Marking scheme for AHL Worksheet – Chapter 9

1	**a**	+0.57 V	[1]
		Ni is the negative electrode	[1]
		electrons flow from Ni/Ni^{2+} to Cu/Cu^{2+} half cell	[1]
		$Cu^{2+}(aq) + Ni(s) \rightarrow Cu(s) + Ni^{2+}(aq)$	[1]
	b	+0.27 V	[1]
		$Br_2(Pt)$ is the negative electrode	[1]
		electrons flow from Br_2/Br^- to Cl_2/Cl^- half cell	[1]
		$Cl_2(g) + 2Br^-(aq) \rightarrow Br_2(l) + 2Cl^-(aq)$	[1]
	c	+0.93 V	[1]
		Pb is the negative electrode	[1]
		electrons flow from Pb/Pb^{2+} to Ag/Ag^+ half cell	[1]
		$2Ag^+(aq) + Pb(s) \rightarrow 2Ag(s) + Pb^{2+}(aq)$	[1]
	d	+2.09 V	[1]
		Zn is the negative electrode	[1]
		electrons flow from Zn/Zn^{2+} to $Cr_2O_7^{2-}/Cr^{3+}$ half cell	[1]
		$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 3Zn(s) \rightarrow 2Cr^{3+}(aq) + 7H_2O_{(l)} + 3Zn^{2+}(aq)$	[1]
2	**a**	spontaneous (cell potential +0.59 V)	[1]
		Cl_2 is the oxidising agent and Fe^{2+} the reducing agent	[1]
	b	not spontaneous (cell potential –0.27 V)	[1]
	c	not spontaneous (cell potential –0.15 V)	[1]
	d	spontaneous (cell potential +0.74 V)	[1]
		Fe^{2+} reducing agent and MnO_4^- oxidising agent	[1]
3	**a**	anode: iodine	[1]
		cathode: hydrogen	[1]
	b	anode: oxygen	[1]
		cathode: copper	[1]
	c	anode: chlorine	[1]
		cathode: hydrogen	[1]
	d	anode: oxygen	[1]
		cathode: hydrogen	[1]
	e	anode: oxygen	[1]
		cathode: hydrogen	[1]

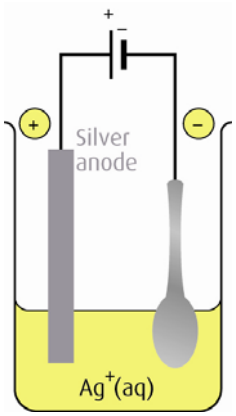
4 **a** cathode: $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ [1]

anode: $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$ [1]

b cathode: $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ [1]

anode: $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$ [1]

5



spoon as cathode [1]

silver anode [1]

electrolyte containing $Ag^+(aq)$ [1]

6 44.0 cm^3 of hydrogen produced [1]

twice as many electrons required to produce one mole of oxygen [1]

reference to the appropriate half equations [1]

7 number of moles of copper produced = $\frac{0.636}{63.55}$ = 0.0100 mol [1]

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ and $2H_2O(l) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$ [1]

number of moles of O_2 = 0.00500 mol [1]

volume of $O_2 = 0.00500 \times 22.4$ [1]

$= 0.112\ dm^3$ [1]