

Question number	Answer	Marks	Guidance
1	C	B1	1 is addition so 100%; 2 is 62.5/99
2	D	B1	K salts give H <sub>2</sub> at cathode; iodides give I <sub>2</sub> at anode
3	D	B1	Products are sodium and chlorine
4	C	B1	
5	B	B1	
6	D	B1	
7	B	B1	
8	A	B1	
9	B	B1	HCl does not reduce H <sub>2</sub> SO <sub>4</sub>
10	D	B1	Copper is plated on the cathode; no SO <sub>2</sub> is produced at all
11 (a) (i)	$\text{Cl}_2 + 2\text{Br}^- \rightarrow 2\text{Cl}^- + \text{Br}_2$	B1	Ignore state symbols
11 (a) (ii)	chlorine is a better oxidising agent than bromine OR bromide is a better oxidising agent than chloride	B1	
11 (b)	It is too dilute in 1.	B1	
11 (c) (i)	volatile or low boiling	B1	
11 (c) (ii)	brown or red	B1	Allow brown-red but no other colours
11 (d)	$\text{Br}_2 + \text{SO}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{HBr} + \text{H}_2\text{SO}_4$ .  Two bromine atoms go from zero to -1  so S must be oxidised from +4 to +6.	B1  B1  B1	Correct assignment of oxidation states without idea of 'two down, two up' scores one of last two marks.
11 (e)	negative: $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	B1	Allow halves or multiples

	positive: $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	B1	
11 (f) (i)	$\text{Cl}_2 + \text{H}_2\text{O} \rightleftharpoons \text{HCl} + \text{HClO}$ 0                      -1            +1  $\text{Cl}_2$ and HCl correct  HClO correct  $\text{Cl}_2$ / chlorine is both oxidised and reduced	 B1  B1  B1	
11 (f) (ii)	chloric(I) acid	B1	Allow gap between 'chloric' and '(I)' Ignore 'hypochlorous acid'
12 (a)	rate of forward reaction = rate of back reaction  Either 'closed system' <b>OR</b> 'concentrations of products and reactant are constant'	 B1  B1	
12 (b) (i)	$[\text{HCl}]^2/[\text{H}_2][\text{Cl}_2]$	B1	Ignore state symbols
12 (b) (ii)	(nearly) all product/HCl	B1	
12 (b) (iii)	<b>Level 3 (5–6 marks)</b> Candidate answers the question fully with all key points and three fine detail points  <i>The ideas are well structured providing significant clarity in the communication of the science</i>  <b>Level 2 (3–4 marks)</b> Candidate answers the question but without full detail by including all key points and at least one fine detail point.  <i>There is partial structuring of the ideas with the communication of the science generally clear</i>  <b>Level 1 (1–2 marks)</b> Candidate makes a reasonable attempt at the answer by giving 1 <sup>st</sup> , 3 <sup>rd</sup> and 5 <sup>th</sup> key points  <i>The ideas expressed are poorly structured and do not contribute to the communication of the science</i>	B1 × 6	<b>Key points</b> <ul style="list-style-type: none"> <li>• pressure – no effect</li> <li>• equal moles on each side</li> <li>• increased temp, some indication equm (posn) moves to left (or reverse for lowered temp)</li> <li>• forward reaction exothermic (stated or implied)</li> <li>• more <math>\text{H}_2</math>: some indication equm (posn) moves to right (or reverse for less <math>\text{H}_2</math>)</li> </ul> <b>Fine detail</b> <ul style="list-style-type: none"> <li>• reference to 'opposing change' [or Le Chatelier] for temp</li> <li>• use of Kc for more <math>\text{H}_2</math></li> <li>• increased temp, more reactants (or their names), less product/ HCl [subsumes third key point]</li> <li>• adding hydrogen: <math>[\text{H}_2]</math> and <math>[\text{HCl}]</math> greater, <math>[\text{Cl}_2]</math> less.</li> </ul>

	<b>Level 0 (0 marks)</b> No response or no response worthy of credit.		
13 (a)	Equilibrium (position) does not change	B1	
13 (b)	Dissolve contents of tube in water  Titrate with sodium thiosulfate  ....of known concentration  $\text{mass I}_2 = (0.5 \times \text{moles thiosulfate} \times 253.8) \text{ g}$	B1  B1  B1  B1	<b>ALLOW</b> 254 for 253.8
13 (c)	$[\text{HI}] = 161.15/127.9 (= 1.26)$  $[\text{H}_2] = 0.2/2 (= 0.1)$ <b>AND</b> $[\text{I}_2] = 25.38/253.8 (= 0.1)$  Use of $[\text{HI}]^2/[\text{H}_2][\text{I}_2]$  answer 159 ( $\pm 2$ )	B1  B1  B1  B1	<b>ALLOW</b> values of ten times these    <b>ALLOW</b> ecf from clear values above any units are CON
13 (d) (i)	potassium iodate(V)	B1	Ignore gaps
13 (d) (ii)	1. $n(\text{KIO}_3) = 20 \times 0.002/1000$ ( $= 4 \times 10^{-4}$ )  2. $n(\text{Na}_2\text{S}_2\text{O}_3) = 6 \times \text{ans to 1.}$  3. $\text{vol Na}_2\text{S}_2\text{O}_3$ $= \text{ans to 2} \times 1000/0.5 (= 4.8)$  4. answer to 3. to 3 sf with unit ( $4.80 \text{ cm}^3$ )	B1  B1  B1  B1	<b>ALLOW</b> ecf as shown
13 (d) (iii)	titre can be measured to $\pm 0.1$  larger percentage uncertainty for smaller titre  use more conc $\text{KIO}_3$ or more dilute thiosulfate	B1  B1  B1	<b>ALLOW</b> 'burette read to $\pm 0.05$ '