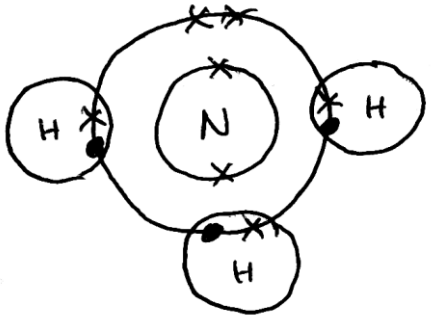
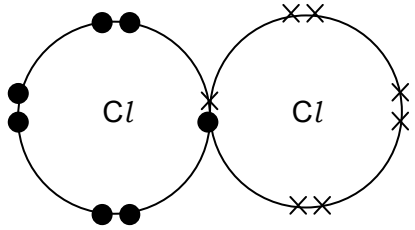
Question	Answer	Marks	Guidance
1 a i	**W** (1)	1	**allow** sodium / Na
ii	**Z** (1)	1	**allow** argon / Ar
iii	**W** and **Y** (1)	1	both required but order is unimportant **allow** sodium or Na **and** chlorine or Cl
b	At least one pair of electrons shared correctly between nitrogen and hydrogen (1) remainder of structure correct (1)  	2	can use all dots or all crosses **not** ionic structures = 0 for the question **allow** Lewis diagrams i.e. without circles **allow** lone pair electrons as two single electrons **ignore** inner electrons on nitrogen
c	solid – ions not free / ions cannot move / ions held in a lattice / ions in a giant structure (1) dissolved in water – ions can move (1)	2	**ignore** electrons / particles cannot move in a solid **allow** has free ions **not** electrons can move in a liquid **ignore** particles can move in a liquid
	Total	**7**	

Question	Answer	Marks	Guidance
2 a	collision frequency (between ions) is high (1)	1	**allow** large number of collisions (between ions) every second / lots of collisions (between ions) per unit time / high chance of collision (between ions) / highly likelihood of collisions (between ions) **not** collision frequency between atoms or molecules is high **allow** collision frequency between Pb^{2+} and I^- is high **allow** positive and negative **<u>ions</u>** attract / oppositely charged ions attract **allow** has a low activation energy **ignore** ions cancel out
b	idea of ion that is in the solution at start and at the end of the reaction (1)	1	**allow** an ion present that takes no part in the reaction / ion that does not react / they do not contribute towards the reaction **ignore** they do not change state during the reaction
c	**Any two from:** idea of results can be replicated / allows peer review (1) idea that further evidence can be collected / can be used by other scientists to develop the work (1) to gain funding (1) idea of recognition (1)	2	**allow** so the work can be checked **allow** so other scientists can help
	Total	**4**	

Question			Answer	Marks	Guidance
3			**D** (1) contains a sulfate because of white precipitate with barium chloride (1) contains a chloride because of white precipitate with silver nitrate (1)	3	**If any other letter given = 0 marks** **If no letter given maximum of two marks** **allow** barium chloride is a test for sulfate **allow** silver nitrate is a test for chloride **allow** for one mark contains a sulfate and a chloride / forms a precipitate with barium chloride and silver nitrate
			Total	**3**	

Question			Answer	Marks	Guidance
4	(a)		solvent evaporates / water evaporates (1)	1	**allow** liquid evaporates **ignore** binding medium oxidises **not** binding medium evaporates
	(b)		pigment **C** because (pigment **C**) is a thermochromic pigment / changes colour when temperature increases (1) (pigment will) act as a warning as the kettle heats up / indicates when the water is boiling / indicates when the water is hot (1)	2	**marks are for explanation** no marks if wrong pigment is chosen **allow** it changes colour as it is heated but **not** changes colour as heat increases
	(c)		pigment is dispersed throughout the mixture / solid scattered throughout the mixture / solid is dispersed throughout the mixture (1) (pigment or solid) particles are sufficiently small so as not to settle to the bottom (of the liquid) (1)	2	**not** pigment or solid dissolves **allow** pigment or solid particles are too small to separate from the liquid **not** reference to emulsifiers or detergents
			Total	**5**	

Question	Answer	Marks	Guidance
5	**Level 3** **Candidate applies knowledge to predict the name of both products AND predicts a reaction time for rubidium AND writes a correctly balanced symbol equation.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **Level 2** **EITHER** **Candidate applies knowledge to predict the names of both products AND predicts a reaction time for rubidium** **OR** **predicts a reaction time for rubidium AND attempts a symbol equation.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **EITHER** **Candidate applies knowledge to predict the names of both products** **OR** **predicts a reaction time for rubidium and the name of one product** **OR** **candidate attempts a symbol equation.** Quality of written communication impedes communication of the science at this level. (1 – 2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0marks)	6	**This question is targeted at grades up to A*.** **Indicative scientific points may include:** **Names of Products** • hydrogen must be stated but can be in a word equation • rubidium hydroxide must be stated but can be in a word equation **Reaction Time** • any time less than 7 seconds / reaction time less than potassium **Equation** • $2Rb + 2H_2O \rightarrow 2RbOH + H_2$ or correct multiple **note** $Rb + H_2O \rightarrow$ product / formula is an attempt to write an equation **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
		6	

Question			Answer	Marks	Guidance
6	(a)		(add up number of electrons) and this is the atomic number (and check on periodic table) (1)	1	**allow** has 20 electrons and on periodic table element number 20 is calcium **allow** element is in Group 2 and Period 4 it has 20 electrons on its own is **not** sufficient
	(b)		one shared pair of electrons between the chlorine atoms (1) rest of outer shells correct (1)	2	**allow** electrons to be all crosses or all dots  **ignore** inner shell electrons even if incorrect **do not allow** diagams with charges / diagrams with double bonds = 0 marks
	(c)		sodium (atoms) lose electrons (1) chlorine (atoms) gain electrons (1)	2	**allow** sodium ions have more protons than electrons **not** sodium ions lose electrons **allow** chloride ions have more electrons than protons **not** chloride ions gain electrons

	(d)		(chlorine molecule) gains electron(s) (1)	1	
	(e)		$Cl_2 + 2KI \rightarrow 2KCl + I_2$ **OR** $Cl_2 + 2I^- \rightarrow I_2 + 2Cl^-$ correct formulae (1) correct balancing – dependent on correct formulae (1)	2	**ignore** state symbols **allow** = instead of → **allow** any correct multiple including fractions **not** & or and instead of + **allow** one mark for correct equation with minor errors of subscript, superscript and case eg $cl2 + 2KI \rightarrow 2KCl + I^2$
			Total	**8**	