>M2 diagram of alloy structure showing minimum of three layers with at least one different sized circle</p> <p>M3 (having different sized particles/ions/atoms) disrupts/breaks up regular arrangement OWTTE</p> <p>M4 so hard(er) for layers to slide over each other</p>	<p>REJECT molecules once only</p> <p>ALLOW disrupts the lattice / layers / rows (of particles/ions /atoms)</p> <p>ALLOW layers cannot slide over each other</p> <p>IGNORE references to strength/breaking of forces/(metallic) bonds</p>	4 exp

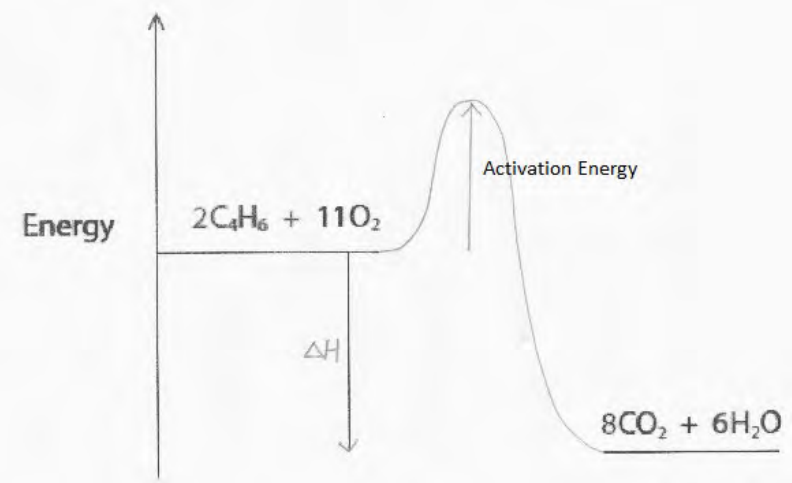
Total for Q3 = 10

Question number	Answer	Notes	Marks
4 (a)	CH <sub>3</sub> OH	IGNORE displayed formula	1 grad
(b) (i)	fermentation		1 cler
(ii)	<p>Explanation including four from</p> <p>M1 fermentation/reaction/respiration needs to be anaerobic</p> <p>M2 because in air / aerobic conditions ethanol not produced</p> <p>M3 because in air / aerobic conditions CO<sub>2</sub> and H<sub>2</sub>O are produced</p> <p>M4 (if temperature above 40 °C/too high) enzymes (in yeast) become denatured/lose their structure OWTTE</p> <p>M5 causing fermentation/reaction to slow down /stop</p>	<p>ALLOW</p> <p>M1 in air ethanol would react with oxygen / be oxidised</p> <p>M2 in air ethanol would form ethanoic acid /carboxylic acid/vinegar</p> <p>ALLOW reference to optimum temperature (between 30 °C and 40 °C)</p>	4 exp

Question number	Answer	Notes	Marks
4 (c) (i)	 <p>M1</p> <p>M2 C<sub>3</sub>H<sub>6</sub>O<sub>2</sub></p> <p>M3 butanoic acid</p>		3 grad
(ii)	carboxylic (acids)		1 grad
(d) (i)	(acid acts as) a catalyst/to speed up reaction	IGNORE references to activation energy	1 grad
(ii)	 <p>M1 ester linkage</p> <p>M2 rest of molecule fully correct</p>	M2 DEP M1	2 exp
(iii)	<p>M1 (Property:) distinctive/sweet/fruity smell</p> <p>M2 used in perfumes/flavourings</p>	<p>ALLOW volatile</p> <p>ALLOW any correct use eg in making soaps/ in solvents (for paints/varnishes)</p>	2 exp

Total for Q4 = 15

Question number	Answer	Notes	Marks
5 (a)	Explanation including following points M1 (unsaturated because) contains (carbon to carbon) double bond(s) M2 (hydrocarbon because) contains (the elements/atoms) carbon and hydrogen M3 only	ALLOW contains C=C  REJECT molecules  M3 DEP on carbon and hydrogen	3 grad
(b) (i)	from orange to colourless	ALLOW yellow for orange or any combination of orange/yellow IGNORE clear	1 grad
(ii)	calculation including following steps M1 calculation of energy involved in bond breaking in reactants M2 calculation of energy involved in bond making in products M3 evaluation of difference M4 correct answer and sign  Example calculation M1 $2(612) + 1(348) + 6(412) + 2(193)$ OR 4430 M2 $3(348) + 6(412) + 4(276)$ OR 4620  M3 $(4620 - 4430 = )$ 190  M4 -190	ECF from M1 and M2      IGNORE signs in M1 and M2  ACCEPT $2(612) + 2(193)$ OR 1610 for M1 and $2(348) + 4(276)$ OR 1800 for M2  IGNORE sign ACCEPT $(1800 - 1610 = )$ 190  M3 M4 ECF from M1 and M2  If $M1 > M2$ answer for M4 must be positive If $M1 < M2$ answer for M4 must be negative  -190 with or without working scores 4 (+) 190 with or without working scores 3	4 Exp

(c) (i)	$2\text{C}_4\text{H}_6 + 7\text{O}_2 \rightarrow 2\text{C} + 4\text{CO} + 2\text{CO}_2 + 6\text{H}_2\text{O}$		1 Exp
(ii)	<p>Explanation including</p> <p>M1 CO/carbon monoxide</p> <p>M2 is poisonous/toxic/reduces capacity of blood to carry oxygen OWTTE</p> <p>OR</p> <p>M1 CO<sub>2</sub>/carbon dioxide</p> <p>M2 is a greenhouse gas/contributes to global warming/ contributes to climate change OWTTE</p>	<p>M2 DEP M1 correct or missing</p> <p>ACCEPT prevents blood from carrying oxygen OWTTE ALLOW correct explanation in terms of haemoglobin eg prevents haemoglobin from carrying oxygen / forms carboxyhaemoglobin</p>	2 Exp
(iii)	 <p>M1 horizontal line below level of reactants with 8 CO<sub>2</sub> + 6 H<sub>2</sub>O</p> <p>M2 profile curve rising from reactants level to form “hump” and then falling down to products level</p> <p>M3 activation energy correctly shown and labelled</p> <p>M4 ΔH correctly shown and labelled</p>	<p>ALLOW double headed arrow</p> <p>REJECT arrow pointing downwards</p> <p>ALLOW double headed arrow</p> <p>REJECT arrow pointing upwards</p> <p>ALLOW -3446 for ΔH label</p> <p>an endothermic reaction profile can score M2 M3 M4 ECF</p>	4 Exp

Total for Q5 = 15

Question number	Answer	Notes	Marks
6 (a) (i)	zinc would react with sulfuric acid/solution X	IGNORE zinc is too reactive	1 grad
(ii)	bubbles	ALLOW fizzing / effervescence IGNORE gas evolved IGNORE incorrectly named gas	1 grad
(iii)	<p><b>B</b> a burning splint gives a squeaky pop is correct because this is the test for hydrogen</p> <p><b>A</b> is incorrect because a glowing splint relights is not the test for hydrogen</p> <p><b>C</b> is incorrect because a burning splint goes out is not the test for hydrogen</p> <p><b>D</b> is incorrect because limewater turns cloudy is not the test for hydrogen</p>		1 comp
(b)	<p>description including</p> <p>M1 add barium chloride/<math>\text{BaCl}_2</math></p> <p>M2 white ppt forms</p>	<p>ACCEPT barium nitrate/<math>\text{Ba}(\text{NO}_3)_2</math> IGNORE references to adding (dilute) <math>\text{HCl}/\text{HNO}_3</math> REJECT add <math>\text{H}_2\text{SO}_4</math></p> <p>M2 DEP M1</p>	2 Grad
(c) (i)	(graduated) pipette	ALLOW burette	1 Cler

(ii)	<p>calculation with following steps</p> <p>M1 setting out of how to calculate n(KOH)</p> <p>M2 evaluation</p> <p>Example calculation</p> <p>M1 <math>n(\text{KOH}) = 0.125 \times 25 \div 1000</math></p> <p>M2 <math>= 0.003125 / 3.125 \times 10^{-3}</math></p>	<p>ALLOW any number of sig figs except one</p> <p>If no division by 1000 giving answer of 3.125 award 1 mark</p> <p>correct answer with no working scores 2</p>	2 Exp
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(iii)	<p>calculation with following steps</p> <p>M1 calculate <math>n(\text{H}_2\text{SO}_4) = \text{M2 from (i)} \div 2</math></p> <p>M2 calculate vol <math>\text{H}_2\text{SO}_4 = (\text{M1} \times 1000) \div 0.10</math></p> <p>M3 evaluation of volume</p> <p>Example calculation</p> <p>M1 <math>0.003125 \div 2 = 0.0015625 / 1.5625 \times 10^{-3}</math></p> <p>M2 <math>0.0015625 \times 1000 \div 0.10</math></p> <p>M3 <math>= 15.625/15.63/15.6 /16 \text{ (cm}^3\text{)}</math></p>	<p>Mark ECF from M1</p> <p>Mark ECF from M2</p> <p>ALLOW any number of sig figs except one</p> <p>correct answer with no working scores 3</p> <p>Do not penalise not multiplying by 1000 in (iii) if they have not divided by 1000 in (ii)</p> <p>31.25/31.3/31 scores 2 62.5/63 scores 2</p>	3 Exp
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Total for Q6 = 11

Question number	Answer	Notes	Marks
7 (a)	calculation with following steps M1 calculation of $n(\text{K}_2\text{CO}_3)$ M2 deduction of $n(\text{CO}_2)$ and $\text{vol}(\text{CO}_2)$ by multiplying by 24 ( $\text{dm}^3$ ) M3 correct evaluation of volume in $\text{cm}^3$ Example calculation M1 $n(\text{K}_2\text{CO}_3) = 6.9 \div 138$ OR 0.05 M2 $\text{vol}(\text{CO}_2) = 0.05 \times 24$ ( $\text{dm}^3$ ) M3 1200 ( $\text{cm}^3$ )	Mark ECF from M1 correct answer with no working scores 3 1.2 scores 2 marks	3 Exp
(b) (i)	M1 higher yield of CO M2 because (equilibrium shifts to the right as the forward) reaction is endothermic	ACCEPT more CO is produced IGNORE references to Le Chatelier's Principle eg increasing temperature favours the forward reaction M2 DEP M1 correct or missing	2 Exp
(ii)	M1 no effect (on yield) OWTTE M2 because equal numbers of moles/molecules (of gas) on both sides	M2 DEP M1 correct or missing	2 Exp

Total for Q7 = 7

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