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Mark Scheme (Results)

November 2025

Pearson Edexcel International GCSE in Chemistry
4CH1/1C

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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)	**M1** X melting **M2** Y boiling **M3** Z sublimation	 **ALLOW** evaporation **ALLOW** vaporisation	3
(b)	H_2O (g) $\rightarrow$ H_2O (l) **M1** both formulae correct **M2** both state symbols correct	 **IGNORE** 'water' instead of formulae **IGNORE** letter case M2 dep on M1	2
(c)	**M1** solid (particles) have a regular arrangement OR gas particles are randomly arranged **M2** solid (particles) are closely/tightly packed OR gas particles widely spaced	**IGNORE** statements related to liquids **IGNORE** diagrams **IGNORE** statements related to movement including 'random movement'	2
			Total 7

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Question number	Answer	Notes	Marks
2 (a) (i)	nitrogen	**ALLOW** N_2 **IGNORE** N	1
(ii)	argon	**ALLOW Ar**	1
(iii)	oxygen	**ALLOW** O_2 **IGNORE** O	1
(b)	**M1** heat (the copper(II) carbonate) **M2** until it decomposes (into carbon dioxide) **OR** **M1** add an acid **M2** forming salt, water and carbon dioxide	**ALLOW** thermal decomposition for 2 marks **ALLOW** correct equation for M2 only **ACCEPT** acid/carbonate equation for 2 marks	2
(c) (i)	**M1** (height of oxygen =) 93 – 77 **OR** 16 (mm) **M2** $\frac{16 \times 100}{93}$ = 17 (%)	 **M2** subsumes **M1** **ACCEPT** 17/17.2/17.20 or any number of sig figs except 1 83/82.8 scores M2 – ecf	2
(ii)	Leave the experiment for longer (than a week)/leave until the water is at a constant height	**ALLOW** use a measuring cylinder/graduated tube **ALLOW** use iron fillings **ALLOW** more iron wool **ALLOW** warmer temperature repeat/average does not score - apply list principle	1
			Total 8

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Question number	Answer	Notes	Marks
3 (a) (i)	**B (X)** *A is incorrect as W is a neutron* *C is incorrect as Y is an electron* *D is incorrect as Z is the nucleus*		1
(ii)	**A (W)** *B is X incorrect as X is a proton which has a +1 charge* *C is incorrect as Y is an electron which has a -1 charge* *D is incorrect as Z is the nucleus which contains protons so has an overall positive charge*		1
(iii)	Nucleus		1
(iv)	**B** (3) *A is incorrect as it is not 2* *C is incorrect as it is not 5* *D is incorrect as it is not 11*		1
(v)	**A** (2) *B is incorrect as it is not 3* *C is incorrect as it is not 5* *D is incorrect as it is not 11*		1
(vi)	B		1
(b)	(positive) ion/cation	**ALLOW** 'an ion' **REJECT** 'anion' **REJECT** negative	1
(c) (i)	scale on y-axis starting at 6.0 and going up in twos for each large square		1
(ii)	all points plotted to the nearest grid line	ECF for correct points on an appropriate alternative axis	2
(iii)	there is a positive correlation (between the relative atomic mass and the atomic number) / as the atomic number increases so does the relative atomic mass	**REJECT** directly proportional **REJECT** proportional **REJECT** linear	1
			Total 11

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Question number	Answer	Notes	Marks
4 (a)	**M1** a correct diagram which has an inner shell configuration of 2,8 **M2** a correct diagram which has an outer shell configuration of 8	'2,8,8' with no diagram scores 1 mark only **IGNORE** charge on the ion	2
(b)	Test for chloride ions **M1** add (nitric) acid (to the ammonium chloride) **M2** add silver nitrate solution **M3** white precipitate forms Test for sulfate ions **M4** add (nitric acid/hydrochloric) acid (to the ammonium sulfate) **M5** add barium chloride **M6** white precipitate forms	**IGNORE** tests for ammonium ions **REJECT** add HCl – loses M1 and M3 **M3** dep on addition of silver nitrate **REJECT** add H_2SO_4 – loses M4 and M6 **ALLOW** barium nitrate **M6** dep on addition of barium chloride/nitrate	6
(c) (i)	**M1** the ammonium chloride should be closer to the hydrochloric acid/further from the ammonia solution/further to the right **M2** as hydrogen chloride has a higher M_r/relative molecular mass/relative formula mass ORA **M3** so hydrogen chloride (molecules) moves more slowly/diffuses more slowly/travel a shorter distance ORA	**ACCEPT** (reactant) labels should be the other way around for M1 **REJECT** ammonium chloride should be in the centre for M1	3
(ii)	NH_3 **(g)** + HCl **(g)** ⇌ NH_4Cl **(s)**	**IGNORE** letter case	1
			Total 12

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Question number	Answer	Notes	Marks
5 (a)	Copper(II) carbonate is insoluble/doesn't dissolve (in water)		1
(b)	**M1** polystyrene cup is an insulator **M2** so less heat is lost	**ALLOW** ORA **REJECT** prevents heat loss/no heat loss for M2	2
(c)	Allow any two from: **M1** concentration of copper(II) sulfate **M2** volume of copper(II) sulfate **M3** rate of stirring **M4** surface area of metal (W) **M5** Same initial temperature **M6** Same (polystyrene) cup	**IGNORE** same mass/amount of metal W If no reference to concentration and volume allow amount of copper(II) sulfate for 1 mark	2
(d) (i)	**M1** $\frac{6.1 + 6.3 + 6.0}{3}$ **OR** 6.13 **M2** 6.1	6.1 in table or in the space available scores 2. Answer line takes priority over the table. ECF for correct calculation to 2sf for any data taken for metal Y	2
(ii)	**M1** any one from: Overall temp change should be similar/same as Exp 1/3 OWTTE Temperature increase should not be lower than Exp1/3 Temperature increase would be higher than 2.0 given in the table **M2** (as stirring too quickly) would increase the rate of reaction/wouldn't have reduced the amount of heat produced (in the reaction)	**REJECT** answers which indicate that stirring would have caused the error (i.e. Yes). This scores 0 for the question.	2
(iii)	**M1** Z>Y>W>X **M2** because the higher the temperature (increase) the more reactive the metal OR more heat released the more reactive the metal		2

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5 (d) (iv)	**M1** silver is less reactive than copper **M2** therefore there was no reaction/there was no (mean) temperature increase/no displacement reaction		**M2** dep on correct **M1** or **M1** missing	2
				Total 13

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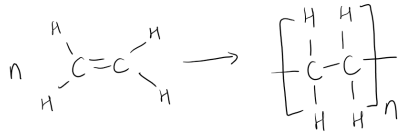
Question number	Answer	Notes	Marks
6 (a) (i)	fractional distillation	**ACCEPT** fractionation **ACCEPT** fractionating	1
(ii)	**M1** a tower drawn with one entrance and more than one exit **M2** crude oil heated/vapourised **before** entering the tower OR passing through a furnace **M3** crude oil enters at bottom **M4** kerosene leaves tower but not right at top/bottom One from: **M5** a temperature gradient up the column/hottest label at the bottom/coldest label at the top **M6** 3 or more other fractions labelled in correct place relative to kerosene	'bottom' meaning not higher than the exit of the second lowest fraction **REJECT** both M5/M6 if either is incorrect	5
(b) (i)	**M1** 600 to 700 °C inclusive **M2** silica/alumina (catalyst)	**ACCEPT** zeolites/SiO_2/Al_2O_3 aluminosilicates /silicon dioxide /aluminium oxide	2
(ii)	$C_{14}H_{30} \rightarrow C_8H_{18} + 3C_2H_4$	**ALLOW** multiples or fractions	1
(c)	An explanation that links the following three points **M1** (octane) can be used as petrol/(fuel) for cars **M2** (as it) undergoes combustion/reacts with oxygen/burns **M3** releasing heat (energy)	 **ALLOW** other acceptable uses for petrol **ACCEPT** thermal energy	3
(d) (i)	 **M1** correct repeat unit with extension bonds **M2** full equation including ethene, n and brackets	 M2 dep on M1	2
(ii)	monomer		1
			Total 15

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Question number	Answer	Notes	Marks
7 (a) (i)	any value between 21.4 and 21.8 inclusive		1
(ii)	any value between 16.1 and 16.3 inclusive		1
(b) (i)	**M1** should not be nitric acid added/sodium hydroxide should be added (not nitric acid) **M2** the point where the lines cross shows where the acid was neutralised/the acid was neutralised before 40 cm^3/ the acid was neutralised at 21.6 cm^3	**ALLOW** any value between 21.4-21.8 cm^3 for 21.6 cm^3	2
(ii)	Any one statement that is: A suitable description e.g. The temperature decreases after the neutralisation point/after 21.6cm^3 (or any value between 21.4-21.8) OR A suitable explanation e.g. The second line shows that there is no further reaction and the cool sodium hydroxide solution decreases the temperature OWTTE		1
(c) (i)	**M1** mass of solution = 25 + 25 **OR** 50 (g) **M2** $Q = mc\Delta T$ **OR** $3780 = 50 \times 4.2 \times \Delta T$ **M3** $\Delta T = \frac{3780}{50 \times 4.2}$ **OR** 18 (°C) **M4** (maximum temperature = 19 + 18 =) 37 (°C)	**ALLOW** ecf for M2 onwards answer of 36 scores 2 answer of 55 scores 3 correct answer without working scores 4	4
(ii)	**M1** $\frac{3780}{0.079}$ **OR** 47 848 (J/mol) **M2** 47.8 (kJ/mol) **M3** − 47.8 (kJ/mol) OR **M1** $\frac{3780}{1000}$ **OR** 3.78 (kJ) **M2** $\frac{3.78}{0.079}$ OR 47.8 (kJ/mol) **M3** − 47.8 (kJ/mol)	correct answer without working scores 3 or 2 without or incorrect sign Incorrect rounding loses M2	3
			Total 12

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<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>8 (a)</td><td>
<table>
<tr><th>Ions</th><th>Li^+</th><th>Mg^{2+}</th><th>Al^{3+}</th></tr>
<tr><td>NO_3^-</td><td></td><td>$Mg(NO_3)_2$</td><td></td></tr>
<tr><td>SO_4^{2-}</td><td>Li_2SO_4</td><td></td><td></td></tr>
<tr><td>PO_4^{3-}</td><td></td><td></td><td>$AlPO_4$</td></tr>
</table>
</td><td></td><td>3</td></tr>
<tr><td>(b)</td><td>M1 (sodium chloride and magnesium oxide) have a giant ionic structure /lattice

M2 (there are) electrostatic forces / attraction between oppositely charged ions /negative and positive ions / anions and cations

M3 MgO has stronger attraction (between ions) than NaCl ORA

M4 (because the) ions in MgO have a higher charge/higher charge density (than NaCl) ORA

M5 which take more energy (to overcome the forces / break the bonds) ORA</td><td>Mention of covalent bonding, intermolecular forces, metallic bonding, molecules loses M1-M4.

ALLOW ionic bonds

‘stronger ionic bonds in MgO’ scores M2 and M3

ACCEPT correct charges on ions</td><td>5</td></tr>
<tr><td></td><td></td><td></td><td>Total 8</td></tr>
</table>

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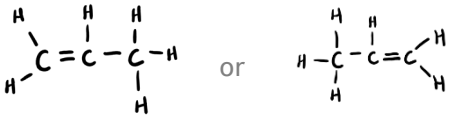
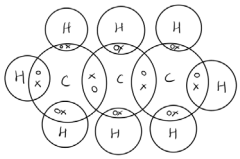
Question number	Answer	Notes	Marks
9 (a)	Displayed formula of propene  Molecular formula of propene C_3H_6 Empirical formula of propene CH_2 Relative formula mass of propene 42	Must show **ALL** the bonds **IGNORE** calculation	3
(b)	**M1** correct electron sharing between 3 carbon atoms **M2** rest of structure correctly drawn 	**ACCEPT** any combination of dots and crosses M2 dep on M1	2
(c) (i)	**B** (1, 2) A as (1,1) is incorrect C as (2,1) is incorrect D as (2,2) is incorrect		1
(ii)	ultra violet radiation / ultra violet light/UV	**IGNORE** sunlight	1
(iii)	**M1** $\frac{25.9}{12}$ $\frac{5.0}{1}$ $\frac{11.5}{16}$ $\frac{57.6}{80}$ **M2** $\frac{2.16}{0.72}$ $\frac{5.0}{0.72}$ $\frac{0.72}{0.72}$ $\frac{0.72}{0.72}$ **OR** 3 6.94 1 1 **M3** C_3H_7OBr	0 marks for upside down calculation or use of any atomic number (6/8/35) ecf allowed from M2 if one incorrect Ar value used that is not an atomic number for these element (6/8/35) correct answer without working scores 3	3
(d) (i)	atom/groups of atoms (in a compound)/part of a molecule that determines its chemical properties/reactions OWTTE		1
(ii)	structure of cyclopropane		1
			Total 12

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Question number	Answer	Notes	Marks
10 (a)	**A** (3) B is incorrect as there are not 5 elements C is incorrect as there are not 14 elements D is incorrect as there are 17 atoms not 17 elements		1
(b) (i)	**M1** (excess) aluminium (powder) **M2** aluminium sulfate AND water	**ACCEPT** (leftover) water **IGNORE** aluminium sulfate solution unless water is also stated **ALLOW** correct symbols	2
(ii)	Ensure all the (sulfuric) <u>acid</u> reacts	**ALLOW** neutralises (all) the <u>acid</u> **IGNORE** maximum yield	1
(iii)	**M1** greater surface area (to volume ratio) **M2** increases the rate of reaction/speeds up the reaction/more frequent (successful) collisions/more (successful) collisions per unit time	**REJECT** kinetic energy for M1 **IGNORE** dissolving faster	2
(c) (i)	**M1** amount of Al = $3.20 \div 27$ **OR** 0.119 (mol) **M2** $\frac{0.120 \times 2}{3}$ = 0.08 (mol) of Al (so 0.1 is in excess) **OR** **M2** $\frac{0.119 \times 3}{2}$ = 0.179 (mol) of H_2SO_4 (only 0.12 used)	alternative answer **M1** only 0.08 (mol) of Al needed **M2** mass of Al = 0.08 x 27 = 2.16g (less than 3.20 g)	2

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(ii)	**M1** amount of $Al_2(SO_4)_3$ = 0.120 ÷ 3 **OR** 0.04(00) (mol) **M2** theoretical mass = (0.04(00) × 342 =) 13.68 g **M3** recorded actual mass = (13.68 × 1.13) = 15.46 g	correct answer without working scores 3 **ALLOW** ecf for incorrect M_r **ALLOW** any number of sig figs except 1 46.38 scores 2 marks	3
(iii)	Any one from: **M1** (the crystals/product) haven't fully dried/still contain water/not all water evaporated **M2** sulfuric acid used was more concentrated **M3** higher volume of sulfuric acid used than stated	**ALLOW** reference to hydrated salt **IGNORE** calculation error REJECT add more aluminium	1
			Total 12