



JABchem



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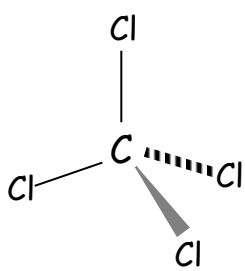
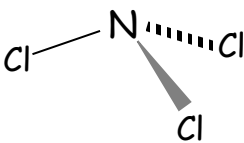
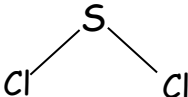
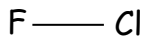
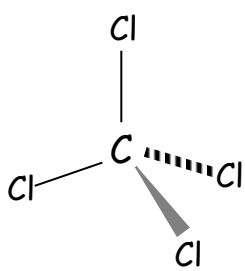
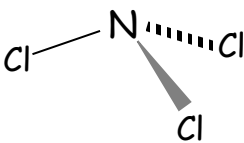
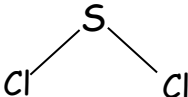
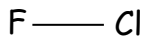
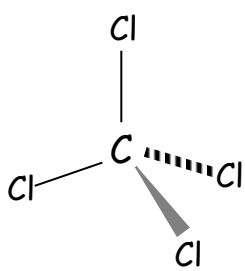
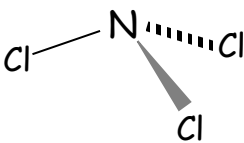
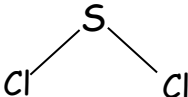
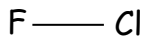
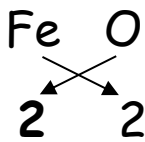
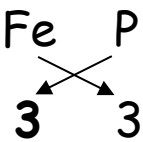
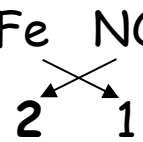
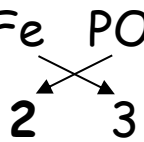
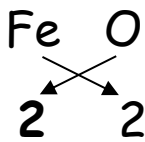
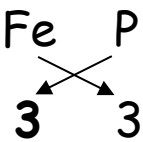
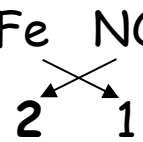
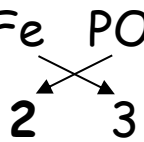
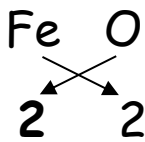
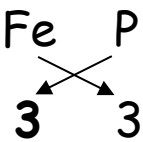
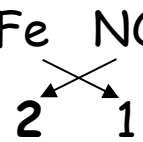
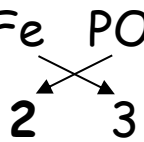
Past Papers Nat 5 Chemistry

2023 Marking Scheme

Grade Awarded	Mark Required		% candidates achieving grade
	(/100)	%	
A	69+	69%	42.5%
B	57+	57%	20.3%
C	46+	46%	15.1%
D	34+	34%	12.2%
No award	<34	<34%	9.9%

Section:	Multiple Choice	Extended Answer	Assignment
Average Mark:	16.1 /25	46.0 /75	No Assignment in 2023

2023 National 5 Chemistry Marking Scheme

MC Qu	Answer	% Correct	Reasoning																
1	D	62	$\text{Rate} = \frac{\Delta \text{Quantity}}{\Delta \text{Time}} = \frac{300 \text{ cm}^3}{60 \text{ s}} = 5 \text{ cm}^3 \text{ s}^{-1}$																
2	A	92	<table border="1"> <thead> <tr> <th>Particle</th> <th>Location</th> <th>Charge</th> <th>Mass</th> </tr> </thead> <tbody> <tr> <td>proton</td> <td>inside nucleus</td> <td>+1</td> <td>1 amu</td> </tr> <tr> <td>neutron</td> <td>inside nucleus</td> <td>0</td> <td>1 amu</td> </tr> <tr> <td>electron</td> <td>outside nucleus</td> <td>-1</td> <td>approx 0</td> </tr> </tbody> </table>	Particle	Location	Charge	Mass	proton	inside nucleus	+1	1 amu	neutron	inside nucleus	0	1 amu	electron	outside nucleus	-1	approx 0
Particle	Location	Charge	Mass																
proton	inside nucleus	+1	1 amu																
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electron	outside nucleus	-1	approx 0																
3	C	80	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td> CCl_4  </td> <td> NCl_3  </td> <td> SCl_2  </td> <td> FCl  </td> </tr> <tr> <td>tetrahedral</td> <td>trigonal pyramidal</td> <td>angular</td> <td>linear</td> </tr> </tbody> </table>	A	B	C	D	CCl_4 	NCl_3 	SCl_2 	FCl 	tetrahedral	trigonal pyramidal	angular	linear				
A	B	C	D																
CCl_4 	NCl_3 	SCl_2 	FCl 																
tetrahedral	trigonal pyramidal	angular	linear																
4	B	58	<p>Lithium Chloride is ionic as compound has metal bonded to non-metal.</p> <p><input checked="" type="checkbox"/> A Diagram shows metallic bonding (positive ions surrounded by delocalised electrons)</p> <p><input checked="" type="checkbox"/> B Diagram shows ionic bonding (positive ions and negative ions)</p> <p><input type="checkbox"/> C Diagram shows covalent molecular (separate molecules with covalent bonds inside molecule)</p> <p><input type="checkbox"/> D Diagram shows covalent network (long network of covalent bonds)</p>																
5	B	52	<table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td> Fe O  FeO </td> <td> Fe P  FeP </td> <td> Fe NO_3^-  $\text{Fe}(\text{NO}_3)_2$ </td> <td> Fe PO_4^{3-}  $\text{Fe}_3(\text{PO}_4)_2$ </td> </tr> <tr> <td>valency of Fe = 2</td> <td>valency of Fe = 3</td> <td>valency of Fe = 2</td> <td>valency of Fe = 2</td> </tr> </tbody> </table>	A	B	C	D	Fe O  FeO	Fe P  FeP	Fe NO_3^-  $\text{Fe}(\text{NO}_3)_2$	Fe PO_4^{3-}  $\text{Fe}_3(\text{PO}_4)_2$	valency of Fe = 2	valency of Fe = 3	valency of Fe = 2	valency of Fe = 2				
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valency of Fe = 2	valency of Fe = 3	valency of Fe = 2	valency of Fe = 2																
6	D	71	<p><input checked="" type="checkbox"/> A no. of mol = volume x concentration = $0.1_{\text{litres}} \times 1.00_{\text{mol l}^{-1}} = 0.1\text{mol}$</p> <p><input checked="" type="checkbox"/> B no. of mol = volume x concentration = $0.15_{\text{litres}} \times 0.75_{\text{mol l}^{-1}} = 0.1125\text{mol}$</p> <p><input checked="" type="checkbox"/> C no. of mol = volume x concentration = $0.2_{\text{litres}} \times 0.60_{\text{mol l}^{-1}} = 0.12\text{mol}$</p> <p><input checked="" type="checkbox"/> D no. of mol = volume x concentration = $0.25_{\text{litres}} \times 0.25_{\text{mol l}^{-1}} = 0.0625\text{mol}$</p>																
7	B	54	<p><input checked="" type="checkbox"/> A aluminium oxide is insoluble \therefore no change to pH of water</p> <p><input checked="" type="checkbox"/> B barium oxide is a soluble metal oxide \therefore dissolves in water to form alkaline pH>7</p> <p><input checked="" type="checkbox"/> C nitrogen oxide is a non-metal oxide \therefore dissolves in water to form pH<7</p> <p><input checked="" type="checkbox"/> D hydrogen oxide H_2O is water with a pH=7 \therefore does not change pH of water when added</p>																
8	C	45	<p>nickel carbonate + sulfuric acid \longrightarrow nickel sulfate + water + carbon dioxide</p> <p>nickel hydroxide + sulfuric acid \longrightarrow nickel sulfate + water</p> <p>nickel + sulfuric acid \longrightarrow nickel sulfate + hydrogen</p> <p><input checked="" type="checkbox"/> A nickel hydroxide does not produce a gas when reacted with sulfuric acid</p> <p><input checked="" type="checkbox"/> B nickel does not produce a gas when reacted with sulfuric acid</p> <p><input checked="" type="checkbox"/> C nickel sulfate is produced in all three reactions</p> <p><input checked="" type="checkbox"/> D no water produced in reaction of nickel and sulfuric acid \therefore not a neutralisation reaction</p>																

9	B	59	$(\text{Na}^+)_2\text{CO}_3^{2-}(\text{aq}) + 2\text{H}^+\text{Cl}^-(\text{aq}) \rightarrow 2\text{Na}^+\text{Cl}^-(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$ <p style="text-align: center;">Split solutions into ions</p> $2\text{Na}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) + 2\text{Cl}^-(\text{aq}) \rightarrow 2\text{Na}^+(\text{aq}) + 2\text{Cl}^-(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$ <p style="text-align: center;">Identify Spectator Ions and cancel out Spectator Ions</p> $2\text{Na}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) + 2\text{Cl}^-(\text{aq}) \rightarrow 2\text{Na}^+(\text{aq}) + 2\text{Cl}^-(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$ <p style="text-align: center;">Re-write equation without spectator ions</p> $\text{CO}_3^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$															
10	A	49	<p>Carbon number: 5 4 3 2 1</p> $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{C}(\text{CH}_3)_2\text{CH}_3$ <p style="text-align: center;"> ↑ ↑ 1x methyl group on C₄ 2x methyl group on C₂ </p> <p style="text-align: center;">Name of compound: 2,2,4-trimethylpentane</p> <p>NB: Overall formula is of alkane as formula C₈H₁₈ fits general formula C_nH_{2n+2}</p>															
11	C	56	<input checked="" type="checkbox"/> A This structure is also 2-methylbut-2-ene but drawn differently <input checked="" type="checkbox"/> B This structure has formula C ₅ H ₁₂ but 2-methylbut-2-ene has formula C ₅ H ₁₀ <input checked="" type="checkbox"/> C Both have formula C ₅ H ₁₀ and have different structures ∴ isomers <input checked="" type="checkbox"/> D This structure has formula C ₆ H ₁₂ but 2-methylbut-2-ene has formula C ₅ H ₁₀															
12	B	33	<input checked="" type="checkbox"/> A Addition of H ₂ across the C=C double bond in but-2-ene produces butane C ₄ H ₁₀ <input checked="" type="checkbox"/> B Butan-1-ol cannot be produced as -OH group must be added to C ₂ to form butan-2-ol <input checked="" type="checkbox"/> C Addition of H ₂ O across the C=C double bond in but-2-ene produces butan-2-ol <input checked="" type="checkbox"/> D Addition of Br ₂ across the C=C double bond in but-2-ene produces 2,3-dibromobutane															
13	A	87																
14	D	68	<input checked="" type="checkbox"/> A methanol CH ₃ OH has a lower formula mass compared to octan-1-ol C ₈ H ₁₇ OH <input checked="" type="checkbox"/> B CH ₃ OH has a higher solubility than C ₈ H ₁₇ OH as methanol has a shorter carbon chain <input checked="" type="checkbox"/> C methanol CH ₃ OH has a lower formula mass compared to octan-1-ol C ₈ H ₁₇ OH <input checked="" type="checkbox"/> D methanol CH ₃ OH has a lower formula mass and higher solubility than octan-1-ol C ₈ H ₁₇ OH															
15	D	78	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="width: 33%;">Chemistry</th> <th style="width: 33%;">butane</th> <th style="width: 33%;">cyclobutane</th> </tr> </thead> <tbody> <tr> <td>General Formula</td> <td>C₄H₁₀ fits C_nH_{2n+2}</td> <td>C₄H₈ fits C_nH_{2n}</td> </tr> <tr> <td>Melting Point</td> <td>-138°C</td> <td>-90°C</td> </tr> <tr> <td>Solubility in water</td> <td>insoluble in water</td> <td>insoluble in water</td> </tr> <tr> <td>Saturation</td> <td>Saturated (no C=C double bonds)</td> <td>Saturated (no C=C double bonds)</td> </tr> </tbody> </table>	Chemistry	butane	cyclobutane	General Formula	C ₄ H ₁₀ fits C _n H _{2n+2}	C ₄ H ₈ fits C _n H _{2n}	Melting Point	-138°C	-90°C	Solubility in water	insoluble in water	insoluble in water	Saturation	Saturated (no C=C double bonds)	Saturated (no C=C double bonds)
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Saturation	Saturated (no C=C double bonds)	Saturated (no C=C double bonds)																
16	C	69	<p style="text-align: center;">Acid + Metal Oxide → Salt + Water</p> <p style="text-align: center;">methanoic acid + sodium oxide → sodium methanoate + water</p>															
17	A	72	<input checked="" type="checkbox"/> A conducts as solid and liquid ∴ metallic bonding <input checked="" type="checkbox"/> B does not conduct as solid or liquid and has low m.pt. and b.pt. ∴ covalent molecular <input checked="" type="checkbox"/> C conducts as liquid but not solid ∴ ionic bonding <input checked="" type="checkbox"/> D does not conduct as solid or liquid and has high m.pt. ∴ covalent network															
18	B	70	<input checked="" type="checkbox"/> A Y is least reactive as it is only metal not to react with acid. (Least reactive comes first in list) <input checked="" type="checkbox"/> B Y is least reactive and Z is most reactive ∴ Y then X then Z <input checked="" type="checkbox"/> C Z is most reactive as it is only metal to react with water. (Most reactive comes last in list) <input checked="" type="checkbox"/> D Z is most reactive as it is only metal to react with water. (Most reactive comes last in list)															

19	D	86	<input checked="" type="checkbox"/> A Nickel(A) is lower than zinc(B) in Electrochemical series so electrons flow from B to A <input checked="" type="checkbox"/> B Zinc(A) is lower than aluminium(B) in Electrochemical series so electrons flow from B to A <input checked="" type="checkbox"/> C Aluminium(A) is lower than magnesium(B) in Electrochemical series so electrons flow from B to A <input checked="" type="checkbox"/> D Aluminium(A) is higher than nickel(B) in Electrochemical series so electrons flow from A to B												
20	A	29	<p>As Magnesium is higher up the electrochemical series. Magnesium will oxidise into Mg^{2+} ions and Ag^+ ions will reduce back to silver atoms in a redox reaction.</p> <p>Oxidation $Mg(s) \longrightarrow Mg^{2+}(aq) + 2e^-$</p> <p>Reduction $Ag^+(aq) + e^- \longrightarrow Ag(s)$</p> <p>Oxidation $Mg(s) \longrightarrow Mg^{2+}(aq) + 2e^-$</p> <p>Reduction x2 $2Ag^+(aq) + 2e^- \longrightarrow 2Ag(s)$</p> <p>Redox $Mg(s) + 2Ag^+(aq) \longrightarrow Mg^{2+}(aq) + 2Ag(s)$</p>												
21	C	72	<table border="1"> <thead> <tr> <th>Process</th> <th>Reactants</th> <th>Products</th> <th>Catalyst</th> </tr> </thead> <tbody> <tr> <td>Haber</td> <td>Nitrogen + Hydrogen</td> <td>Ammonia</td> <td>Iron</td> </tr> <tr> <td>Ostwald</td> <td>Ammonia + oxygen</td> <td>Nitric acid (ultimately)</td> <td>Platinum</td> </tr> </tbody> </table>	Process	Reactants	Products	Catalyst	Haber	Nitrogen + Hydrogen	Ammonia	Iron	Ostwald	Ammonia + oxygen	Nitric acid (ultimately)	Platinum
Process	Reactants	Products	Catalyst												
Haber	Nitrogen + Hydrogen	Ammonia	Iron												
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22	C	74	${}_{90}^{227}\text{Th} \xrightarrow{\alpha} {}_{88}^{223}\text{Ra} \xrightarrow{\alpha} {}_{86}^{219}\text{Rn} \xrightarrow{\alpha} {}_{84}^{215}\text{Po} \xrightarrow{\alpha} {}_{82}^{211}\text{Pb}$												
23	C	70	<input checked="" type="checkbox"/> A Barium sulfate is insoluble and can be collected in a precipitation reaction by filtration <input checked="" type="checkbox"/> B Lead(II) sulfate is insoluble and can be collected in a precipitation reaction by filtration <input checked="" type="checkbox"/> C Calcium chloride is soluble so will not form a precipitate <input checked="" type="checkbox"/> D Silver Chloride is insoluble and can be collected in a precipitation reaction by filtration												
24	A	80	<input checked="" type="checkbox"/> A Glucose gives blue to orange with Benedict's and sodium chloride gives yellow flame test <input checked="" type="checkbox"/> B Starch is not present as there was no change in the iodine test <input checked="" type="checkbox"/> C Flame test gave yellow flame but strontium chloride would give a red flame test result <input checked="" type="checkbox"/> D Starch is not present as there was no change in the iodine test												
25	B	44	$2\text{NaOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ <p style="text-align: center;"> 2mol 1mol </p> <p style="text-align: center;"> 0.004mol 0.002mol </p>												

2023 National 5 Chemistry Marking Scheme

Long Qu	Answer	Reasoning																
1a	7	<table border="1"> <tr> <th>Diatomic Element</th> <th>Hydrogen</th> <th>Nitrogen</th> <th>Oxygen</th> <th>Fluorine</th> <th>Chlorine</th> <th>Bromine</th> <th>Iodine</th> </tr> <tr> <td>Formula</td> <td>H₂</td> <td>N₂</td> <td>O₂</td> <td>F₂</td> <td>Cl₂</td> <td>Br₂</td> <td>I₂</td> </tr> </table>	Diatomic Element	Hydrogen	Nitrogen	Oxygen	Fluorine	Chlorine	Bromine	Iodine	Formula	H ₂	N ₂	O ₂	F ₂	Cl ₂	Br ₂	I ₂
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Formula	H ₂	N ₂	O ₂	F ₂	Cl ₂	Br ₂	I ₂											
1b	35	Chlorine 35 is the common isotope in sample as the average is closer to 35 than 37																
1c	<p>One from:</p> <table border="1"> <tr> <td>Fluorine</td> <td>Bromine</td> </tr> <tr> <td>Iodine</td> <td>Astatine</td> </tr> </table>	Fluorine	Bromine	Iodine	Astatine	Elements in the same chemical group have similar chemical properties due to having the same number of outer electrons.												
Fluorine	Bromine																	
Iodine	Astatine																	
1d	<table border="1"> <tr> <td>10</td> <td></td> </tr> <tr> <td></td> <td>20</td> </tr> </table>	10			20	<table border="1"> <tr> <td> ²⁴₁₂Mg²⁺ </td> <td> No. of protons = atomic number = 12 No of neutrons = mass number - atomic number = 24 - 12 = 12 No of electrons = atomic number - charge = 12 - (2) = 10 </td> </tr> <tr> <td> ³⁷₁₇Cl⁻ </td> <td> No. of protons = atomic number = 17 No of neutrons = mass number - atomic number = 37 - 17 = 20 No of electrons = atomic number - charge = 17 - (-1) = 18 </td> </tr> </table>	²⁴ ₁₂ Mg ²⁺	No. of protons = atomic number = 12 No of neutrons = mass number - atomic number = 24 - 12 = 12 No of electrons = atomic number - charge = 12 - (2) = 10	³⁷ ₁₇ Cl ⁻	No. of protons = atomic number = 17 No of neutrons = mass number - atomic number = 37 - 17 = 20 No of electrons = atomic number - charge = 17 - (-1) = 18								
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2a	Hydrocarbon	A hydrocarbons is a compounds containing carbon and hydrogen only.																
2b(i)	Hydrogen	$C_2H_6 \rightarrow C_2H_4 + H_2$																
2b(ii)	decolourises bromine solution	Unsaturated compounds will decolourise bromine solution quickly. Bromine adds across the double bond in ethene to form 1,2-dibromoethane																
2c(i)	$H-C \equiv C-H$	Carbon has valency of 4 and makes four bonds per carbon atom Hydrogen has valency of 1 and make only one bond per hydrogen atom																
2c(ii)A	carbon dioxide and water	Ethyne is a hydrocarbon containing only carbon and hydrogen atoms. <ul style="list-style-type: none"> Complete combustion of carbon produced carbon dioxide. Complete combustion of hydrogen produced water. 																
2c(ii)B	Gives out heat	Exothermic reactions are reactions where heat is given out to the surroundings. Endothermic reactions are reactions where heat is taken in from the surroundings																
3a	Group 2	Only Groups 2 contains metals only. Group 1 starts with the non-metal hydrogen. The remaining groups 3-0 all start with a non-metal at the top of the group																
3b(i)	KMnO ₄	<table border="1"> <tr> <td>Write down Symbols and valency below</td> <td>Cross-Over arrows to work out formula</td> <td>Work out chemical formula (Cancel down if necessary)</td> </tr> <tr> <td> $K \quad MnO_4^-$ 1 1 </td> <td> $K \quad MnO_4^-$ </td> <td>KMnO₄</td> </tr> </table>	Write down Symbols and valency below	Cross-Over arrows to work out formula	Work out chemical formula (Cancel down if necessary)	$K \quad MnO_4^-$ 1 1	$K \quad MnO_4^-$ 	KMnO ₄										
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3b(ii)	Aluminium or zinc	<table border="1"> <tr> <td>Observation</td> <td>Blinding white light</td> <td>Bright light</td> <td>Red glow with few sparks</td> <td>Dull red glow</td> </tr> <tr> <td>Metal</td> <td>Magnesium</td> <td>X</td> <td>Iron</td> <td>Copper</td> </tr> <tr> <td>Reactivity</td> <td colspan="3">High</td> <td>Low</td> </tr> </table> <p>Conclusion: X must have reactivity between Magnesium and Iron ∴ 2 possible metals: aluminium or zinc</p>	Observation	Blinding white light	Bright light	Red glow with few sparks	Dull red glow	Metal	Magnesium	X	Iron	Copper	Reactivity	High			Low	
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3c	Hydrogen Burns with a pop	<table border="1"> <tr> <td>Gas</td> <td>Hydrogen</td> <td>Oxygen</td> <td>Carbon Dioxide</td> </tr> <tr> <td>Test</td> <td>Burns with a pop</td> <td>Relights a glowing splint</td> <td>Turns limewater cloudy</td> </tr> </table>	Gas	Hydrogen	Oxygen	Carbon Dioxide	Test	Burns with a pop	Relights a glowing splint	Turns limewater cloudy								
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3d(i)	Voltage between 0.5 and 2.7	As Iron is between magnesium and tin on the electrochemical series, the voltage of an iron/copper cell will be between the voltage of a magnesium/copper cell and a tin/copper cell																
3d(ii)	Electrically conducting solutions containing ions	An electrolyte is an ion containing solution which completes the circuit in a cell and allows electricity to flow.																

3d(iii)	one answer from:	temperature	concentration	Type of electrode	Distance between electrodes	Surface area of electrodes				
4a	From air	Problem Solving: Extracting information from a passage								
4b	Lowers temperature or don't get used up	A catalyst speeds up a chemical reaction but does not get used up in the reaction. This often means that a chemical reaction can proceed at a lower temperature.								
4c	534.1	1 litre jet fuel made from 4700g CO ₂ 5 litres jet fuel made from 5x4700g CO ₂ = 23500g CO ₂ $\text{gfm CO}_2 = (1 \times 12) + (2 \times 16) = 12 + 32 = 44\text{g}$ $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{23500}{44} = 534.1\text{mol}$								
5	Open Question:	3 mark answer	2 mark answer		1 mark answer					
		Demonstrates a good understanding of the chemistry involved. A good comprehension of the chemistry has provided in a logically correct, including a statement of the principles involved and the application of these to respond to the problem.	Demonstrates a reasonable understanding of the chemistry involved, making some statement(s) which are relevant to the situation, showing that the problem is understood.		Demonstrates a limited understanding of the chemistry involved. The candidate has made some statement(s) which are relevant to the situation, showing that at least a little of the chemistry within the problem is understood.					
6a(i)	carboxyl group	—O—H hydroxyl group		$\begin{array}{c} \text{O} \\ \\ \text{—C—OH} \end{array}$ carboxyl group						
6a(ii)	Addition Polymerisation	C=C double bonds in monomer open up and join together to form polymer								
6a(iii)	Polymer diagram:	$\begin{array}{c} \text{COOH} \\ \\ \text{H} \\ \\ \text{C}=\text{C} \\ \\ \text{H} \end{array}$ Monomer	$\begin{array}{c} \text{COOH} \quad \text{COOH} \quad \text{COOH} \quad \text{COOH} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\ \quad \quad \quad \\ \text{—C—C—C—C—} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}$ Polymer			$\begin{array}{c} \text{COOH} \\ \\ \text{H} \\ \\ \text{—C—C—} \\ \quad \\ \text{H} \quad \text{H} \end{array}$ Repeating Unit				
6b(i)	CsCl and Material A	Problem Solving: Prediction of value and completion of bar graph								
6b(ii)	Bar bigger than 18 and lower than 32	As strontium is the metal between calcium and barium in group 2, the prediction for SrCl ₂ would be between CaCl ₂ (18) and BaCl ₂ (32).								
6c(i)	measuring cylinder or pipette	Beakers are less accurate than measuring cylinders at measuring volumes of liquid. Pipettes are the most accurate device for measuring exact volumes.								
6c(ii)	Line Graph Showing:	1 mark	1 mark		1 mark	1 mark				
		One mark is awarded for a graph which shows points plotted rather than bars.	The axis/axes of the graph has/have suitable scale(s). <ul style="list-style-type: none"> plotted points occupies at least half of the width and half of the height of the graph paper The axes have suitable scales 		The axes of the graph have suitable labels and units.	All data points plotted accurately (within a half box tolerance) with either a line of best fit drawn or plots joined by curve. This mark can only be accessed if linear scales for both axes have been provided.				
7a	Trisilane	Prefix	Mono-	Di-	Tri-	Tetra-	Penta-	Hexa-	Hepta-	Octa-
		Meaning	1	2	3	4	5	6	7	8
7b	Si ₅ H ₁₂	General Formula of silanes is Si _n H _{2n+2} in line with alkanes C _n H _{2n+2} For pentasilane, n=5 ∴ 2n+2 = (2×5)+2 = 12 ∴ Pentasilane formula = Si ₅ H ₁₂								

7c	185	Compound	Monosilane	Disilane	Trisilane	Tetrasilane	Pentasilane	Hexasilane
		Formula	SiH ₄	Si ₂ H ₆	Si ₃ H ₈	Si ₄ H ₁₀	Si ₅ H ₁₂	Si ₆ H ₁₄
		Boiling Point (°C)	-112	-15	53	108	153	-
		Difference		97	68	55	45	(35)
		Prediction (°C)	-	-	-	-	-	185
7d	One diagram from:							
7e	Stronger intermolecular forces due to longer silicon chain	<p>1st Mark: pentasilane has stonger/larger forces of attraction.</p> <p>2nd Mark: forces of attractions are intermolecular/between molecules</p> <p>The longer the silicon chain, the greater the number of atoms within the molecule. Bigger molecules have stronger intermolecular bonds between molecules which raises the boiling point of pentasilane over tetrasilane</p>						
7f	3.1	<p>gfm SiO₂ = (1×28)+(2×16) = 28+32 = 60g</p> $\text{no. of mol} = \frac{\text{mass}}{\text{gfm}} = \frac{6}{60} = 0.1\text{mol}$ $7\text{Mg} + 2\text{SiO}_2 + 14\text{HCl} \longrightarrow \text{Si}_2\text{H}_6 + 7\text{MgCl}_2 + 4\text{H}_2\text{O}$ <p style="text-align: center;"> 2mol 1mol </p> <p style="text-align: center;"> 0.1mol 0.05mol </p> <p>gfm Si₂H₆ = (2×28)+(6×1) = 56+6 = 62g</p> <p>mass = no. of mol × gfm = 0.05mol × 62 = 3.1g</p>						
8a	Fluorapatite	Problem Solving: extracting information from a passage						
8b	C ₆ H ₁₂ O	As there are no metals in the formula, any order of the non-metal elements is acceptable although most tend to list C then H then O.						
8c(i)	Nitrogen	ADP has the formula NH ₄ H ₂ PO ₄ contains nitrogen and phosphorus. Both are essential elements for plant growth. The 3rd essential element for plant growth is potassium.						
8c(ii)	Soluble	Fertilisers must contain at least one of the three essential elements nitrogen, phosphorus or potassium and be soluble in water.						
8d	31.6	<p>gfm H₃PO₄ = (3×1)+(1×31)+(4×16) = 3+31+64 = 98g</p> $\% \text{ P} = \frac{\text{mass of P}}{\text{gfm}} \times 100 = \frac{31}{98} \times 100 = 31.6\%$						
8e	Filtration	Solid calcium sulfate can be separated from a liquid by filtration.						
8f	$\frac{1}{2}$ mol or 0.5mol	CaSO ₄ ·2H ₂ O 1mol : 2mol		CaSO ₄ · $\frac{1}{2}$ H ₂ O 1mol : $\frac{1}{2}$ mol				
9a(i)	0.627	<p>heat energy = specific heat capacity × mass × change in Temperature</p> $E_h = C \times m \times \Delta T$ $E_h = 4.18 \times 0.01 \times 15$ $E_h = 0.627 \text{ kJ}$						
9a(ii)	One from:	No draft shield	Energy lost to surroundings	Temperature not consistent in water				
		Glass absorbs heat	Incomplete combustion					

9b	150	1g biscuit releases 20.9 kJ 30g biscuit releases $20.9 \text{ kJ} \times \frac{30}{1}$ $= 627 \text{ kJ}$ 4.18kJ equals 1 kilocalorie 627 kJ equals $1 \text{ kilocalorie} \times \frac{627}{4.18}$ $= 150 \text{ kilocalorie}$																																	
10a(i)	electrolysis	As caesium is more reactive than potassium then electrolysis would be the method to extract caesium from its ore. <table border="1"> <thead> <tr> <th>Method</th> <th colspan="2">Electrolysis</th> <th colspan="2">Heat With Carbon</th> <th colspan="2">Heat Alone</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Metals Made This Way</td> <td>Potassium</td> <td>Sodium</td> <td>Zinc</td> <td>Iron</td> <td>Mercury</td> <td>Silver</td> </tr> <tr> <td>Lithium</td> <td>Calcium</td> <td>Nickel</td> <td>Tin</td> <td>Gold</td> <td>Platinum</td> </tr> <tr> <td>Magnesium</td> <td>Aluminium</td> <td>Lead</td> <td>Copper</td> <td></td> <td></td> </tr> <tr> <td>Reason</td> <td colspan="2">most reactive metals</td> <td colspan="2">medium reactive metals</td> <td colspan="2">least reactive metals</td> </tr> </tbody> </table>	Method	Electrolysis		Heat With Carbon		Heat Alone		Metals Made This Way	Potassium	Sodium	Zinc	Iron	Mercury	Silver	Lithium	Calcium	Nickel	Tin	Gold	Platinum	Magnesium	Aluminium	Lead	Copper			Reason	most reactive metals		medium reactive metals		least reactive metals	
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