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# Mark Scheme (Results)

## Summer 2022

Pearson Edexcel GCSE  
In Chemistry (1CH0) Paper 2F

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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.

## Chemistry 1CH0/2F

Question number	Answer	Additional guidance	Mark
1(a)(i)	strong / unreactive (with water/air) / non-toxic / can be moulded	allow: flexible; allow: waterproof, insoluble  ignore: easy to make, cheap  ignore lightweight and any other properties/ descriptions	(1) AO1 1

Question number	Answer	Additional guidance	Mark
1(a)(ii)	an explanation linking <ul style="list-style-type: none"> <li>plastics made from (crude) oil (1)</li> <li>which is {finite/ non-sustainable} (1)</li> </ul> OR <ul style="list-style-type: none"> <li>the plastic is non-biodegradable (1)</li> <li>plastic ends up in landfill (1)</li> </ul>	MP2: allow non-renewable  MP3: allow: {takes a long time/hard} to {decompose/ break down}  MP4: allow: {hard to/ cannot be} recycled / may give toxic fumes if incinerated ignore any reference to effect on wildlife ignore general <b>answers such as 'harmful to environment'</b> mark independently	(2) AO2 1

Question number	Answer	Mark
1(b)	<p>B it does not react with water is the only correct answer</p> <p>A, C are not correct because they are not useful</p> <p>D is an incorrect statement</p>	(1) AO1 1

Question number	Answer	Mark
1(c)	<p>C the size of a few hundred atoms is the only correct answer</p> <p>A and B are incorrect because nanoparticles are made of more than one atom</p> <p>D is incorrect as there are too many molecules</p>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
1(d)	<ul style="list-style-type: none"> <li>• % water = <math>100 - 35 - 25 = 40\%</math> (1)</li> <li>• <math>40\% \times 150 = 60 \text{ (cm}^3\text{)}</math> (1)</li> </ul>	<p>60 with no working at all scores 2 35 + 25 = 60 scores 0.</p> <p>with ANY working shown:</p> <p>MP1 – for 40(%) (do not need to show how calculated). Can be shown on pie chart.</p> <p>allow 0.4 or 2/5</p> <p>ECF for MP2</p>	(2) AO2 1

Question number	Answer	Additional guidance	Mark
2(a)(i)	Rb / Cs / Fr	symbols must have uppercase letter then lowercase letter reject answers with any other symbols ignore any names	(1) AO2 1

Question number	Answer	Mark
2(a)(ii)	3 / three	(1) AO2 1

Question number	Answer	Additional guidance	Mark
2(a)(iii)	A description including <ul style="list-style-type: none"> <li>(the melting points) decrease (1)</li> <li>as the atomic number increases/ as you go down {the group / the alkali metals / group 1} (1)</li> </ul>	allow (melting points) {go down / get smaller} ignore less heat needed to melt it  MP2 depends on MP1  allow (going) down (the table / list) allow down the periodic table  ignore references to boiling point  higher the atomic number, lower the melting point (2) ORA  higher in {group/ table} the higher the melting point (2) ORA	(2) AO3 1

Question number	Answer	Additional guidance	Mark
2(b)(i)	test tube / boiling tube	ignore <b>just 'tube'</b> , testing tube	(1) AO2 2

Question number	Answer	Additional guidance	Mark
2(b)(ii)	<p>An explanation to include any three from: Step 2</p> <ul style="list-style-type: none"> <li>cut a <u>smaller</u> piece of sodium (1)</li> <li>so less reaction / slower reaction (1)</li> </ul> <p>Step 3</p> <ul style="list-style-type: none"> <li>use a larger {container / trough} (of water) (1)</li> <li>there is more water so more heat is absorbed (1)</li> </ul>	<p>reject use powdered sodium for MP1 and MP2</p> <p>MP2 is dependent on MP1</p> <p>allow less sodium / smaller volume of sodium / <math>1(\text{cm}^3) \times 1(\text{cm}^3) \times 1(\text{cm}^3)</math> cube / smaller mass of sodium</p> <p>ignore use less cubes</p> <p>allow smaller reaction / it is less reactive ignore so reaction is less vigorous</p> <p>MP4 is dependent on MP3</p> <p>allow name of larger container: beaker/ flask ignore use larger test tube / boiling tube ignore change container ignore add more water</p> <p>ignore add a safety screen / observe from a distance</p>	(3) AO3 3a



Question number	Answer	Additional guidance	Mark
3(a) (i)	A description to include <ul style="list-style-type: none"> <li>• add water (1)</li> <li>• shake/ stir (1)</li> </ul>	allow: solvent / liquid Ignore: acid or alkali for MP1 but can score MP2  allow: mix; ignore dissolve  MP2 depends on MP1 reject whole answer if referring to melting	(2) AO1 2

Question number	Answer	Mark
3(a) (ii)	pipette / dropper	(1) AO1 2

Question number	Answer	Mark
3(a) (iii)	A aq is the only correct answer  B, C and D are incorrect as the substance is a solution in water	(1) AO2 2

Question number	Answer	Additional guidance	Mark
3(b) (i)	solid/ goes cloudy	allow forms of solid e.g. powder/ sediment / goes milky ignore substance ignore any colours/ colour change  reject answers involving fixing/ bubbles/ effervescence	(1) AO1 2

Question number	Answer	Additional guidance	Mark
3(b)(ii)	bromide	reject bromine allow Br <sup>-</sup> (allow br <sup>-</sup> , BR <sup>-</sup> , bR <sup>-</sup> )	(1) AO3 2

Question number	Answer	Additional guidance	Mark
3(c)(i)	potassium chloride	allow KCl (must be capital K, capital C and small l with no charges)	(1) AO3 2

Question number	Answer	Additional Guidance	Mark
3(c)(ii)	11.8 (g) with or without working scores 2 <ul style="list-style-type: none"> <li>• <math>0.2 \times 4 (= 0.8)</math> (1)</li> <li>• <math>10 + 1 + 0.8 = 11.8</math> (g) (1)</li> </ul>	allow $0.2 + 0.2 + 0.2 + 0.2 / 0.8$ (no working needed)  ECF for MP2 if 11 + incorrect mass of 4 drops	(2) AO2 1

Question number	Answer	Mark
4(a)(i)	A Heat energy is the only correct answer. B, C and D are incorrect as all exothermic reactions give out heat	(1) AO1 1

Question number	Answer	Mark
4(b)(i)	A / thermometer	(1) AO2 2

Question number	Answer	Additional guidance	Mark
4(b)(ii)	beaker	allow measuring beaker/ plastic beaker reject measuring cup/ jug	(1) AO2 2

Question number	Answer	Additional guidance	Mark
4(b)(iii)	it is a (good heat) insulator	allow would hold / trap heat / keeps heat in / <b>doesn't absorb heat</b> / reduces heat loss / poor conductor  allow correct comparison of heat conductivity with glass e.g polystyrene is a better insulator than glass  ignore keeps temperature in / heat resistant ignore not breakable / glass is breakable <b>ignore 'traps energy' alone</b>	(1) AO2 2

Question number	Answer	Additional guidance	Mark
4(b)(iv)	-2.5°C scores 3 with or without working  16.1 – 18.6 (1)  = -2.5 (1)  °C (1)	2.5°C scores 2 with or without working 2.5 scores 1 with or without working  MP3 standalone mark  <b>ignore 'C' / 'o' alone</b>  <b>ignore 'deg C'</b>	(3) AO2 1

Question number	Answer	Additional guidance	Mark
4(b)(v)	formula: $\text{NH}_4\text{NO}_3$ (1)      name: ammonium nitrate (1)	letters must be capitals and 4, 3 must be subscripts allow $\text{NH}_4^+\text{NO}_3^-$ allow $\text{N}_2\text{H}_4\text{O}_3$ ignore state symbols ignore $\text{NH}_4^+ + \text{NO}_3^-$  reject ammonia nitrate	(2) AO2 1

Question number	Answer	Additional guidance	Mark
5(a)(i)	carbon (1) hydrogen (1)	allow answers in either order  ignore C and H alone	(2) AO1 1

Question number	Answer	Mark
5(a)(ii)	B a chain molecule is the only correct answer.  A, C and D are incorrect because propane is a not an oxide, a fullerene or a ring molecule	(1) AO1 1

Question number	Answer	Mark
5(a)(iii)	C 44 is the only correct answer.  A, B and D are incorrect because $3 \times 12 + 8 \times 1 = 44$	(1) AO2 1

Question number	Answer	Additional guidance	Mark
5(b)	<p>The diagram shows a matching exercise between fractions and their uses. The 'fraction' column lists petrol, kerosene, and bitumen. The 'use' column lists fuel for aircraft, fuel for ships, fuel for cars, making plastic, extracting iron, and making road surfaces. Lines connect petrol to fuel for aircraft and fuel for cars; kerosene to fuel for ships; and bitumen to making road surfaces.</p>	reject more than one line from each fraction	(3) AO1 1

Question number	Answer	Additional guidance	Mark
5(c)	<p>An explanation to include three from :</p> <p>HCl</p> <ul style="list-style-type: none"> <li>• goes red (1)</li>   <li>• (HCl) is an acid (1)</li>   </ul> <p>SO<sub>2</sub></p> <ul style="list-style-type: none"> <li>• goes red (1)</li>   <li>• (SO<sub>2</sub> solution) is an acid (1)</li> </ul>	<p>all MPs are marked independently</p> <p>allow pink for red reject other colours for MP1 reject references to test for chlorine/ bleaching for MP1</p> <p>allow hydrogen chloride for HCl</p> <p>allow pink for red reject other colours for MP3 reject references to test for chlorine/ bleaching for MP3</p> <p>both go red/ they go red (2) for MP1 and MP3 both are acids (2) for MP2 and MP4</p>	<p>(3) AO1 1 AO2 1</p>

Question number	Answer	Mark
6(a)	B chlorine is the only correct answer  A, C and D are incorrect because only chlorine is green	(1) AO1 1

Question number	Answer	Additional guidance	Mark
6(b)(i)	iron + chlorine → (1)  → iron chloride (1)	allow = for → <b>MP1: allow iron wool/</b> reactants in either order/ ignore heat  MP2: reject if extra products but ignore heat  reject more than one arrow for both marks e.g. iron → chlorine → iron chloride  if symbol equation given only allow: Fe + Cl <sub>2</sub> → FeCl <sub>2</sub> (2) OR 2Fe + 3Cl <sub>2</sub> → 2FeCl <sub>3</sub> (2) all formulae must have correct capital and small letters and subscripts	(2) AO2 1

Question number	Answer	Additional guidance	Mark
6(b)(ii)	chlorine	allow CL / Cl / Cl <sub>2</sub>	(1) AO3 2

Question number	Answer	Additional guidance	Mark
6(b)(iii)	<p>iron = 43 and chlorine = 82 scores 3 with or without working</p> $\frac{34.4}{100} \times 125 \text{ (1)}$ <p>= 43 given as mass of iron (1)</p> $125 - 43 = 82 \text{ given as mass of chlorine (1)}$ <p>OR</p> $\frac{65.6}{100} \times 125 \text{ (1)}$ <p>= 82 given as mass of chlorine (1)</p> $125 - 82 = 43 \text{ given as mass of iron (1)}$	<p>one correct and one incorrect (or missing) value with or without working scores 2</p> <p>allow ECF</p> <p>allow ECF but must add up to 125g for MP3</p> <p>allow ECF but must add up to 125g for MP3</p> <p>allow final answers reversed on answer lines for 2 marks with or without working.</p>	(3) A02 1

Question number	Answer	Mark
6(c)	<ul style="list-style-type: none"> <li>• catalyst (1)</li> <li>• unchanged (1)</li> </ul>	(2) A01 1



Question number	Answer	Mark
7(a)	D $C_3H_6$ is the only correct answer  A, B and C are incorrect formula	(1) AO2 1

Question number	Answer	Additional guidance	Mark
7(b)	(unsaturated) <ul style="list-style-type: none"> <li>it has a double bond/ <math>C=C</math> (1)</li> </ul> (hydrocarbon) <ul style="list-style-type: none"> <li>it contains carbon and hydrogen (1)</li> <li>(carbon and hydrogen) (atoms) only (1)</li> </ul>	read whole answer then award marks from either section  allow <b>'double carbon bond'</b>  MP3 allow alternatives <b>such as 'just carbon and hydrogen'</b>  mixture of carbon and hydrogen/ contains molecules of carbon and hydrogen gets MP2 but not MP3	(3) AO1 1

Question number	Answer	Mark
7(c)(i)	C polymer is the only correct answer  A is incorrect because there is only one substance  B is incorrect because this is a long chain  D is incorrect because the molecule is not made from proteins	(1) AO2 1

Question number	Answer	Additional guidance	Mark
7(c)(ii)	<p>4.52304 x 10<sup>-18</sup> with or without working scores 2</p> <ul style="list-style-type: none"><li>• 6.98 x 10<sup>-23</sup> x 64800 (1)</li><li>• = 4.52(304) x 10<sup>-18</sup> (g) (1)</li></ul>	<p>do not award 4.52304 x 10<sup>18</sup> (but could score MP1 if this is correctly shown)</p> <p>Allow 2-6 sig fig.</p> <p>MP2 scores for correct evaluation of a division including the two pieces of data ONLY: 1.07716 x 10<sup>-27</sup> (1) <b>9.2836... x 10<sup>26</sup></b> (1)</p>	(2) A02 1

Question number	Indicative content	Mark
*7(d)	<p><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.</b></p> <p>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.</p> <p>AO2 (3 marks) AO3 (3 marks)</p> <p>Reactions</p> <ul style="list-style-type: none"><li>• combustion is reaction with oxygen</li><li>• complete combustion produces carbon dioxide</li><li>• complete combustion produces water</li><li>• incomplete combustion with lack of oxygen</li><li>• incomplete combustion produces carbon/ soot</li><li>• incomplete combustion produces carbon monoxide</li></ul> <p>Equations</p> <ul style="list-style-type: none"><li>• word equation shows reactants and products for complete combustion</li><li>• word equation shows reactants and products for incomplete combustion</li><li>• credit any symbol equations even if incorrectly balanced</li></ul> <p>Energy released</p> <ul style="list-style-type: none"><li>• as you go down table molecules get larger</li><li>• temperature rise increases as alkane molecule size increases</li><li>• temperature rise means energy released/ exothermic</li><li>• least to most is methane, ethane, propane, butane</li><li>• bigger molecules release more energy</li></ul>	(6) AO2 1 AO3 1

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	<ul style="list-style-type: none"><li>• 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)</li><li>• 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)</li></ul>
Level 2	3–4	<ul style="list-style-type: none"><li>• Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3)</li><li>• 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)</li></ul>
Level 3	5–6	<ul style="list-style-type: none"><li>• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3)</li><li>• 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)</li></ul>

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Ignore any material about properties of CO or CO <sub>2</sub> Read whole answer and ignore all incorrect material/ discard any contradictory material then:
Level 1	1-2	<u>Additional Guidance</u> The pattern in the table is described OR Correct products in complete OR incomplete combustion given <i>Products can be written or given in full or partial equations</i>	<u>Possible candidate response</u> Incomplete combustion is with a lack of oxygen (1) Methane has the lowest temperature change (1) Methane has lowest temperature change and butane highest (1) Incomplete combustion is with a lack of oxygen and forms CO (2) As you go down the table, the temperature change is higher/ more energy is released (2)
Level 2	3-4	<u>Additional Guidance</u> The pattern in the table is described and correct products in complete OR incomplete combustion given <i>Products can be written or given in full or partial equations</i>	<u>Possible candidate response</u> As you go down table, molecules get larger and the larger the molecule is the more energy is released (3) As you go down the table, the temperature change increases, alkane + oxygen → carbon dioxide (3) Complete combustion produces carbon dioxide and water and incomplete combustion gives carbon monoxide (3) The larger the molecule the higher the temperature change, and when an alkane completely burns it produces carbon dioxide and water (4)
Level 3	5-6	<u>Additional Guidance</u> The pattern in the table MUST be described and correct products in complete AND incomplete combustion given <i>Products can be written or given in full or partial equations</i>	<u>Possible candidate response</u> As you burn bigger molecules down the table more energy is released. If the alkanes burn completely, carbon dioxide and water are released, but if with a lack of oxygen, carbon monoxide is formed (6)

Question number	Answer	Additional Guidance	Mark
8(a)(i)	<ul style="list-style-type: none"> <li>100 cm<sup>3</sup> measuring cylinder/ (gas) syringe (1)</li> <li>which has smaller gradations / higher resolution (1)</li> </ul>	<p><b>allow 'smaller measuring cylinder'</b></p> <p>ignore gas measurer reject (upturned) burette for MP1</p> <p>MP2 is dependent on MP1 allow (more) precise / (more) accurate allow smaller measurements/ increments</p> <p>ignore easier to use / no gas will escape</p>	(2) AO3 3b

Question number	Answer	Additional guidance	Mark
8(a)(ii)	<ul style="list-style-type: none"> <li>volume read at 90s = 29 cm<sup>3</sup> (1)</li> <li>rate = <math>\frac{\text{volume}}{90}</math> (1)</li> <li>= 0.3222.... (cm<sup>3</sup> per second) (1)</li> </ul>	<p>0.31, 0.32, 0.33 with or without working scores 3 all other answers require working to have marks awarded 0.3 alone scores 0</p> <p>allow any value 28-30 ECF for incorrect volume</p> <p>ECF if fraction inverted ECF if 1.5 used instead of 90 eg <math>\frac{28/29/30}{1.5} = 18.66.../ 19.33.../ 20</math> scores 2</p> <p>MP3 must be decimal value correctly rounded – ignore fractions</p>	(3) AO3 2

Question number	Answer	Additional guidance	Mark
8(a)(iii)	volumes were {constant / stopped rising}  OR  graph was {flat/plateaued/ levelled off}	allow reactant(s) used up / limiting factor allow no more hydrogen evolved allow EVIDENCE that reaction stopped: measurements stayed the same/ no more bubbles  allow graph has reached zero gradient ignore graph is a straight line ignore it has reached the highest {point / volume}  ignore reaction has stopped / is complete reject reaction is becoming slower	(1) AO3 2

Question number	Answer	Additional guidance	Mark
8(b)(i)	An explanation linking <ul style="list-style-type: none"> <li>more particles present (in same volume) (1)</li> <li>so more frequent collisions/ more chance of collision (1)</li> </ul>	allow atoms/ molecules/ ions for particles ignore more acid present  allow more collisions per {sec/min/unit time} ignore more collisions/ more successful collisions ignore references to energy / moving faster  mark independently	(2) AO1 1

Question number	Answer	Mark
8(b)(ii)	D use the same metal but in a powdered form is the only correct answer B and C are incorrect because the reactants are not changed A is incorrect because the reaction will be slower	(1) AO2 1

Question number	Answer	Additional guidance	Mark
8(c)	<p>A description including any two from:</p> <ul style="list-style-type: none"> <li>• {crush/ break} the large chips (1)</li> <li>• in pestle and mortar (1)</li> <li>• use sieves to separate different sized chips/ sort the chips by size (1)</li> </ul>	<p>ignore {cut / chop} them up ignore breaking down by cutting / chopping / tearing / heating etc</p> <p>allow any suitable <u>laboratory</u> apparatus/ tool e.g. hammer ignore domestic equipment e.g. scissors / rolling pin allow leave in acid (to reduce size) for MP2 but MP1 cannot score</p> <p>allow pick out the sizes you need allow repeat the method to get even smaller chips</p>	(2) AO1 2

Question number	Answer	Mark
9(a)	<p>B effervescence is seen is the only correct answer.</p> <p>A, C and D are incorrect as they are not linked to gas production</p>	(1) AO1 2

Question number	Answer	Mark
9(b)	<p>B chlorine is the only correct answer.</p> <p>A, C and D are incorrect because only chlorine bleaches litmus</p>	(1) AO1 1



Question number	Answer	Additional guidance	Mark
9(c)	2.20 with or without working scores (2) <ul style="list-style-type: none"> <li>• <math>5(.000) - 2.8(00) = 2.2(00)</math> (1)</li> <li>• <math>= 2.20</math> (1)</li> </ul>	reject additional processing for MP1 (e.g $5 - 2.8 = 2.2$ then $\frac{2.2}{100} = 0.0220$ ) does not score MP1 – additional process of dividing by 100 does not score MP2 - using a number not in the question  for MP2 final answer must be to 3sf, correct evaluation of expression using only numbers from the question  $2.2 / 2.200$ scores 1 mark $\frac{5.000}{2.800} = 1.79$ scores 1 mark $\frac{2.800}{5.000} = 0.560$ scores 1 mark [ $0.56 = 0$ ] $5.000 \times 2.800 = 14.0$ scores 1 mark [ $14 = 0$ ] $5.000 + 2.800 = 7.80$ scores 1 mark [ $7.8 = 0$ ]	(2) AO2 1

Question number	Answer	Additional guidance	Mark
9(d)(i)	An explanation linking: <ul style="list-style-type: none"> <li>• it has two electrons in outer shell/ it has a full outer shell / OWTTE (1)</li> <li>• so does not {gain/ lose/ transfer/ share} electrons (1)</li> </ul>	MP1 – reject if number of electrons in outer shell is stated and not 2 ignore references to protons and neutrons allow helium has two electrons in its (only) shell / <b>helium's (only) shell is full</b>  ignore helium does not need to react	(2) AO1 1

Question number	Answer	Additional guidance	Mark
9(d)(ii)	less dense than air	allow less dense than nitrogen allow low density / not (very) dense allow diffuses slowly out of balloon  ignore less dense than oxygen ignore it is a gas / light / lightweight / inert/ unreactive/ non-flammable / lighter than air / makes balloon float / it rises/ it floats  ignore non-toxic / not poisonous	(1) AO2 1

Question number	Indicative content	Mark
*9(e)	<p><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.</b></p> <p>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.</p> <p>AO1 (6 marks)</p> <p>Natural: Origins:</p> <ul style="list-style-type: none"> <li>• {carbon dioxide / water / gases} from volcanoes</li> <li>• the Earth cooled</li> <li>• so water vapour condensed (to form oceans/seas) reducing amount of water vapour</li> <li>• carbon dioxide {dissolves in/absorbed by} the oceans reducing amount of carbon dioxide</li> <li>• <b>some carbon dioxide incorporated into sea animals' shells</b></li> </ul> <p>Natural: Evolution</p> <ul style="list-style-type: none"> <li>• plants evolved</li> <li>• photosynthesis</li> <li>• photosynthesis releases oxygen increasing amount of oxygen</li> <li>• photosynthesis absorbs carbon dioxide reducing amount of carbon dioxide</li> </ul> <p>Human effects</p> <ul style="list-style-type: none"> <li>• amounts of carbon dioxide in recent time increasing due to burning fossil fuels</li> <li>• amounts of carbon dioxide in recent time increasing due to agriculture</li> <li>• deforestation means less carbon dioxide absorbed</li> <li>• reforestation means more oxygen produced</li> </ul>	(6) AO1

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	<ul style="list-style-type: none"><li>• Demonstrates elements of chemical knowledge, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1)</li><li>• Presents an explanation with some structure and coherence. (AO1)</li></ul>
Level 2	3–4	<ul style="list-style-type: none"><li>• Demonstrates chemical knowledge, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1)</li><li>• Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)</li></ul>
Level 3	5–6	<ul style="list-style-type: none"><li>• Demonstrates accurate and relevant chemical knowledge throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1)</li><li>• Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)</li></ul>

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material/ discard any contradictory material then: Information directly copied from the table is not credited e.g water vapour goes down Water vapour has gone down (0) Humans respire giving carbon dioxide (0)
Level 1	1–2	<u>Additional Guidance</u> Candidate gives basic ideas only, these may or may not be linked	<u>Possible candidate response</u> Carbon dioxide is produced by volcanoes (1) Water vapour decreased because the earth cooled (1) Water vapour in the atmosphere condensed to form oceans (2) Trees photosynthesise and absorb carbon dioxide (2) Trees take in carbon dioxide and produce oxygen (2) Plants release oxygen, burning fossil fuels release carbon dioxide (2)
Level 2	3–4	<u>Additional Guidance</u> candidate gives basic idea about two areas. OR candidate gives a detailed explanation about one process	<u>Possible candidate response</u> Carbon dioxide is absorbed during photosynthesis by plants and burning fossils produces carbon dioxide (3) Trees photosynthesise which absorb carbon dioxide and release oxygen. The Earth cooled and water condensed to produce oceans, these oceans absorbed carbon dioxide (4)  Trees photosynthesise which absorb carbon dioxide and release oxygen (3) Primitive plants evolved in oceans and started to photosynthesise which decreased the amount of carbon dioxide and increase the amount oxygen in the atmosphere. (4)
Level 3	5–6	<u>Additional Guidance</u> candidate explains ideas about all three areas	<u>Possible candidate response</u> Trees photosynthesise which absorb carbon dioxide and release oxygen. The Earth cooled and water condensed to produce oceans, these oceans absorbed carbon dioxide. Cars produce carbon dioxide (5)  Trees photosynthesise which absorb carbon dioxide and release oxygen. The Earth cooled and water condensed to produce oceans, these oceans absorbed carbon dioxide. Burning fossil fuels produces carbon dioxide and deforestation has led to fewer trees and therefore less carbon dioxide being absorbed (6)

Question number	Answer	Additional guidance	Mark
10(a)(i)	An explanation linking <ul style="list-style-type: none"> <li>corrosive (1)</li> <li>so wear gloves/ (safety) goggles (1)</li> </ul>	allow safety glasses/ safety spectacles / eye protection ignore glasses and any other precautions  mark independently	(2) A03 3a

Question number	Answer	Mark
10(a)(ii)	nitric acid	(1) AO1 1

Question number	Answer	Additional guidance	Mark
10(a)(iii)	inert/ unreactive/ does not corrode	<b>reject 'is not corrosive'</b>  allow acid will not dissolve/ react with glass  <b>ignore 'acid won't burn through'</b>  ignore references to clear / strong	(1) AO2 1

Question number	Answer	Additional guidance	Mark
10(b)(i)	An explanation linking <ul style="list-style-type: none"> <li>Hold the wire in the flame / at the tip of the (blue) cone (1)</li> <li>(as) it is hotter (1)</li> </ul>	if the wire has been placed <u>in the flame</u> then any colour of flame is allowed.  if the wire has not been placed in the flame then allow use of a blue/roaring flame/open air hole, but NOT any other specified colours of roaring flame.	(2) AO1 2

Question number	Answer	Additional guidance	Mark
10(b)(ii)	P: lithium / Li (1) Q: potassium / K (1) R: copper / Cu (1)	for P allow strontium / Sr ignore any charges, even if incorrect (e.g. allow Li <sup>+</sup> , Li <sup>2+</sup> ) do not penalise incorrect capital/small letters (e.g. allow CU, li)	(3) AO1 2

Question number	Answer	Additional guidance	Mark
10(c)	$20 \times 5/1000 \times 219$ (2) (= 21.9 g) <ul style="list-style-type: none"> <li>• <math>5/1000</math> (= 0.005) (1)</li> <li>• <math>20 \times 0.005 \times 219</math> (1) (= 21.9 g)</li> </ul>	<p>overall calculation is <math>5 \times 219 \times 20 / 1000</math> deduct 1 mark per error</p> <p>allow ECF for MP2</p> <p>21900 scores 1 (has not /1000)</p> <p>219 with working scores 1 (has used 100 not 1000)</p>	(2) AO2 1