Pearson Edexcel

Mark Scheme (Results)

Summer 2023

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.

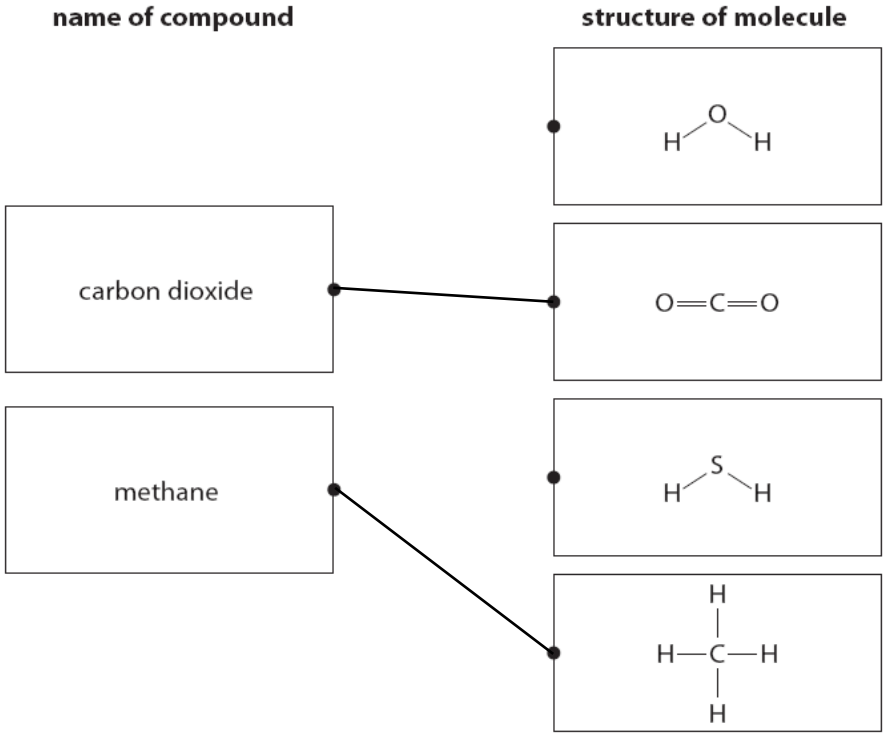
When marking questions with a 'describe' or 'explain' command word, the detailed marking guidance below should be consulted to ensure consistency of marking.

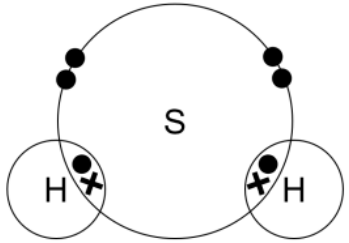
Assessment Objective		**Command Word**	
Strand	**Element**	**Describe**	**Explain**
AO1*		An answer that combines the marking points to provide a logical description	An explanation that links identification of a point with reasoning/justification(s) as required
AO2		An answer that combines the marking 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.

Paper 2F Foundation Tier

Question number	Answer	Additional guidance	Mark
1(a)	CH_4	allow H_4C / C_1H_4 reject CH4 / H4C / CH^4 / Ch_4 / ch_4	(1) AO3-1

Question number	Answer	Additional guidance	Mark
1(b)	 one mark for each line	do not award mark if more than one line join a left hand box with those on the right	(2) AO1-1

Question number	Answer	Additional guidance	Mark
1(c)	 shared pair (1) rest of molecule correct (1)	allow all dots or all crosses or a mixture of both allow remaining electrons not shown as pairs MP2 depends on MP1	**(2)** **AO2-1**

Question number	Answer	Additional guidance	Mark
1(d)	protons – 15 (1) neutrons – 16 (1) electrons – 15 (1)	accept ONLY whole numbers if no marks scored then maximum 1 mark for number of electrons = number of protons OR p + n = 31	**(3)** **AO1-1**

Total for Question 1 = 8 marks

Question number	Answer	Mark
2(a)	24.16 – 22.52 = 1.64 (g)	**(1) AO2-2**

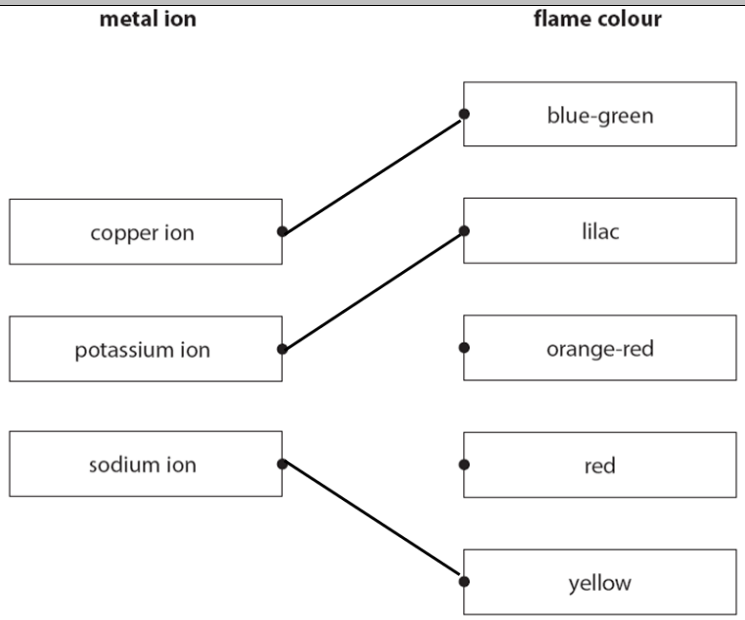
Question number	Answer	Additional guidance	Mark
2(b)(i)	**+** (1) 8.7 (1) (°C) sign (1) value (1)	Allow answer to be shown on the table mark independently	**(2) AO2-2**

Question number	Answer	Additional guidance	Mark
2(b)(ii)	An explanation linking • salt with larger positive temperature rise in part (i) (1) • shows the {largest/highest} temperature rise (1)	allow ecf from Q02b(i) +8.7 °C in part(i) gives salt C in Q02b(ii) MP2 depends on MP1 allow gives out most heat / loses most energy /heats up the most / biggest temperature change ignore just quoting numbers ignore biggest exothermic change / because it's getting hotter reject B for both marking points	**(2) AO2-1**

Question number	Answer	Additional guidance	Mark
2(c)	An explanation linking • polystyrene is an insulator / poor conductor (of heat) (1) • reduces {heat/energy} {loss/transfer} (1)	allow RA for glass allow polystyrene has a higher specific heat capacity than glass allow (polystyrene) {keeps heat in / doesn't absorb heat} allow holds {warmth/heat} better (than glass) ignore temperature stays in the cup ignore loss of heat through the top	**(2)** **AO3-3**

Total for Question 2 = 7 marks

Question number	Answer	Additional guidance	Mark
3(a)(i)	{dip/put} flame test wire into dilute hydrochloric acid, (1) then into {substance / ion} (1)	allow dip wire into water mark independently ignore metal in place of substance ignore use of spatula OR make solution of substance (1) dip {wire / splint} into solution (1)	**(2)** **AO1-2**

Question number	Answer	Additional guidance	Mark
3(a)(ii)	 one mark for each line	do not award mark if more than one line join a left hand box with those on the right	**(3)** **AO1-1**

Question number	Answer	Mark
3(b)	**C** red-brown precipitate is the only correct answer. **A**, **B** and **D** are incorrect results for this test	**(1)** **AO1-2**

Question number	Answer	Additional guidance	Mark
3(c)(i)	carbon dioxide	allow CO_2 do not accept CO^2	**(1)** **AO1-2**

Question number	Answer	Additional guidance	Mark
3(c)(ii)	{remove / loosen / slacken} {bung / stopper/lid} of right-hand test tube	allow any change that allows gas to bubble through the limewater	**(1)** **AO3-3**

Question number	Answer	Additional guidance	Mark
3(d)	ammonia	allow NH_3 / NH3 reject ammon**ium** / NH^3	**(1)** **AO1-2**

Total for Question 3 = 9 marks

Question number	Answer	Additional guidance	Mark
4(a)	bar on bar chart for carbon dioxide to 95 %	allow ±½ small square ignore width of bar	**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
4(b)(i)	over the past 3 billion years the average surface temperature of the Earth has decreased.		**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
4(b)(ii)	an explanation linking any **two** from • {the Earth / atmosphere / water vapour} cooled (1) • water vapour condensed / formed clouds (1) • {(liquid) water / rain} formed (1) • produced {oceans / seas / rivers / bodies of water} (1)	 allow surface temperature has decreased allow lakes	**(2)** **AO2-1**

Question number	Answer	Mark
4(c)(i)	photosynthesis	**(1)** **AO1-1**

Question number	Answer	Mark
4(c)(ii)	**B** put a glowing splint into the gas and it relights **A**, **C** and **D** are incorrect tests for oxygen	**(1)** **AO1-2**

Question number	Answer	Additional guidance	Mark
4(d)(i)	(416.56 – 371.17 =) 45.39 (1) = 45 (1) (to nearest whole number)	answer of 45 alone with or without working scores (2) 1 mark for correct rounding (has to use only the numbers 416.56 and 371.17 in any calculation)	**(2)** **AO2-1**

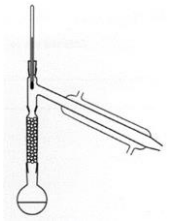
Question number	Answer	Additional guidance	Mark
4(d)(ii)	eg global warming / {ice caps/glaciers} melting / changing habitats / rising sea levels	allow {**enhanced/increased}** greenhouse effect / increased global temperatures / climate change / allow effects of climate change eg <u>more</u> extreme weather allow more photosynthesis ignore references to pollution / less oxygen in the air reject references to ozone layer / deforestation / acid rain	**(1)** **AO1-1**

Total for Question 4 = 9 marks

Question number	Answer	Additional guidance	Mark
5(a)(i)	(conical) flask	ignore volumetric flask	**(1) AO2-2**

Question number	Answer	Additional guidance	Mark
5(b)	$\frac{45}{150}$ = 0.3 (1) 0.3 x 1000 (1) = 300 (g dm^{-3}) OR $\frac{150}{1000}$ = 0.15 (dm^3) (1) $\frac{45}{0.15}$ = 300 (g dm^{-3}) (1)	answer of 300 (g dm^{-3}) alone scores (2) allow ecf from MP1 on both methods $\frac{150}{45}$ = 3.333 (0) 3.333 x 1000 = 3333 (1)	**(2) AO2-1**

Question number	Answer	Additional guidance	Mark
5(c)	yeast / zymase	allow enzyme / biological catalyst	**(1) AO2-2**

Question number	Answer	Mark
5(d)	**D**  is the only correct answer **A** is filtration **B** is simple distillation, **C** is evaporation / crystallisation	**(1)** **AO1-1**

Question number	Answer	Additional guidance	Mark
5(e)	$\frac{92}{180}$ = 0.5111111 (1) 0.51111111 x 45 = 23 (g) (1) OR $\frac{180}{92}$ = 1.956 (1) $\frac{45}{1.956}$ = 23 (1) OR $\frac{180}{45}$ = 4 (1) $\frac{92}{4}$ = 23 (1) OR $\frac{45}{180}$ = 0.25 (1) 92 x 0.25 = 23 (1) OR 92 x 45 = 4140 (1) $\frac{4140}{180}$ = 23 (1)	answer of 23 (g) alone scores (2) allow any number of sig figs on step 1 except 1 for any method calculation, allow ecf from MP1 to MP2	**(2)** **AO2-1**

Question number	Answer	Mark
5(f)	**D** -O–H is the only correct answer **A**, **B** and **C** are not correct functional groups of an alcohol	**(1)** **AO1-1**

Question number	Answer	Additional guidance	Mark
5(g)	turns {orange /red / yellow}	allow combinations of red, orange & yellow ignore 'changes colour'	**(1)** **AO2-2**

Total for Question 5 = 9 marks

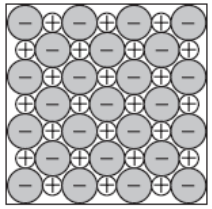
Question number	Answer	Mark
6(a)	**B** halogens **A**, **C** and **D** are names for other groups in the periodic table	**(1)** **AO1-1**

Question number	Answer	Additional guidance	Mark
6(b)(i)	Left side: sodium + chlorine (1) Right side: sodium chloride (1)	reactants in either order reject chlor**ide** on left hand side reject sodium chlor**ine** on right hand side reject if other substances on right side use of formulae to produce a correctly balanced equation: $2Na + Cl_2 \rightarrow 2NaCl$ (2)	**(2)** **AO2-1**

Question number	Answer	Additional guidance	Mark
6(b)(ii)	A description to include • (two or more) atoms joined together (1) • by a {covalent bond / shared pair of electrons} (1)	 allow made up of more than one atom / group of atoms ignore 'compound atoms' MP2 depends on MP1 allow {(chemically) bonded / chemically joined} together reject references to ionic bonding for MP2 if no other mark scored, allow 'particles joined by a {covalent bond / shared pair of electrons} (1)	**(2)** **AO1-1**

Question number	Answer	Additional guidance	Mark
6(b)(iii)	An explanation linking • electrons (1) • (electrons) {can move / are delocalised / can pass through / can flow} (1)	reject ions MP2 depends on MP1 allow charged particles can move / are delocalised (1) ignore 'free' alone allow free-moving electrons / delocalised electrons / free flowing electrons (2)	**(2)** **AO2-1**

Question number	Answer	Additional guidance	Mark
6(b)(iv)	NaCl / Na^+Cl^-	allow ClNa ignore upper case A, upper case L, lower case n ignore numbers in front of formula reject $Na^+ + Cl^-$ as final answer / Na^-Cl^+	**(1)** **AO3-1**

Question number	Answer	Mark
6(b)(v)	**D**  is the only correct answer **A**, **B** and **C** represent different structure types	**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
6(b)(vi)	ammeter / (light) bulb / lamp	allow buzzer / multimeter allow correct symbol (on diagram) ignore voltmeter / data logger (alone) ignore 'add arrows'	**(2)** **AO3-3**

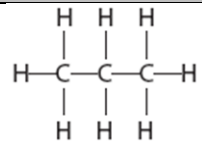
Question number	Answer	Additional guidance	Mark
6(c)(i)	$H_2 + Cl_2 \rightarrow 2\,HCl$	allow multiples	**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
6(c)(ii)	{dissolve in / add} water	allow {make aqueous / dissolve into a solution} allow bubble through water / mix with water ignore dilute / make it a liquid reject other substances	**(1)** **AO1-1**

Total for Question 6 = 12 marks

Question number	Answer	Mark
7(a)(i)	**B** 5 **A**, **C** and **D** are not correct because the equation would not balance	**(1)** **AO2-1**

Question number	Answer	Mark
7(a)(ii)	**C** pentane is oxidised **A, B** and **D** are not correct as these are different processes	**(1)** **AO1-1**

Question number	Answer	Additional guidance	Mark
7(b)(i)	 (1) C_4H_{10} (1)	allow lower case h allow non-linear structures allow non subscript numbers reject C^4H^{10}	**(2)** **AO1-1**

Question number	Answer	Additional guidance	Mark
7(b)(ii)	C_3H_7 (1)	allow non subscript numbers <u>but</u> reject C^3H^7 ignore 2 in front of correct empirical formula	**(1)** **AO3-1**

Question number	Indicative content	Mark
***7(b)(iii)**	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. **AO2-2 (3 marks) and AO3-3a (3 marks)** plan (alkanes used could be in either order) • measure known volume of water • put into beaker • put hexane into burner • find mass of burner + hexane • record temperature of water • light the burner under the beaker of water • put draft shield around apparatus • stir water with thermometer • heat water until temperature has risen by 30 °C • extinguish flame • find new mass of burner + hexane • replace with same volume of cold water • repeat experiment with octane in burner variables controlled • same volume of water being heated • same height of water above flame • same temperature rise recorded • shield prevents drafts • same sized wick	**(6)** **AO2-2** **AO3-3**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• The plan attempts to link and apply knowledge and understanding of scientific enquiry, techniques and procedures, flawed or simplistic connections made between elements in the context of the question. (AO2) • Analyses the scientific information but understanding and connections are flawed. An incomplete plan that provides limited synthesis of understanding. (AO3)
Level 2	3–4	• The plan is mostly supported through linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, some logical connections made between elements in the context of the question. (AO2) • Analyses the scientific information and provides some logical connections between scientific enquiry, techniques and procedures. A partially completed plan that synthesises mostly relevant understanding, but not entirely coherently. (AO3)
Level 3	5–6	• The plan is supported throughout by linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, logical connections made between elements in the context of the question. (AO2) • Analyses the scientific information and provide logical connections between scientific concepts throughout. A well-developed plan that synthesises relevant understanding coherently. (AO3)

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material / discard any contradictory material then:
Level 1	1–2	Additional Guidance One relevant instruction (1) One variable to be controlled (1) Two relevant instructions (but not linked in sequence) (2) Two or more variables to be controlled (2) (just a list variables limits answer to level 1)	Possible candidate response (all examples, not a definitive list) • put hexane (or alkane) into burner (1) • same volume of water (being heated) (1) • measure known volume of water AND light the burner (2) • same volume of water being heated AND same temperature rise (2)
Level 2	3–4	Additional Guidance At least three relevant instructions (but not linked) (3) Two relevant instructions that are linked in sequence (3) At least three relevant instructions (but not linked) AND a relevant variable to be controlled (4) A part method (4)	Possible candidate response (all examples, not a definitive list) • measure known volume of water, find mass of burner + hexane, extinguish flame (3) • put hexane into spirit burner , find mass of burner + hexane (3) • measure known volume of water, find mass of burner + hexane, extinguish flame; use same volume of water for both alkanes (4) • measure known volume of water, put into beaker, record temperature, alkane into burner, find mass, light the burner, heat the water (4)
Level 3	5–6	Additional Guidance Basic method that would work, but lacks detail AND repeated with other alkane AND at least one variable to be controlled Method described that has details about apparatus AND repeated with other alkane AND at least one variable to be controlled	Possible candidate response • measure known volume of water, put into beaker, record temperature, alkane into burner, find mass, light the burner, heat the water, after temp rise find new mass of burner + alkane, repeat with other alkane. Keep same volume of water being heated (5) • measure 100 cm^3 of water, put into beaker, record temperature, hexane into burner, find mass of burner + hexane, light the burner, heat the water, after temp rise of 30^oC, extinguish flame, find new mass of burner + hexane, repeat with octane. Keep same volume of water being heated, same temp rise (6)

Total for Question 7 = 11 marks

Question number	Answer	Additional guidance	Mark
8(a)	6 or 7 points plotted correctly (2) or 4 or 5 points plotted correctly (1) best fit curve starting at (0,0) (1)	allow +/- half a square. for MP3, curve must be a single smooth curved line going through most or all of THEIR plotted points (ecf allowed), or if the points are not visible, through most or all of the correct values. reject curves going above or below 100cm^3 by more than half a square. reject straight line / dot to dot straight lines bar charts – max 2 marks for plotting points if time value is clear	**(3)** **AO2-1**

Question number	Answer	Additional guidance	Mark
8(b)(i)	13	answer may be given in table	**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
8(b)(ii)	An explanation linking • rate of reaction decreases / reaction is slow**er** (1) • as {reactants /acid/ marble chips} are used up (1) • so less frequent collisions (1)	Note: a comparison of the rate of marble chips with that of marble powder is ignored ignore anything about rate increasing at the beginning / starts fast allow (rate of) reaction slows down ignore references to volumes of gas produced ignore reaction stops allow {concentration/amount} of acid decreases / marble chips getting smaller allow {marble chips <u>have</u> / acid <u>has</u>} react**ed** allow less {reactants/ marble chips/ acid} available ignore limiting factor/ reaction is ending allow fewer (successful) collisions ignore less particles have less energy	**(3)** **AO3-2**

Question number	Answer	Additional guidance	Mark
8(c)	graph to show • initial line steeper and to the left (1) • line levelling off at 100 cm^3 before 5 minutes (1)	there must be a line from part (a) to award these marks. if lines are not labelled, make a reasonable assumption about which is C. mark independently. line should start from start of original line all levelling off within half a square of original line	**(2)** **AO3-2**

Question number	Answer	Mark
8(d)	**C** use a more concentrated acid is the only correct answer **A**, **B** and **D** will have no effect on the speed of reaction	**(1)** **AO1-2**

Question number	Answer	Additional guidance	Mark
8(e)	stopwatch / clock	allow timer / time app on phone	**(1)** **AO1-2**

Total for Question 8 = 11 marks

Question number	Answer	Additional guidance	Mark
9(a)	An explanation linking • 1 <u>electron</u> (1) • in outer shell(s) (1)	 allow 1 is the last number of the electronic configuration (1) ignore electronic configurations written out reject incorrect number of electrons MP2 depends on MP1 for outer allow {highest energy / last} for shell allow ring, energy level, orbital allow: 1 outer electron (2) 1 valence electron (2) have to lose 1 electron to get full outer shell (2) same number of electrons in outer shell (1) forms a +1 ion by losing one electron (1)	**(2)** **AO1-1**

Question number	Answer	Mark
9(b)	**C** soft enough to be cut by a knife / low melting point is the only correct answer **A** and **D** are incorrect because alkali metals do not have a high density **B** is incorrect because alkali metal compounds are not blue in colour	**(1)** **AO1-1**

Question number	Answer	Additional Guidance	Mark
9(c)	$2\ K(s) + Br_2(g) \rightarrow 2\ KBr(s)$ balancing (1) state symbol s (1)	allow multiples ignore 'two' ignore 'solid'	**(2)** **AO2-1**

Question number	Answer	Additional guidance	Mark
9(d)	An explanation linking • (atom**s**) {of same element / with same number of protons} / all contain 19 protons / same atomic number (1) • different number of neutrons / different mass <u>number</u> / have 20, 21, 22 neutrons (1)	reject compound / molecule / ion / element**<u>s</u>** once allow same protons ignore electrons reject different protons allow different / extra / more / fewer neutrons ignore different mass / relative atomic mass reject different electrons	**(2)** **AO1-1**

Question number	Indicative content	Mark
9(e)	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. • lithium, sodium, potassium float on water • metals move around on the water • bubbles form / fizz / effervescence • hydrogen / gas produced • metal hydroxide solution formed • metal + water $\rightarrow$ metal hydroxide + hydrogen • purple solution formed if universal indicator present in the water • lithium slowly disappears • sodium forms a ball / melts • sodium disappears quickly • potassium burns with a lilac flame • potassium disappears very quickly • rubidium much more reactive (than potassium) • rubidium burns with coloured flame • caesium explosive / more reactive than rubidium	**(6)** **AO1-1**

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. • 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.
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. • 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.
Level 3	5–6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. • 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.

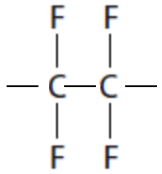
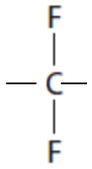
Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material/ discard any contradictory material then:
Level 1	1–2	Additional Guidance Correctly describes the trend in reactivity of group 1 metals down the group. Gives at least 1 observation for reaction of one alkali metal and water. Identifies at least 1 product formed when alkali metals react with water. Writes at least one correct word equation	Possible candidate response potassium is more reactive than sodium (1) the metals get more reactive down the group (1) water with universal indicator turns purple when lithium is added (1) when potassium is added to water it moves on the surface with a lilac flame (2) when lithium is added to water, bubbles of hydrogen are formed (2) sodium makes sodium hydroxide (1) sodium + water → sodium hydroxide + hydrogen (2)
Level 2	3–4	Additional Guidance Compares reactions of at least 2 alkali metals including at least 1 observation. Compares at least 2 alkali metals including identifying at least 1 product of reaction with water. Gives at least 1 observation about reaction of alkali metals and makes prediction for Rb / Cs.	Possible candidate response lithium and sodium both float on the water (3) lithium is the least reactive because it moves less than the others, with fewer bubbles (4) lithium is less reactive than sodium because it produces fewer bubbles of hydrogen (4) sodium makes sodium hydroxide, potassium makes potassium hydroxide (3) potassium burns with a flame, caesium would explode (3) rubidium would give off more bubbles than potassium, and would move faster in the water (4)
Level 3	5–6	Additional Guidance Compares reactions of at least 3 alkali metals including at least 2 observations for at least one metal AND identifies at least one product of reaction with water. Compares at least 3 alkali metals, including predictions for Cs / Rb AND identifies at least one product of reaction with water.	Possible candidate response potassium is more reactive than sodium, which is more reactive than lithium. When added to water they move around the surface and then disappear, with lithium moving the slowest. The metals react to form metal hydroxides and hydrogen (6) sodium + water → sodium hydroxide + hydrogen potassium + water → potassium hydroxide + hydrogen rubidium + water → rubidium hydroxide + hydrogen (5)

Total for Question 9 = 13 marks

Question number	Answer	Additional guidance	Mark
10(a)	proton atom molecule nanoparticle in the correct order (2)	allow proton molecule atom nanoparticle (1)	**(2)** **AO1-1**

Question number	Answer	Mark
10(b)(i)	**C** 9.0×10^{-8} is the only correct answer **A** is incorrect as it is 90000 nanometres **B** is incorrect as it is 9000 nanometres **D** is incorrect as it is 0.09 nanometres	**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
10(b)(ii)	surface area = 90 x 90 x 6 (1) = 48 600 volume = 90 x 90 x 90 (1) = 729 000 729 000 = 15 (1) 48 600 answer = 1 : 15	correct answer of 1:15 without working 3 marks allow ecf surface area calculated correctly evaluated (1) volume calculated ratio 1:90 scores 2 48600 = 0.066 (2) 729000 729000 = 90 (2) 8100 8100 = 0.011 (1) 729000	**(3)** **AO3-2**

Question number	Answer	Additional guidance	Mark
10(c)(i)	 (2) OR repeat unit including: • no double bond (1) • rest of repeat unit with linking bonds (1)	allow lowercase f allow diagram to show 1, 2, 4 or 6 carbon atoms eg  2 marks ignore brackets around repeat unit and n	**(2)** **AO2-1**

Question number	Answer	Additional guidance	Mark
10(c)(ii)	Use (1) Property (1) Reason (1) (Property & reason **MUST** depend on use) Examples**:** • for coating (frying) pans (1) • because it is {slippery/non stick} (1) • food will not stick to the (frying) pan (1) OR • clothing /carpets (1) • because it is non-stick (1) • easy to clean / will not stain (1) OR • bottom of skis (1) • because it is slippery (1) • less friction on snow (1)	USES allow: pans / frying pans / saucepans / tennis rackets / named kitchen equipment / piping / skis ignore: sports equipment (in general) / 'kitchenware' / windows / window ledge / toothpaste PROPERTIES allow: slippery / smooth / non-stick / unreactive / does not conduct electricity / non-toxic / high melting point ignore: strong / lightweight / high boiling point Other reasonable uses include: lubricants - reduces friction graft material in surgery – inert/non-reactive prevent insects from climbing surfaces - slippery insulation of wiring & electrical circuits – does not conduct electricity/high melting point plumbers' tape – flexible/waterproof bottles – inert/non-reactive raincoat / rainjacket – waterproof Goretex clothing - waterproof Umbrella – water repellant flame retardant material (2) – high melting point hair straighteners – non-stick/no hair damage Allow any reasonable use	**(3)** **AO1-1**

Total for Question 10 = 11 marks