Smart Edge!
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EDEXCEL · GCSE CHEMISTRY 1CH0

Higher Tier — Paper 1

June 2024 exam series

MARK SCHEME

Mark Scheme (Results)

Summer 2024

Pearson Edexcel GCSE
In Chemistry (1CH0)
Paper 1H

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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.

Paper 1H Higher Tier

Question number	Answer	Additional guidance	Mark
1(a)	A description to include two from • shows a constant voltage (1) • decreases (1) • to 0 (v) (1)	mark independently ignore initially increases (when connected)	**(2)** AO2-2

Question number	Answer	Mark
1(b)	**D** iron has a high density is the only correct answer **A**, **B** and **C** are incorrect as they are not typical properties of transition metals	**(1)** AO1-1

Question number	Answer	Mark
1(c)	**B** 0.252 is the only correct answer **A**, **C** and **D** are mathematically incorrect	**(1)** AO2-1

Question number	Answer	Additional guidance	Mark
1(d)	An explanation linking • alloy C is the strongest (1) with any **one** of the following • alloy C has <u>most</u> atoms of a different size (1) • <u>greatest</u> disruption of layers of (zinc) atoms / <u>most</u> difficult for layers to slide over one another (1)	 allow 3rd alloy MP2 depends on MP1 allow contains <u>most</u> copper (atoms / ions) allow <u>most</u> particles of different size allow <u>highest</u> copper to zinc ratio allow has the <u>most</u> irregular structure ignore 'has an irregular structure' alone	**(2)** AO3-2

Total for question 01 = 6 marks

Question number	Answer	Mark
2(a)(i)	$Ba(OH)_2(s) + 2HCl(aq) \rightarrow BaCl_2(aq) + 2H_2O(l)$	**(1) AO2-1**

Question number	Answer	Additional guidance	Mark
2(a)(ii)	barium hydroxide {disappears / gets smaller} / (it) becomes clear	allow 'solid' for barium hydroxide allow barium hydroxide dissolves ignore any colours mentioned / colour change / any incorrect observations ignore becomes a {liquid/solution} reject bubbles	**(1) AO2-2**

Question number	Answer	Additional guidance	Mark
2(b)(i)	pH meter	allow pH probe ignore pH paper / data logger / pH scale	**(1) AO3-3b**

Question number	Answer	Additional guidance	Mark
2(b)(ii)	An explanation linking • to ensure that the mixture is evenly spread (1) • to make substances {react/ dissolve} / to speed up the {reaction / dissolving} (1)	 allow to mix the reactants allow so pH (in mixture) is uniform / concentration is uniform / to get an accurate pH ignore more accurate / valid / fair test allow 'so the reaction is complete' / 'to dissociate all the hydroxide ions'	**(2)** **AO2-2**

Question number	Answer	Additional Guidance	Mark
2(b)(iii)	all points plotted correctly (± half a small square) (2) OR 7/8 points plotted correctly (1) S-shaped line of best fit (1)	 line of best fit must go through 7 points if the points are not visible a line going through **all** correct values scores 3 reject dot-to-dot line / line starting from origin tramlines allowed here but rejected in 2(b)(iv) bar chart scores 0	**(3)** **AO2-1**

Question number	Answer	Additional guidance	Mark
2(b)(iv)	pH reading at 4.5 spatula measures from their line on graph	allow ± half a small square on the **y**-axis ignore any candidate working allow ECF from 2(b)(iii) but if no graph line or multiple lines, cannot score. if bar chart has been drawn for 2(b)(iii), then mark for 2biv cannot be awarded	**(1)** **AO3-2a**

Total for question 02 = 9 marks

Question number	Answer	Mark
3(a)(i)	**B** 2.8 **A** is incorrect as there are too few electrons **C** and **D** are incorrect as there are too many electrons	**(1)** **AO1-1**

Question number	Answer	Additional guidance	Mark
3(a)(ii)	an explanation linking SOLID • has an {(ionic) lattice / ions held by strong (electrostatic) attractions} (1) • so the **ions** {cannot move / are fixed / just vibrate} (1) SOLUTION • in solution the **ions** {can move / are free} (1)	 allow giant structure / regular arrangement / regular structure for lattice allow atoms / (charged) particles in MP1 only ignore electrons for MP1 reject molecules / elements reject electrons allow liquid for solution reject electrons reject intermolecular forces	**(3)** **AO2-1**

Question number	Answer	Additional guidance	Mark
3(b)	43(.4) with or without working scores 3 2x23 + 12 + 3x16 = 106 (1) $\frac{46}{106}$ = 0.4339622642 (1) 0.4339622642 x 100 = 43.4 (1)	43.39622642 rounded correctly to 2 or more sig. fig. scores 3 if M_r incorrect, must show working to allow ECF on MP2 and MP3 $\frac{46}{\text{attempt of } M_r\ Na_2CO_3}$ $\frac{23 \text{ or } 46}{\text{attempt of } M_r\ Na_2CO_3}$ x 100 the following common answers with working are awarded 21.69811321 rounded correctly to 2 or more sig. fig. scores 2 76.6666667 rounded correctly to 2 or more sig. fig. scores 2 48.11320755 rounded correctly to 2 or more sig. fig. scores 1	**(3)** **AO2-1**

Total for question 03 = 7 marks

Question number	Answer	Additional guidance	Mark
4(a)(i)	75.4 with or without working scores 3 marks 45.26 = 0.7543 (1) 60.00 (0.7543) x 100 = 75.43 (1) = 75.4 (1 dp) (1)	75.43 / 75.40 with or without working scores 2 marks allow ECF using numbers from the question allow 1 mark for correct rounding to 1 d.p. of an incorrectly calculated value only if **using numbers from the question** 91.2 with working scores 2 marks	**(3)** AO3-1

Question number	Answer	Additional guidance	Mark
4(a)(ii)	any two reasons valid for this reaction • not enough magnesium used (1) • not all titanium oxide reacted (1) • magnesium reacts with something else (1) • some titanium lost during {separation / purification} (1)	 allow impurities in reactants allow not all reactants used allow incomplete reaction allow side reactions allow practical losses during {separation / purification} allow left on equipment ignore spillages ignore {reactants / products} lost	**(2)** AO2-1

Question number	Answer	Additional guidance	Mark
4(a)(iii)	38 with or without working scores 3 marks 48 + (2x16) + (2x24) = 128 (1) $\frac{\mathbf{48}}{128}$ x 100 = 37.5 (1) 38 % (1)	37.5 with or without working scores 2 marks to score MP1, 128 must have working or appear as denominator in MP2. allow ECF from MP1 as long as working is shown allow MP3 for correct rounding to 2 sig figs of an incorrectly calculated value only if MP2 scored	**(3)** AO2-1

Question number	Answer	Additional guidance	Mark
4(b)(i)	only one product / ethanol is the **only** product	allow this is an addition reaction allow there are no unwanted products / no waste produced / no by-products allow all atoms from reactants in product allow mass of reactants = mass of desired products ignore it is a balanced equation ignore same number of atoms on each side of the equation reject no gas given off	**(1)** AO2-1

Question number	Answer	Additional guidance	Mark
4(b)(ii)	An explanation linking • find a use for the {carbon dioxide / waste product} (1) • so carbon dioxide becomes a <u>useful product</u> / increase mass of <u>useful product</u> (1)	allow a named use of carbon dioxide e.g in fizzy drinks allow sell the {carbon dioxide / waste product}	**(2)** AO2-1

Total for question 04 = 11 marks

Question number	Answer	Additional guidance	Mark
5(a)	Any two advantages of recycling metals • preserves ore reserves/ ores are finite (1) • prevents waste of the metal (1) • uses less energy (1) • less fossil fuels burned (1) • less {carbon dioxide/ greenhouse gases} emitted (1) • less waste material formed (1) • mining causes {loss of habitat/ noise/ dust} • doesn't fill up landfill (1)	allow uses less electricity ignore less land used for mining/ visual pollution ignore cost arguments ignore vague statements about 'environment' or 'pollution' or 'sustainable'	**(2)** AO1-1

Question number	Answer	Additional guidance	Mark
5(b)(i)	An explanation linking • reduction and oxidation occurring (1) • {Zinc (atoms)/ Zn} lose electrons **and** are oxidised (1) • {Cadmium **ions**/ Cd^{2+}} gain electrons **and** are reduced (1)	ignore numbers of electrons correct or otherwise MP1 scores even if wrong (or no) species identified reject zinc ions reject cadmium (atoms) gains electrons allow half-equations for gain/loss of electrons part of answer For MP2 and MP3 if both marks not scored: {Zinc (atoms)/ Zn} lose electrons **and** {Cadmium **ions**/ Cd^{2+}} gain electrons (1) **OR** {Zinc (atoms)/ Zn} are oxidised **and** {Cadmium **ions**/ Cd^{2+}} are reduced (1)	**(3)** AO1-1

Question number	Answer	Mark
5(b)(ii)	**C** $Cd_3(PO_4)_2$ is the only correct answer **A**, **B** and **D** are incorrect formulae of cadmium phosphate	**(1)** AO1-1

Question number	Answer	Additional guidance	Mark
5(c)	very slow / low yield / {toxic substances / acids / sulfuric acid} can be produced / (leachate) needs further processing	allow time consuming allow inefficient ignore vague statements such as 'damages the environment' or 'causes pollution' or 'produces harmful substances' ignore cost	**(1)** AO1-1

Question number	Answer	Additional guidance	Mark
5(d)	A plan to include a suitable method • add {carbon / hydrogen / methane} (1) • and heat (1) OR • electrolyse (1) • solution formed <u>with acid</u> (1)	MP2 depends on MP1 allow '<u>more</u> reactive {metal / element} ' or sensible named metal e.g. zinc but not sodium allow any named acid allow {liquid / molten} lead oxide / after melting (1)	**(2)** AO3-3a

Total for question 05 = 9 marks

Question number	Answer	Additional guidance	Mark
6(a)	An explanation linking pipette: • water causes barium hydroxide solution to be more dilute (1) • titration result is then <u>decreased</u> (1) conical flask: • any water present does not affect <u>amount of barium hydroxide</u> present (1) • no effect (on titration result) (1)	mark independently reject acid is more dilute allow less concentrated allow fewer hydroxide ions allow alkali more dilute allow less {barium hydroxide / alkali} allow less acid needed allow number of hydroxide ions unchanged allow same volume of acid needed	**(4)** AO1-2

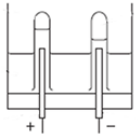
Question number	Answer	Additional guidance	Mark
6(b)(i)	from {magenta / pink} to colourless	both starting and final colours needed allow other shades of magenta / pink / purple-pink for starting colour ignore clear for final colour reject red for starting colour	**(1)** AO1-2

Question number	Answer	Additional guidance	Mark
6(b)(ii)	$H^+ + OH^- \rightarrow H_2O$ (2) left side : $H^+ + OH^- \rightarrow$ (1) right side : $\rightarrow H_2O$ (1)	reject spectator ions on each side ignore state symbols even if incorrect reject lower case H reject superscript 2 incorrect balancing of correct species scores 1 max	**(2)** AO1-1

Question number	Answer	Additional guidance	Mark
6(c)	A plan to include • filter (barium sulfate / precipitate) (1) AND • wash (barium sulfate / precipitate on filter paper) (1) • leave (to dry) in a warm place (1)	 reject crystallisation MP2 and MP3 are dependent on MP1 allow any <u>method</u> to dry reject washing after MP3	**(3)** AO3-3a

Total for question 06 = 10 marks

Question number	Answer	Additional guidance	Mark
7(a)(i)	An explanation linking • it contains (hydrogen / sulf<u>ate</u>) **ions** (1) • which can move (1)	MP2 depends on MP1 reject electrons for MP1 and MP2 allow formula for {hydrogen ion / sulf<u>ate</u> ions} even if incorrect allow charged particles / cations / anions allow hydrogen or sulfate ions even if charge or formula is incorrect allow which are dissociated / are free / in a liquid / in a solution / go to electrodes ignore 'it conducts electricity'	**(2)** AO1-1

Question number	Answer	Mark
7(a)(ii)	**A**  **B**, **C** and **D** are incorrect because they show the incorrect ratio of gases that are produced	**(1)** AO2-2

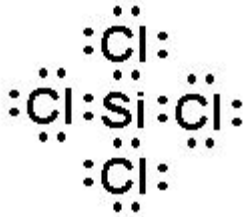
Question number	Answer	Additional guidance	Mark
7(a)(iii)	$4OH^- \rightarrow O_2 + 2H_2O + 4e^{(-)}$ (2)	correct species (1) balancing of only correct species (1) allow incorrect cases / subscripts allow 1 mark for $O_2 + 2H_2O$ on RHS allow 1 mark for $+ 4e^{(-)}$ on RHS	**(2)** AO2-1

Question number	Answer	Additional guidance	Mark
7(b)(i)	A description to include • wash / rinse (1) • dry / leave to dry / allow any solvent to evaporate (1)	mark independently reject clean with sandpaper / scrape off the copper for both marks allow dip in {propanone / water} ignore wipe / clean allow water, propanone for solvent allow pat dry	**(2)** AO1-2

Question number	Answer	Additional guidance	Mark
7(b)(ii)	An explanation linking • {copper **ions** / **cations** / **positive ions**} **and** {gain electrons/ are reduced} (1) • to form {copper / atoms} (on cathode) (1)	allow incorrect size of positive charge on copper ion half-equation (even if incorrect size of positive charge on copper ion or incorrectly balanced) can score MP1 and MP2 if no other marks awarded allow max 1 for {copper **ions** / **cations** / **positive ions**} go to cathode	**(2)** AO1-1

Question number	Answer	Additional guidance	Mark
7(b)(iii)	An explanation linking • {Cu^{2+} / cations / ions} enter solution (from anode) and leave solution (at cathode) (1) • no change in {concentration / amount / number} of {Cu^{2+}/ cations / ions} (1)	 allow constant / same concentration of {Cu^{2+}/cations / ions} allow concentration of copper sulfate	**(2)** AO3-2

Total for question 07 = 11 marks

Question number	Answer	Additional guidance	Mark
8(a)(i)	 (2) all **four** bond pairs (1) rest of molecule correct (1)	MP2 dependent on MP1 electrons may be shown as dots or crosses or any combination electrons can be shown in any overlapping part of intersecting shells allow atoms unlabelled ignore inner shells, whether correct or otherwise	**(2)** AO2-1

Question number	Answer	Additional guidance	Mark
8(a)(ii)	An explanation linking • weak forces **between molecules/ intermolecular forces** (1) • little {**heat** / **energy**} needed (1)	MP2 can score even if MP1 not scored allow **intermolecular** bonds / bonds **between molecules** reject forces between {atoms / bonds / ions} for MP1 only ignore **less** energy needed / 'easy' to break ignore low temperature	**(2)** AO1-1

Question number	Answer	Mark
8(b)	**D** 693 1340 is the only correct answer **A** has a boiling point showing a liquid at room temperature **B** and **C** although solids at room temperature would melt very easily	**(1)** AO2-1

Question number	Indicative content	Mark
***8(c)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** electrical conductivity • diamond – all 4 outer shell electrons of carbon form (covalent) bonds • each carbon joined to four other carbon atoms • no free electrons available for electrical conductivity • graphite – 3 outer shell electrons of carbon form (covalent) bonds • each carbon joined to three other carbon atoms • 1 free electron for each carbon atom • delocalised electrons • are between the layers • delocalised electrons move to carry current hardness • diamond - strong (covalent) bonds • between all carbon atoms • in 3D lattice / giant (covalent) lattice / tetrahedral structure • requires a very high amount of energy to overcome • graphite – giant (covalent) lattice • strong (covalent) bonds between all carbon atoms within each layer • weak forces between layers / allow weak intermolecular forces • layers can slide	**(6)** AO1-1

Level	Mark	Descriptor
	0	• No awardable content
Level 1	1-2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3-4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Level	Mark	Descriptor	Possible candidate response
Read whole answer. Ignore all incorrect / irrelevant material and reject any contradictory material.			
	0	No rewardable material.	
Level 1	1–2	Additional Guidance explains fully one property **OR** describes structure of diamond **or** graphite	Possible candidate response • Diamond has strong bonds (1) • Diamond is hard because the strong covalent bonds need a lot of energy to break (2) • Graphite has layers of carbon atoms with delocalised electrons between layers (2)
Level 2	3–4	Additional Guidance explains fully two properties **OR** describes fully structure of diamond **and** graphite	Possible candidate response • Graphite conducts electricity because the delocalised electrons can move but diamond does not because it does not have free electrons (3) • Graphite conducts electricity because the free electrons can move between layers and graphite is soft because the layers of atoms can slide because of weak forces between the layers (4) • Graphite has layers of carbon atoms with delocalised electrons between layers and diamond has a giant lattice with each carbon atom bonded to four others (4)
Level 3	5–6	Additional Guidance explains fully three properties using the structure and bonding of diamond **and** graphite	Possible candidate response • Graphite has layers of carbon atoms so it is flaky because the layers slide; and diamond has a giant lattice with each carbon atom bonded to four others with strong bonds, so it is hard because the carbon atoms need energy to separate and does not conduct because there are no free electrons (5) • Graphite has layers of carbon atoms held with weak intermolecular forces with delocalised electrons between layers so it is flaky because the layers easily slide off and conducts electricity because the free electrons move; and diamond has a giant lattice with each carbon atoms bonded to four others, so it is hard because the covalent bonds between the carbon atoms need a lot of energy to break (6)

Total for question 08 = 11 marks

Question number	Answer	Additional guidance	Mark
9(a)(i)	A description to include • bubbles formed {slowly / steadily / quite quickly} / some bubbles form (1) • some metal remains (1)	allow bubbling faster than F / more bubbles than F/ bubbling slower than D / fewer bubbles than D allow some metal has reacted allow metal looks changed mark anything written in table **only** if answer lines blank	**(2)** AO3-1a/1b

Question number	Answer	Additional guidance	Mark
9(a)(ii)	An explanation linking dilute: • low concentration (1) • of the {solute / acid / (hydrogen) ions / H^+} (1) strong acid • acid <u>fully</u> {dissociated / ionised} (1) • forming {hydrogen/ H^+} ions (1)	MP2 depends MP1 allow low {mass/ amount} ignore 'not concentrated' ignore 'weak concentration' if no MP1 or MP2. allow 'dilute acid has more water in it'/ 'has had water added' for 1 mark only mark MP3 and MP4 independently ignore all references to pH	**(4)** AO1-1

Question number	Answer	Additional guidance	Mark
9(b)	4.515 x 10^{23} scores 4 with or without working relative formula mass $Pb(C_2H_3O_2)_2$ 207 + 2 x (2x12 + 3x1 + 16x2) = 325 (1) moles of $Pb(C_2H_3O_2)_2$ $\frac{16.25}{325}$ = 0.05 (1) no of "$Pb(C_2H_3O_2)_2$" 0.05 x 6.02 x 10^{23} = 3.01 x 10^{22} (1) no of atoms 15 x 3.01 x 10^{22} = 4.515 x 10^{23} (1)	allow ECF at all stages for ECF using Avogadro's number, must x previously calculated **attempt at moles using the data in the question** allow any number of sig figs except one with correct rounding 3.01x10^{22} with working scores 3 1.204x10^{25} with working scores 2 1.9565x10^{26} with working scores 1	**(4)** AO2-1

Question number	Answer	Additional guidance	Mark
9(c)	moles Fe = $\frac{2.24}{56.0}$ = 0.04 (1) moles Cu = $\frac{3.81}{63.5}$ = 0.06 (1) ratio moles Fe : moles Cu = 2 : 3 or 1 : 1.5 **and so equation 2** (1) **OR** moles Fe = $\frac{2.24}{56.0}$ = 0.04 (1) moles Cu if equation 1 = 0.04 (1) expected mass Cu equation 1 = 0.04 x 63.5 = 2.54g **and** so not equation 1, **equation 2** (1) **OR** moles Fe = $\frac{2.24}{56.0}$ = 0.04 (1) moles Cu if equation 2 = 0.04 x 3/2 = 0.06 (1) expected mass Cu equation 2 =0.06 x 63.5 = 3.81g **and** so **equation 2** (1)	**must state Equation 2 to score MP3** stating Equation 2, with no calculation to justify, scores 0 No ECF in this question moles of "2Fe" = $\frac{2.24}{112}$ = 0.02 scores 0, BUT: with either: moles of "3Cu" = $\frac{3.81}{190.5}$ = 0.02 these are same so equation 2, scores 3 or: mass of Cu = 3 x 63.5 x 0.02 = 3.81g so equation 2, scores 3	**(3)** AO3-1a/b

Total for question 09 = 13 marks

Question number	Answer	Additional guidance	Mark
10(a)(i)	A description including • rate (of attainment of equilibrium) increased (1) • no effect equilibrium yield (1)	 allow rate of (forward and backward) reaction(s) increased allow equilibrium reached faster ignore any reference to activation energy	**(2)** AO1-1

Question number	Indicative content	Mark
***10(a)(ii)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. Increase temperature to 1000 °C • increase temperature increases rate (of attainment of equilibrium) • higher temperature means more frequent collisions because molecules have more energy • equilibrium between reactants and products reached faster • higher temperature favours forward reaction which is endothermic • increasing temperature moves equilibrium to the right/products side • higher temperature increases equilibrium yield as forward reaction is endothermic Decrease pressure to 10 atm • equilibrium reached slower because of lower pressure • lower pressure causes molecules to be further apart so less frequent collisions • lower pressure moves equilibrium to the right/products side • higher yield because products occupy larger volume than reactants	**(6)** AO1-1 AO2-1

Level	Mark	Descriptor
	0	• No awardable content
Level 1	1-2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
Level 2	3-4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)
Level 3	5-6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)

Level	Mark	Descriptor	Possible candidate response
Read whole answer. Ignore all incorrect material and reject any contradictory material. Ignore references to catalysts			
	0	No rewardable material.	
Level 1	1–2	describe effect of **one** condition on rate **and** yield **OR** describes the effect of **both** conditions on rate **or** yield	increase in temperature increases rate (1) decrease in pressure decreases rate (1) increase in temperature increases rate and decrease in pressure decreases rate of attainment of equilibrium (2) decrease in pressure decreases rate but increases yield (2) increase in temperature increases rate and yield (2)
Level 2	3–4	describes the effect of **both** conditions on rate **and** yield OR explains fully the effects of **both** conditions on the rate **or** yield OR explains fully the effects of **one** condition on the rate **and** yield	Increasing the temperature and decreasing the pressure will decrease the yield and the decreased pressure will decrease the rate (3) increased temperature increases the rate and increases the yield, whereas decreasing the pressure will decrease the rate but still increase the yield (4) increased temperature will increase the rate but decreased pressure will decrease the rate as the particles are further apart so there are less frequent collisions, but the lower pressure will move equilibrium to the right (3) increased temperature means an increased rate of reaction, as there are more frequent collisions and particles have more energy. The reaction is endothermic so a higher temperature favours the forward reaction so equilibrium moves to the right, resulting in a higher yield (4)
Level 3	5–6	explains fully the effect of **both** conditions on rate **and** yield	increased temperature will increase the rate and will increase the yield but decreased pressure will decrease the rate because the molecules are further apart so there are less frequent collisions, but the lower pressure will move equilibrium to the right because the products occupy a larger volume than the reactants (5) increased temperature means an increased rate, as there are more frequent collisions and particles have more energy. The higher temperature favours the forward reaction so equilibrium moves to the right, resulting in a higher yield, whereas the decrease in pressure will increase the yield as the equilibrium will move to the right, the decrease in pressure will decrease the rate (6)

Question number	Answer	Additional guidance	Mark
10(b)	3250 (dm^3) with or without working scores 2 1 mole CH_4 produces 5 moles products (1) 5 x 650 = 3250 (dm^3) (1)	 allow **1x**650 = 650 or **4x**650 = 2600 for 1 mark.	**(2)** AO2-1

Question number	Answer	Additional guidance	Mark
10(c)	825 (g) with or without working scores 3 no moles H_2 $\frac{1800}{24}$ = 75 (1) no moles CO_2 $\frac{75}{4}$ = 18.75 (1) mass of CO_2 18.75 x 44 g = 825 (g) (1)	 allow ECF from incorrect answer but only if using 1800 and 24 allow ECF from an incorrect calculation of number of moles 450 with working gains 1 mark 3300 with working gains 2 marks 13200 with working gains 2 marks	**(3)** AO2-1

Total for question 10 = 13 marks