Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6	**1**	(a)			1	**B**	Ne / neon		
		(b)			2	**D** and **F** (1) **both** needed *either order* (**D** and **F**) are in the same group / (**D** and **F**) are both in Group 6 (**D** and **F**) both have 6 electrons in their outer shell (1) [Marks linked (unless **no** letters given)]			
		(c)			2	Set of properties: **2** (1) **both** metallic **and** non-metallic properties / metalloid / semi-metal [If referring to specific properties from table it must clearly convey the idea that one (or more) is a metallic property and another is a non-metallic property, e.g. high m.p. and b.p. (like a metal) and brittle (like a non-metal); no credit for a simple list of all properties] (1) [Marks linked (unless **no** number is given) i.e. second mark cannot be awarded if first is not]	'high m.p., b.p. and shiny **BUT** brittle'	Reference to Group 4	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	**2**	(a)	(i)		1	1			
			(ii)		1	increases			
			(iii)		1	8	C_8		
		(b)			1	lighter / lower density doesn't break (as easily) / not brittle / flexible	not dangerous when broken	can be recycled strong / durable can be coloured	
		(c)			2	12/60 (1) 12/60 × 100 = 20 % (1) 2 marks for correct answer only (cao)			
		(d)			3	Advantages reducing amount of plastic for disposal (1) conservation of raw materials/crude oil (1) Further (1) mark for development of any link to either advantage, e.g. less plastic going to landfill so fewer sites needed; less plastic litter which is unsightly / harms wildlife; burning plastics produces toxic gases; crude oil is a finite resource; crude oil can be used for other things.			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	**3**	(a)			3	copper chloride (1) carbon dioxide (1) sodium hydroxide (1)	$CuCl_2$ CO_2 NaOH		
		(b)			1	2			

Question Number			
FT	HT	Mark	Answer
9	**4**	6 QWC	**Indicative content:** **Fluoridation** **Chlorination** **Reasons why:-** **Reasons why:-** reduce tooth decay / kill bacteria/ sterilisation reduce teeth extractions / reduce number of general anaesthetics **Reasons for opposition** **Reasons for no opposition** mass medication / freedom of choice makes water safe to drink / excess fluoride discolours teeth / causes fluorosis / poisonous couldn't drink the water otherwise not added for medical reasons may also cause brittle bones / IBS / thyroid problems / cancer / bone cancer **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	(a)	(i)		2	an ion: Al^{3+} / O^{2-} an atom: Al a molecule: O_2 All **three** correct (2) Any **one** correct (1)	$2O^{2-}$		
			(ii)		2	cathode / negative / – (1) Al^{3+} / aluminium ions / positive ions attracted to cathode / negative electrode (1)	'go to **opposite charge**'	'go to'	attach
			(iii)		2	aluminium oxide (1) Al_2O_3 (1)	$Al^{3+}{}_2O^{2-}{}_3$		
			(iv)		1	*problem to be associated with electrolysis process **not** the extraction of the ore* fluoride emission / acid rain / global warming / climate change		reference to carbon dioxide / greenhouse gas	
		(b)			1	heat conductor e.g. saucepans low density e.g. aeroplanes malleable e.g. cans corrosion resistance e.g. window frames ductile e.g. over-head power cables shiny e.g. mirrors *correct property must be linked with an appropriate use to gain mark*			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)	(i)		1	2×10^6	2000000 2 million		2
			(ii)		2	***(1) for a reason and (1) for linked explanation*** sulfur scrubbing / react with lime / with sea water ….removes sulfur dioxide / neutralises sulfur dioxide use cleaner fuels …….remove sulfur from oil / gas / fuel use coal / fuel containing less sulfur use less coal ……greater use of alternative energy sources which do not produce sulfur dioxide			
			(iii)		1	$\mathbf{2}SO_2 + \mathbf{2}H_2O + O_2 \longrightarrow \mathbf{2}H_2SO_4$			
		(b)	(i)		1	neutralisation		exothermic	
			(ii)		2	(adding limestone) increases the pH (1) (higher the pH the) lower the acidity (1) *i.e. relationship between pH and acidity*	goes from 3.4 → 4.3 'weaker' the acidity		
			(iii)		1	increased lake acidity /decreased pH of lakes increased soil acidity / decreased pH of soil destruction of trees / fish killed / destruction of food chains / destruction of food webs increased metal corrosion (e.g. bridges)	lakes = reservoirs / ponds / rivers	'harmful to nature' 'marine life'	drinking water

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			2	**increased** (fossil) fuel consumption / **burning more** (fossil) fuels causes (1) **increased** carbon dioxide emissions / **more** carbon dioxide formed (1) [Credit (1) for 'burning (fossil) fuels forms carbon dioxide' when no reference made to **increase**]	accept named fossil fuel	deforestation	reference to 'ozone layer' or 'acid rain'
		(b)			1	Any **one** from: sea level rises / flooding destruction of habitats / kills wildlife	accept named animal e.g. polar bears decrease in number / nowhere for polar bears to live		
		(c)			2	Any **two** sensible disadvantages, e.g. separation issues: cost (of separation) transport issues: road – burns fuels pipeline – cost, hazards storage issues: leakage back into the atmosphere / dissolves into the sea / increases acidity unproven only power stations – other sources not addressed other options available			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	8	(a)			2	30 cm^3 (1) too much variation between readings (for experiment 1 and 2) (1)	other sensible answer, e.g. 10 cm^3 or 20 cm^3 on the basis that they have the same temperature reading in experiment 2		
		(b)			3	all 9 points plotted correctly (2) any 8 points plotted correctly (1) appropriate curve of best fit – judgement by eye (1)	±½ square		
		(c)			1	when plotted the mean value does not highlight the unreliability in the individual readings unreliability in individual readings cancelled out / mean follows the pattern			
		(d)			3	Three marking points: • (temperature rise due to) neutralisation reaction / exothermic reaction (1) • temperature **peaks** when neutralisation completed / reaction is completed / reaction is over / one reactant used up / both reactants used up (1) • (temperature falls because) dilution causes cooling / cold liquid added causes cooling / cools to room temperature over time (1)	implication of 'peak' by reference to increase followed by decrease		

Question Number			
FT	HT	Mark	Answer
	9	6 QWC	**Indicative content:** Description / explanation of advantages and disadvantages of hydrogen gas as fuel for cars e.g. **Disadvantages** **Production**: requires a lot of electricity (electrolysis), therefore relatively more expensive *NB Electricity generation might form carbon dioxide, therefore contributes to global warming* **Storage**: pressurised gas containers (relatively larger tank for equivalent distance travelled by petrol) **Reactivity**: explosive mixture with air **Distribution and infrastructure**: limited at present **Use in fuel cells requires catalysts**: most often platinum which is extremely rare and expensive **Advantages** **Combustion product**: only water, therefore cleaner (doesn't contribute to global warming) **Availability**: plentiful supply of water so **renewable** resource **Energy release on burning**: large **Efficiency**: good **Ignition:** easy *A 'full answer' should address at least **two** advantages and **two** disadvantages.* **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.