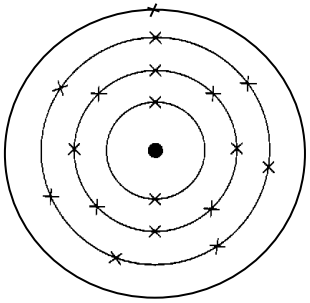
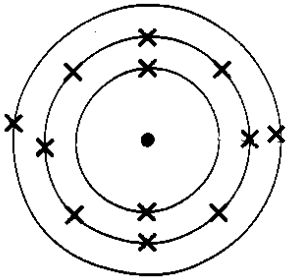
Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
8	1	(a)	(i)		1		2.8.8.1		
			(ii)		1		2.8.2 correct diagram of calcium structure / 2.8.8.2 [element to right of (a)(i) above rather than to right of original element drawn]		
		(b)			1	isotope			

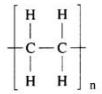
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
9	2	(a)			2	Concentration: 8 (g/dm^3) (1) Reason: experiment times close together / reaction times close together / little variation between times (1)	only 2 seconds variation between reaction times		
		(b)			1	use a light sensor / use a datalogger / same person recording the reaction times / same person adds the acid and starts the stopwatch / same person watches X disappear		use a computer	
		(c)			1	temperature		heat	catalyst
		(d)			3	• the **higher the concentration**, the **faster the rate** the higher the concentration the shorter the reaction time (1) • the higher the concentration the **more particles** are present (1) • the more particles the **greater the chance of collision** the more particles present more collisions per second the more particles present more collisions in a given time (1)		more collisions	reference to increased energy

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
10	3	(a)	(i)		1	tarnish / lose their shiny appearance	go dull / less shiny	grey / forms an oxide / corrodes	reference to rust
			(ii)		1	they react at different speeds / potassium reacts the quickest / lithium reacts the slowest / the speed at which the change occurs	reactivity increases down the group		
		(b)	(i)		3	**A** = bromine / Br_2 / Br **B** = iodine / I_2 / I **C** = chlorine / Cl_2 / Cl all correct (2) any one correct (1) Reason: reactivity decreases down the group (1)	chlorine most reactive, iodine least		
			(ii)		3	Reactants: Fe Cl_2 (1) Product: $FeCl_3$ (1) Balancing: 2:3:2 (1) ***Reactants and products must be correct before balancing mark can be awarded***	multiples of 2 and 3 e.g. 4:6:4		

Question Number			
FT	HT	Mark	
11	4	6	**Indicative content:** Reference to sedimentation, filtration and chlorination together with the reason for each process e.g. sedimentation / settling tank: removal of large insoluble particles filtration / filter bed: removal of small insoluble particles removal of bacteria / germs / micro-organisms chlorination: kills remaining bacteria / germs / micro-organisms **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		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	5	(a)			3	All points plotted correctly ±½ square (2) All but one point plotted correctly (1) Suitable line – judgement by eye (1) ***Consequential marking – ft***			
		(b)			1	67 ± 1 ***Consequential marking – ft***			
		(c)			2	60 °C = 40 24 °C = 22 both needed for (1) 18 (1) ***Consequential marking – ft***			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)			3	**Two** discrete diagrams needed: - diagram 1 showing transfer of electrons - diagram 2 showing ions Diagram 1 Calcium atom loses 2 electrons (1) Two fluorine atoms gain 1 electron each (1) Diagram 2 Ca^{2+} and 2 × F^- ions formed (1) *octet of electrons around F^-* ***not*** *needed* *discrete pair of ions needed for this mark*			
		(b)			2	**three** shared pairs of electrons (P-F's) (1) **octets of electrons** around P and all three Fs (1)			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)	(i)		3	**A** bromine / Br_2 (1) **B** ethane / C_2H_6 / structural formula (1) **C** polyethene / polythene (1)		Br 	
			(ii)		1	addition			additional
			(iii)	I	1	Reason: **weak bonds** between chains / molecules / chains not linked together ***Accept labelled diagram***	forces = bonds	layers	
				II	1	thermoplastic	thermosoftening		
		(b)			3	**mass/A_r** 0.96/12 and 0.2/1 (1) = 0.08 = 0.2 **ratio** 1 2.5 (1) **formula** C_2H_5 (1) ***Consequential marking – ft***	C_4H_{10}		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	(a)	(i)		2	Any **two** for (1) each • All the water samples are hard / become softer • **X** is not softened by boiling / **X** is permanently hard • **Y** and **Z** are softened by boiling / **Y and Z are** temporary hard			
			(ii)		2	Any **two** for (1) each • Ca^{2+} (and Mg^{2+}) present / **X** has the highest Ca^{2+} / Mg^{2+} content • **X** has the highest sulfate (ion) content • **Y** and **Z** contain high hydrogencarbonate (ion) content		reference to only Mg^{2+} **X** is the hardest	
		(b)	(i)		2	**Ca^{2+}/Mg^{2+}** (in hard water) ions (1) **exchanged** with **Na^{+}** ions(in resin) / **swapped** with **Na^{+}** ions (in resin) (1)	replace	reference to 'displace'	'react with'
			(ii)		1	Any **one** for (1) • resin needs regular replenishing / regeneration (with Na^{+} ions) • disposal of waste water (after regeneration) / Na^{+} ions pollute water • iron fouling • bacteria contamination • chlorine contamination	Na^{+} ions could be bad for heart	cost of process cost of sodium solution for regeneration	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	9				3	$M_r(NaHCO_3) = 84$ $M_r(Na_2CO_3) = 106$ } both needed (1) **2**(84) ⟶ **1**(106) 2:1 ratio (1) 168 106 84 53 8.4 ⟶ **5.3** (1) **cao (3)**	Moles approach $M_r(NaHCO_3)$= 84 $Mr(Na_2CO_3)$ = 106 } (1) 8.4/84 = 0.1 **2** ⟶ **1** 2:1 ratio (1) 0.1 **0.05** 0.05 × 106 = **5.3** (1)		

Question Number			
FT	HT	Mark	
	10	6	**Indicative content:** For diamond **and** graphite – reference made to bonding, structure and properties related to uses Diamond Bonding: uniform covalent / strong covalent bonds throughout / each carbon atom joined to four others Structure: giant molecular / covalent Properties and uses: hard – drill bits transparent /sparkly – jewellery Graphite Bonding: strong bonds within layers and weak bonds between layers / carbon atoms / each joined to three others Structure: giant molecular / covalent in layers Properties and uses: soft – pencils electrical conductor – electrodes **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.