Mark Scheme (Results)

Summer 2018

Pearson Edexcel GCSE
Chemistry (1CH0 2H) Paper 2H

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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.

Mark schemes have been developed so that the rubrics of each mark scheme reflects the characteristics of the skills within the AO being targeted and the requirements of the command word. So for example the command word 'Explain' requires an identification of a point and then reasoning/justification of the point.

Explain questions can be asked across all AOs. The distinction comes whether the identification is via a judgment made to reach a conclusion, or, making a point through application of knowledge to reason/justify the point made through application of understanding. It is the combination and linkage of the marking points that is needed to gain full marks.

When marking questions with a 'describe' or 'explain' command word, the detailed marking guidance below should be consulted to ensure consistency of marking.

Assessment Objective		**Command Word**	
Strand	**Element**	**Describe**	**Explain**
AO1*		An answer that combines the marking points to provide a logical description	An explanation that links identification of a point with reasoning/justification(s) as required
AO2		An answer that combines the marking points to provide a logical description, showing application of knowledge and understanding	An explanation that links identification of a point (by applying knowledge) with reasoning/justification (application of understanding)
AO3	1a and 1b	An answer that combines points of interpretation/evaluation to provide a logical description	
AO3	2a and 2b		An explanation that combines identification via a judgment to reach a conclusion via justification/reasoning
AO3	3a	An answer that combines the marking points to provide a logical description of the plan/method/experiment	
AO3	3b		An explanation that combines identifying an improvement of the experimental procedure with a linked justification/reasoning

*there will be situations where an AO1 question will include elements of recall of knowledge directly from the specification (up to a maximum of 15%). These will be identified by an asterisk in the mark scheme.

Paper 1CH0 / 2H

Question Number	Answer	Additional guidance	Mark
1(a)	An explanation linking • (Earth) cooled / temperature decreased (1) • (water vapour / steam) condensed / oceans formed (1)	allow temperature of atmosphere/ Earth decreased allow it rained (and formed oceans) allow lakes/seas	**(2)** AO 1 1

Question Number	Answer	Additional guidance	Mark
1(b)(i)	final answer of 20 (%) with or without working (2) volume gas used = 50-40 (1) (= 10 (cm^3)) percentage = (50-40)/50 x 100 (1) = 20 (%)	allow ecf throughout allow 40-50 (1) (= -10cm^3) allow 40/50 x 100 = 80% (1) then 100 – 80 = 20% (1) if no other marks awarded allow 10/50 = 0.2 (1)	**(2)** AO 2 2

Question Number	Answer	Mark
1(b)(ii)	**C** the gas has expanded when it is hot **The only correct answer is C** ***A*** *is not correct because this is not true* ***B*** *is not correct because this is not relevant* ***D*** *is not correct because this is not true*	**(2)** AO 2 2

Question Number	Answer	Additional guidance	Mark
1(c)	An explanation linking • oxygen increased (in atmosphere) (1) • (oxygen) {reacts / combines} with iron (sulphide) / iron is oxidised (1)	allow oxygen appears (1) photosynthesis produces oxygen (1) ignore oxygen reacts with <u>rocks</u> / sulfur <u>in rocks</u> replaced by oxygen / oxygen enters <u>rocks</u> / iron ore	**(2)** AO 2 1

(Total for Question 1 = 7 marks)

Question Number	Answer	Additional guidance	Mark
2(a)(i)	35	reject 35.5	**(1)** AO 1 1

Question Number	Answer	Additional guidance	Mark
2(a)(ii)	2.8.7	allow any separator including gaps *e.g.* 2 8 7	**(1)** AO 1 1

Question Number	Answer	Additional guidance	Mark
2(b)	A description to include • (blue litmus) (first turns) red (1) • (then) bleaches / turns white (1)	allow shades of red and pink but not other colours *e.g.* red-purple allow colour disappears/goes colourless ignore yellow/colour fades/discolours white then red = 0; just 'goes white' = 1	**(2)** AO 1 2

Question Number	Answer	Additional guidance	Mark
2(c)(i)	A description to include • shared **electron**(s) (1) • {a pair of / two} (**electrons**) (1)	allow a diagram for both mark points reference to ionic bonding/ions scores 0 *e.g.* gains two electrons = 0	**(2)** AO 1 1

Question Number	Answer	Additional guidance	Mark
2(c)(ii)	An explanation linking any two from • intermolecular forces / forces **between** molecules (1) • (intermolecular) forces {weak / take little energy to break}/ little energy to separate molecules (1) • boiling point is below room temperature / has a low boiling point (1)	if answer relates to the breaking of any type of **bond** first two marking points cannot be scored (but 3rd could) allow 'attractions' instead of 'forces'	**(2)** AO 1 1

Question Number	Answer	Additional guidance	Mark
2(d)	(the solution is) acid(ic) / contains {hydrogen ions/ H^+}	allow pH < 7 allow hydrogen chloride is acidic if incorrect identity of acidic solution then 0 marks (*e.g.* chlorine is acidic = 0)	**(1)** AO 2 1

(Total for Question 2 = 9 marks)

Question Number	Answer	Additional guidance	Mark
3(a)	Na : O $\frac{0.92}{23}$: $\frac{0.32}{16}$ (1) 0.04 : 0.02 OR 2 : 1 (1) (empirical formula from ratio) Na_2O (1)	formula alone scores 0 2nd MP is either for working out correct number of moles OR for finding the correct ratio by dividing by the smaller number from an incorrect first step 3rd MP is for correctly converting a ratio to a formula with whole numbers only example $\frac{23}{0.92}$: $\frac{16}{0.32}$ 25 : 50 (0) 1 : 2 (1) NaO_2 (1)	**(3)** AO 2 1

Question Number	Answer	Additional guidance	Mark
3(b)	2Na(s) + $2H_2O$(l) → 2NaOH(aq) + H_2(g) 2 Na (1) 2 NaOH (1) s, l, aq, g (1)	 allow S, L, AQ, G ignore words	**(3)** AO 2 1

Question Number	Answer	Mark
3(c)	**C** is the most reactive **The only correct answer is C** ***A*** *is not correct because this is irrelevant* ***B*** *is not correct because this is irrelevant* ***D*** *is not correct because this is irrelevant*	**(1)** AO 2 1

Question Number	Answer	Additional guidance	Mark
3(d)	An explanation linking • atoms become larger/**outer** electron becomes further from the nucleus / ORA (1) • so **outer** electron more easily **lost** / less energy needed to **lose outer** electron / ORA (1)	allow atomic radius increases / increased shielding effect (by inner complete(electron) shells)/ more (inner) shells/ decreased force of attraction between outer shell electron and nucleus / correct electronic configuration**s** (at least two) reject 'more outer shells' / incorrect forces such as intermolecular	**(2)** AO 1 1

(Total for Question 3 = 9 marks)

Question Number	Answer	Additional guidance	Mark
4(a)(i)	{heat/energy} is lost/escapes	allow anywhere heat is transferred *e.g.* can absorb heat, heat lost to air *etc*	**(1)** AO 3 2b

Question Number	Answer	Additional guidance	Mark
4(a)(ii)	An explanation including: • add a lid / use of draught shield (1) • so more {heat/energy} goes to water/ less {heat/energy} escapes (1) MP2 dependent on MP1	ignore altering distance between flame and can allow any <u>suitable</u> insulating material ignore burning more fuel/ less water	**(2)** AO 3 3b

Question Number	Answer	Additional guidance	Mark
4(a)(iii)	final answer of 7308 with or without working scores 2 210 x 34.8 (1) = 7308 (1)	allow 1 for 210 x (any temp change) **correctly evaluated with working** *e.g.* 210 x 82.4 = 17304 (1) allow 7300, 7310 do not allow 7000 ignore any units	**(2)** AO 2 1

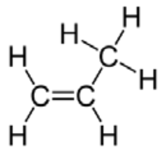
Question Number	Answer	Additional guidance	Mark
4(b)	Any three of the following • all have –OH group/ hydroxyl group / same functional group (1) • same **general formula**/ $C_nH_{2n+1}OH$ (1) • formulae differ by CH_2 units (1) • react similarly with oxygen/all burn to form carbon dioxide and water (1) • trend in physical properties	ignore 'all alcohols' do not allow 'hydroxide' allow similar chemical reactions / a specified reaction allow any sensible physical property *e.g.* increase in boiling point ignore reference to containing C,H,O or single bonds or no double bonds	**(3)** AO 2 1

Question Number	Answer	Additional guidance	Mark
4(c)(i)	propanol + oxygen → propanoic acid + water (2) allow $CH_3CH_2CH_2OH + O_2 \rightarrow CH_3CH_2COOH + H_2O$ (2)	allow 1 mark for any three correctly named substances air is not acceptable for oxygen if a mixture of words and symbols, ignore all of the symbols if 5 substances in equation remove 1 mark if 6 or more substances in equation, score 0	**(2)** AO 2 1

Question Number	Answer	Mark
4(c)(ii)	**C** -COOH **The only correct answer is C** ***A*** *is not correct because this is the functional group of alcohols* ***B*** *is not correct because this is a methyl group* ***D*** *is not correct because this is not a functional group*	**(1)** AO 1 1

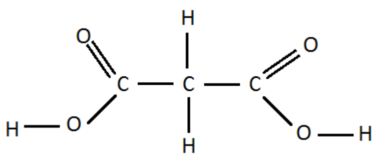
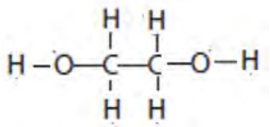
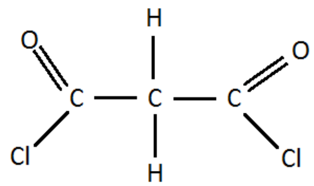
(Total for Question 4 = 11 marks)

Question Number	Answer	Additional guidance	Mark
5(a)	(ceramic) has no reaction with water (1)		**(1)** AO 3 1a

Question Number	Answer	Additional guidance	Mark
5(b)	 (2) one C=C bond in a three consecutive carbon atom molecule (1) all other atoms and bonds correct (1) MP2 is dependent on MP1	ignore bond angles reject CH_3 for MP2	**(2)** AO 2 1

Question Number	Answer	Additional guidance	Mark
5(c)	An explanation linking • low ability to conduct electricity / does not conduct electricity/ insulator (1) • separates user from {current / electricity} / prevents shock electric / prevents electrocution (1)	allow • high flexibility/bendable (1) • less likely to break easily (than other materials) (1) OR • inert/unreactive/waterproof/weatherproof (1) • separates the wire from surrounding water (1)	**(2)** AO 1 1

Question Number	Answer	Mark
5(d)	**B** condensation **The only correct answer is B** ***A*** *is not correct because this is not an addition reaction* ***C*** *is not correct because this is not a neutralisation reaction* ***D*** *is not correct because this is not a precipitation reaction*	**(1)** AO 1 1

Question Number	Answer	Additional guidance	Mark
5(e)(i)	 **(1)**  (1)	either order allow  accept –OH in place of –O-H on both structures.	**(2)** AO 3 2a AO 3 2b

Question Number	Answer	Additional guidance	Mark
5(e)(ii)	water/H_2O	or hydrogen chloride/HCl if diacid chloride shown as monomer	**(1)** AO 1 1

(Total for Question 5 = 9 marks)

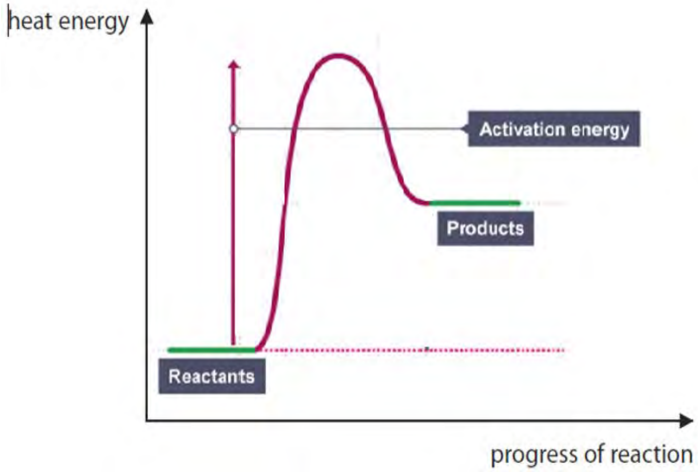
Question Number	Answer	Mark
6(a)	**D** the viscosities increase **The only correct answer is D** ***A*** *is not correct because average number of carbon atoms increases* ***B*** *is not correct because ease of ignition decreases* ***C*** *is not correct because boiling points increase*	**(1)** AO 1 1

Question Number	Answer	Mark
6(b)(i)	**D** C_nH_{2n+2} **The only correct answer is D** ***A*** *is not correct because this is the general formula of an alkene* ***B*** *is not correct because this is not the general formula of an alkane* ***C*** *is not correct because this is not the general formula of an alkane*	**(1)** AO 1 1

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	An explanation linking • (compounds) containing **hydrogen** and **carbon** (atoms) (1) • only (1) MP2 is dependent on MP1	 reject carbon molecules and hydrogen molecules /mixtures of carbon and hydrogen ignore symbols C and H	**(2)** AO 1 1

Question Number	Answer	Additional guidance	Mark
6(c)	An explanation including • boiling points increase as the number of carbon atoms (per molecule) increases (1) • because {strong<u>er</u> forces between molecules / (increased / more) intermolecular forces (1)	ignore {positive correlation alone / proportional} allow 'longer chain' for more C atoms reject any reference to 'bonds' for MP2 allow van der Waals' forces/London forces	**(2)** AO 3 1a AO 3 1b

Question Number	Answer	Mark
6(d)(i)	fuel oil	**(1)** AO 3 2a

Question Number	Answer	Additional guidance	Mark
6(d)(ii)	• reactant(s) and product(s) labelled in their correct positions (1) • activation energy labelled (1) • energy of reactants lower than energy of products (1)	example of diagram  ignore arrow heads allow unlabelled diagram of an endothermic reaction showing the basic outline shape if exothermic reaction profile shown, allow (1) for reactants and products in correct position and (1) for correct labelling of activation energy	**(3)** AO 1 1

Question Number	Answer	Additional guidance	Mark
6(d)(iii)	C_6H_{14}		**(1)** AO 2 1

(Total for Question 6 = 11 marks)

Question Number	Answer	Additional guidance	Mark
7(a)	A description including the following points : • (potassium bromide solution) colourless (1) • (mixture) turns yellow / brown / orange / red (1)	 ignore clear ignore reference to colour of chlorine water /change in colour allow colour combinations *e.g.* yellow-orange reject additional incorrect observations for MP2 but ignore yellow/orange/red/brown vapours	**(2)** AO 1 2

Question Number	Answer	Additional guidance	Mark
7(b)(i)	An explanation linking • (chlorine) gains (an) electron(s) (1) • to form {a chloride (ion) / Cl^- / negative ion} (1) MP2 dependent on MP1	 reject chlorine gains an electron from potassium reject sharing of electrons allow $Cl_2 + 2e \rightarrow 2Cl^-$ even if unbalanced (2) ignore chlorine ion	**(2)** AO 1 1

Question Number	Answer	Additional guidance	Mark
7(b)(ii)	 $2Br^- \rightarrow Br_2 + 2e$ (2) correct species (in correct place) (1) balancing of correct species (1)	allow $2Br^- - 2e \rightarrow Br_2$ (2) unbalanced 1 max allow multiples	**(2)** AO 2 1

Question Number	Answer	Additional guidance	Mark
7(c)	$2Al + 3Cl_2 \rightarrow 2AlCl_3$ (3) LHS (1) RHS (1) balancing of correct formulae (1)	penalise the use of 'CL' or 'AL' once only ignore state symbols allow multiples ignore use of capital L for MP3	**(3)** AO 2 1

Question Number	Answer	Additional guidance	Mark
7(d)	A description to include the following points • insert electrodes (into aqueous solution)(1) • connect to electrical supply /powerpack /battery/cell (1) • bulb lights / ammeter shows current / electrolyte decomposes (1)	first two marks can be given for a suitable diagram allow anode **and** cathode allow carry out an electrolysis experiment alone / see if solution conducts electricity (1) allow pass an electric current through (the solution) (1) ignore electricity alone allow correct observation at one electrode (1)	**(3)** AO 3 3a

(Total for Question 7 = 12 marks)

Question Number	Answer	Additional guidance	Mark
8(a)	• calcium (1) • chloride (1)	allow Ca^{2+} allow Cl^{-}	**(2)** AO 3 2a AO 3 2b

Question Number	Answer	Additional guidance	Mark
8(b)(i)	more than one cation gives white precipitate	allow answers referring to specified cations that give a white precipitate (aluminium, calcium, magnesium, zinc, lead). Ignore incorrect ionic charges. reject incorrect cations	**(1)** AO 1 2

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	(sodium hydroxide) is not used to test for anions	allow (sodium hydroxide) (only) tests for cations	**(1)** AO 1 2

Question Number	Answer	Additional guidance	Mark
8(c)	improve sensitivity / accuracy / speed (of tests)	ignore clearer/better/precise/efficient/reliable/valid results	**(1)** AO 1 1

Question Number	Answer	Additional guidance	Mark
8(d)(i)	$Fe^{2+} + 2OH^{-} \rightarrow Fe(OH)_2$ left hand side (1) right hand side (1) balancing of correct species (1)	allow multiples ignore incorrect state symbols	**(3)** AO 2 1

Question Number	Answer	Additional guidance	Mark
8(d)(ii)	An explanation linking • {iron(II) hydroxide / iron(II) ions / Fe^{2+}} **oxidised** (by air) (1) • (it goes brown due to formation of) {iron(III) hydroxide / iron(III) ions / Fe^{3+}} (1)	‘it’ = iron(II) hydroxide ‘precipitate’ = iron(II) hydroxide Fe^{2+} is oxidised to Fe^{3+} OR Iron(II) is oxidised to iron(III) both score 2 $Fe^{2+} \rightarrow Fe^{3+} + e^{-}$ scores 1 mark for MP2 ignore rusting	**(2)** AO 3 2a AO 3 2b

(Total for Question 8 = 10 marks)

Question Number	Answer	Additional guidance	Mark
9(a)(i)	(gas) syringe / graduated tube / burette (instead of measuring cylinder)		**(1)** AO 3 3b

Question Number	Answer	Additional guidance	Mark
9(a)(ii)	final answer in range 0.44 – 0.52 inclusive with or without working (2) If answer not in range: $\frac{\text{difference in volume}}{\text{difference in time}} = \frac{(43 - 15)}{(60 - 0)}$ (1) = 0.47 / 0.467 (1)	allow ecf throughout where values are less than 1 (1 max) use of inverted gradient expression giving 2.27 – 1.92 scores 1 mark (evidence of working required)	**(2)** AO 2 1

Question Number	Answer	Additional guidance	Mark
9(a)(iii)	steeper **curve** to the left of printed curve and same final volume	line must not go above 40 cm^3 and curve back down	**(1)** AO 2 2

Question Number	Answer	Additional guidance	Mark
9(b)(i)	number of moles = 0.1 /24 = 0.0042 or 4.2×10^{-3} (1)	ignore answer left as fraction 1/240 rounding must be correct: reject 0.00416 (no dot) allow $0.0041\dot{6}$ (with dot above the 6) allow 0.004	**(1)** AO 2 1

Question Number	Answer	Additional guidance	Mark
9(b)(ii)	the equation shows two HCl reacting with one Mg	allow ratio is 2:1 allow 1 mol HCl reacts with 0.5 mol of Mg allow 0.5 mol HCl reacts with 0.25 mol Mg	**(1)** AO 2 1

Question Number	Indicative content	Mark
***9(c)**	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • reactions occur when particle collisions have sufficient energy (activation energy) • reaction rates are increased when the energy collisions is increased • and / or the frequency of collisions is increased • two factors in the reaction have been changed (temperature and concentration of one of the reactants) • experiment 2 was carried out at a higher temperature than experiment 1 • concentrations of reactant are the same in experiment 1 and 2 • particles have more (kinetic energy), so move faster • so there are more frequent collisions between particles in solution **A** solution and solution **B** • collisions will also occur with greater energy • so more collisions will have the minimum activation energy to react when they collide • so greater frequency of successful collisions (so decreased reaction time/increased rate in experiment 2 compared to experiment 1) • experiment 3 was carried out at a higher concentration than experiment 2/ a fourfold increase • temperatures of the reactants are the same in experiment 2 and 3 • there are more reacting particles in the same volume of reaction mixture • so there are more frequent collisions between particles in solution **A** and solution **B** • so greater frequency of successful collisions (so decreased reaction time/increased rate in experiment 3 compared to experiment 2) • reaction rate in experiment 3 is greatest due to combined effects of increased temperature and increased concentration	**(6)** AO 2 2 AO 3 2a

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3)

		• 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	• Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) • 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	• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • 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)

Total for Question 9 = 12 marks)

Question Number	Answer	Additional guidance	Mark
10(a)	award full marks for correct numerical answer without working energy needed to break bonds = (2 x 435) + (1 x 500) = 1370 (kJ mol^{-1}) (1) energy released when bonds are formed = 4 × 460 = 1840 (1) energy change = 1370 – 1840 = (-) 470 (kJ mol^{-1}) (1) negative sign or ‘energy released’ (1)	allow 1840 - 1370 = 470 (1) ignore sign allow exothermic (reaction) final answer 450 award 2 marks -450 award 2 marks final answer +450 award 3 marks	**(4)** AO 2 1

Question Number	Indicative content	Mark
*10(b)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • (add) sodium carbonate (or any suitable carbonate) / test with blue litmus • carboxylic acid sample effervesces / blue litmus turns red • alkane and alkene sample give no effervescence / does not affect litmus • therefore liquid is butanoic acid • butanoic acid + sodium carbonate → sodium butanoate + carbon dioxide + water • (balanced equation) $2\ C_3H_7COOH + Na_2CO_3 \rightarrow 2\ C_3H_7COONa + CO_2 + H_2O$ • (add) bromine water (to separate samples of each liquid) • (bromine water) orange colour • shake • alkene sample changes from orange to colourless • alkane (and carboxylic acid) stay orange • therefore liquid changing is hexene • hexene + bromine → 1,2-dibromohexane (allow any suitable isomer product / ignore numbers) • structural formula of product, *e.g.* • (balanced equation / addition reaction) $C_6H_{12} + Br_2 \rightarrow C_6H_{12}Br_2$ credit any appropriate test for an acid, *e.g.* specific indicator with correct colour change(s) • liquid giving negative results with both the test for acids and the bromine water is the alkane/hexane credit any appropriate test which would distinguish between the substances	**(6)** AO 1 1

Level	Mark	Descriptor
	0	No rewardable material.
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)

(Total for Question 10 = 10 marks)

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