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Pearson Edexcel

# Mark Scheme (Results)

## November 2021

### 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.

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| Question number | | Answer | Notes | Marks |
|---|---|---|---|---|
| 1 | (a) | nitrogen | ALLOW $N/N_2$ | 1 |
| | (b) | silicon/Si or phosphorus/P or sulfur/S | | 1 |
| | (c) | bromine | | 1 |
| | (d) | 73 | | 1 |
| | (e) | The only correct answer is D as francium is the most reactive element in Group 1 and fluorine is the most reactive element in Group 7<br><br>A is not correct because lithium is not the most reactive element in Group 1<br>B is not correct because astatine is not the most reactive element in Group 7<br>C is not correct because lithium is not the most reactive element in Group 1 and astatine is not the most reactive element in Group 7 | | 1 |

Total marks for Question 1 = 5

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 2 (a) | Explanation containing following ideas<br><br>(A saturated solution is one which contains)<br>M1 as much solute as possible in (a certain volume of) the solvent OWTTE<br><br>M2 at a particular / given / constant temperature OWTTE | | 2 |
| 2 (b) (i) | (volumetric) pipette/burette | | 1 |
| (ii) | (water / solution) would be heated too quickly OR (water / solution) might spit out or be lost OWTTE | ALLOW (water / solution) might boil or evaporate | 1 |
| (iii) | repeat (and find the mean temperature) | | 1 |
| (iv) | M1 4.5 (g solid in 10 g water)<br><br>M2 (so solubility = 4.5 x 10) = 45 (g per 100 g of water) | ALLOW M1×10<br><br>45 with no working scores 2 | 2 |
| . | | | |

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 2 (c) (i) | 71 (°C) | ALLOW 70-72(°C) | 1 |
| (ii) | M1 (from curve) 124 g of solid B dissolves in 100 g water<br><br>M2 (so 124 x 2.5) = 310 (g dissolves in 250 g water) | ALLOW 123-125 g<br><br>ALLOW ecf from M1<br><br>307.5-312.5 with no working scores 2 marks<br><br>ALLOW M1×2.5<br><br>If solid A used 1 mark for correct answer of 262-268g | 2 |
| (iii) | some water may have been lost/evaporated OWTTE | | 1 |

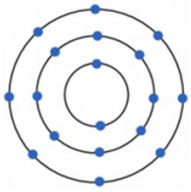
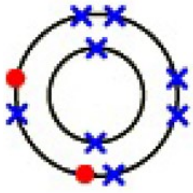
Total marks for Question 2 = 11

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 3 (a) (i) | $2H_2S$ (**g**) + $SO_2$ (**g**) → **3** S (s) + **2** $H_2O$ (l)<br><br>M1 all state symbols correct<br><br>M2 balancing correct | <br><br>ALLOW upper case<br><br>ALLOW multiples/fractions | 2 |
| (ii) | (sulfur dioxide is reduced because it) loses oxygen | IGNORE references to electrons | 1 |
| 3 (b) (i) | Explanation linking following points<br><br>M1 sulfur/(pale yellow) solid forms nearer to sulfur dioxide side/closer to left OWTTE ORA<br><br>M2 so hydrogen sulfide particles moved / diffused further (in same time) OWTTE ORA | | 2 |
| (ii) | M1 $M_r$ of $H_2S$ = (1 + 1 + 32) = 34<br><br>M2 $M_r$ of $SO_2$ = (32 +16 + 16) = 64<br><br>M3 statement of relationship eg the higher the Mr the slower the gas diffuses | <br><br><br><br>ACCEPT reverse argument | 3 |

Total marks for Question 3 = 8

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 4 (a) | M1 (cation) $Mg^{2+}$<br><br>M2 (anion) $SO_4^{2-}$ | ALLOW 1 mark if formulae correct but in wrong order | 2 |
| (b) | M1 potassium ion<br><br><br><br>M2 oxide ion<br><br><br><br>M3 $(K)^+$ and $(O)^{2-}$ | ALLOW any combination of dots and crosses<br><br>If only outer shells shows – max 2 | 3 |

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 4 (c) (i) | hydroxide/$OH^-$ | ALLOW $HO^-$ | 1 |
| (ii) | $K_2O + H_2O \rightarrow 2KOH$ | ALLOW multiples | 1 |
| (d) | M1 (when molten or in aqueous solution) ions can move<br><br>M2 (in solid) ions cannot move | | 2 |
| (e) | M1 X is chlorine / $Cl_2$<br><br>M2 Y is hydrogen / $H_2$<br><br>M3 $2Cl^- \rightarrow Cl_2 + 2e^{(-)}$<br><br>M4 $2H^+ + 2e^{(-)} \rightarrow H_2$ | ALLOW oxygen / $O_2$<br><br>If both given but wrong way round or unclear which is which allow 1 mark from M1 and M2<br><br>$2H_2O \rightarrow O_2 + 4H^+ + 4e^{(-)}$<br>or<br>$4OH^- \rightarrow O_2 + 2H_2O + 4e^{(-)}$ | 4 |

Total marks for Question 4 = 13

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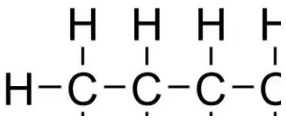
| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 5 (a) (i) | ore(s) | IGNORE minerals | 1 |
| (ii) | gold/platinum | ALLOW silver/copper<br>ALLOW symbols | 1 |
| 5 (b) (i) | (calcium from calcium chloride)<br><br>M1 electrolysis<br><br>M2 (because) calcium is more reactive than carbon **OR** carbon cannot displace calcium | <br><br><br>ALLOW reverse argument<br>M2 dep on M1 | 2 |
| (ii) | (lead from lead oxide)<br><br>M1 carbon extraction<br><br>M2 (because) carbon is more reactive than lead **OR** carbon can displace lead | <br><br><br>ALLOW reverse argument<br>M2 dep on M1 | 2 |

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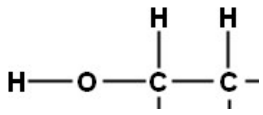
| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 5 (c) | M1 2-D diagram showing at least two layers of particles<br><br>M2 particles labelled atoms or (positive) ions<br><br>(malleable because)<br>M3 layers can slide over each other | | 3 |
| (d) | M1 calculation of $M_r$ of $Al_2O_3$<br><br>M2 moles of $Al_2O_3$<br><br>M3 calculation of mass of aluminium<br><br>exemplar<br><br>M1 102<br><br>M2 1275÷102 OR 12.5(moles)<br><br>M3 (12.5×2×27) = 675g | <br><br><br><br><br><br><br>ALLOW M1×2<br>ALLOW ecf from M1<br><br>ALLOW ecf from M2<br><br>675g without working scores 3<br>0.675 without working scores 2<br>337.5 without working scores 2<br>1350 without working scores 2 | 3 |

Total marks for Question 5 = 12

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 6 (a) | C is the only correct answer as temperature used is 300°C and pressure is 65 atm (60-70 atm)<br>A is incorrect because 35°C and 300 atm are not the correct conditions<br>B is incorrect because 65°C and 300 atm are not the correct conditions<br>D is incorrect because 300°C and 35 atm are not the correct conditions | | 1 |
| (b) |  | formula must be fully displayed<br>ALLOW fully displayed formula for butan-2-ol | 1 |
| (c)(i) | M1 mol(KOH) = $\frac{45.00 \times 0.40}{1000}$<br>= 0.018 | | 2 |
| | M2 conc($CH_3COOH$) = $\frac{0.018 \times 1000}{25}$<br>= 0.72 ($mol/dm^3$) | ALLOW ecf from M1<br>0.72 ($mol/dm^3$) without working scores 2 | |
| (ii) | M1 mol($CO_2$) = (0.0030÷2) = 0.0015 | | |
| | M2 vol($CO_2$) = 0.0015 x 24000 = 36 ($cm^3$) | ALLOW ecf from M1<br>36 ($cm^3$) without working scores 2<br>72 ($cm^3$) without working scores 1 | 2 |
| (d) | **B** $C_2H_5OH$ is the only correct answer<br>A is not correct because $CH_3OH$ could not form the ester ethyl propanoate<br>C is not correct because $C_3H_7OH$ could not form the ester ethyl propanoate<br>D is not correct because $C_4H_9OH$ could not form the ester ethyl propanoate | | 1 |

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| | | | | |
|---|---|---|---|---|
| (e) | (i) | (in condensation polymerisation)<br>two different monomers used / water is produced | ALLOW small molecule is produced | 1 |
| | (ii) | M1  | ALLOW -OH | 2 |
| | | M2  | ACCEPT in either order<br>ALLOW -OH | |
| | (iii) | biodegradable | ACCEPT description | 1 |

Total marks for Question 6 = 11

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| Question number | Answer | Notes | Marks |
|---|---|---|---|
| 7 (a) (i) | M1 no effect on yield | IGNORE comments about rate | 2 |
| | M2 because same number of moles (of gas) on both sides of equation | M2 dep on M1 | |
| (ii) | M1 no effect on yield | | 2 |
| | M2 because catalyst increases rate of both forward and backward reactions by same amount | M2 dep on M1 | |
| (b) | M1 bonds broken = (436 + 158) OR 594 (ignore sign) | | 3 |
| | M2 bonds made = (2 x 562) OR 1124 (ignore sign) | | |
| | M3 $\Delta H$ = -530 (kJ/mol) | -530 with no working scores 3<br>+530 or 530 with no working scores 2<br>+32 or 32 with no working scores 2 | |
| (c) | M1 right hand line below left hand line | | 3 |
| | M2 correct names/formulae of reactants and products | ALLOW reactants and products | |
| | M3 enthalpy change, $\Delta H$ correctly shown and labelled with arrow pointing down | ACCEPT line with no arrow head / double arrow head if<br>-$\Delta H$ or -530 is labelled<br>REJECT arrow pointing upwards | |
| | If the answer to (b) is positive | | |
| | M1 right hand line above left hand line | | |
| | M2 correct names/formulae of reactants and products | ALLOW reactants and products | |
| | M3 enthalpy change, $\Delta H$ correctly shown and labelled with arrow pointing up | ACCEPT line with no arrow head / double arrow head if<br>(+)$\Delta H$ or +530 is labelled<br>REJECT arrow pointing downwards | |

Total marks for Question 7 = 10

**Total for Paper = 70**

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