

AHL Worksheet – Chapter 9

- 1** Predict standard cell potentials for the following cells. Indicate which is the negative electrode. Give the direction of electron flow in the external circuit and write an overall equation for the reaction that occurs. [16]
- a** $\text{Ni}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Ni}(\text{s})$
 $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Cu}(\text{s})$
- b** $\text{Br}_2(\text{l}) + 2\text{e}^{-} \rightarrow 2\text{Br}^{-}(\text{aq})$
 $\text{Cl}_2(\text{g}) + 2\text{e}^{-} \rightarrow 2\text{Cl}^{-}(\text{aq})$
- c** $\text{Ag}^{+}(\text{aq}) + \text{e}^{-} \rightarrow \text{Ag}(\text{s})$
 $\text{Pb}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Pb}(\text{s})$
- d** $\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 14\text{H}^{+}(\text{aq}) + 6\text{e}^{-} \rightarrow 2\text{Cr}^{3+}(\text{aq}) + 7\text{H}_2\text{O}(\text{l})$
 $\text{Zn}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Zn}(\text{s})$
- 2** Use standard electrode potentials to predict whether the following reactions will be spontaneous. If the reaction is spontaneous, state the oxidising agent and the reducing agent. [6]
- a** $\text{Cl}_2(\text{g}) + 2\text{Fe}^{2+}(\text{aq}) \rightarrow 2\text{Cl}^{-}(\text{aq}) + 2\text{Fe}^{3+}(\text{aq})$
- b** $2\text{Cl}^{-}(\text{aq}) + \text{Br}_2(\text{l}) \rightarrow \text{Cl}_2(\text{g}) + 2\text{Br}^{-}(\text{aq})$
- c** $5\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 22\text{H}^{+}(\text{aq}) + 6\text{Mn}^{2+}(\text{aq}) \rightarrow 10\text{Cr}^{3+}(\text{aq}) + 11\text{H}_2\text{O}(\text{l}) + 6\text{MnO}_4^{-}(\text{aq})$
- d** $5\text{Fe}^{2+}(\text{aq}) + \text{MnO}_4^{-}(\text{aq}) + 8\text{H}^{+}(\text{aq}) \rightarrow 5\text{Fe}^{3+}(\text{aq}) + \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l})$
- 3** Predict the products at the anode and cathode when the following aqueous solutions are electrolysed using platinum electrodes. [10]
- a** sodium iodide solution
- b** copper nitrate solution
- c** concentrated magnesium chloride solution
- d** sodium hydroxide solution
- e** sodium sulfate solution
- 4** Write half equations for the reactions that occur at the electrodes when copper sulfate solution is electrolysed: [4]
- a** using copper electrodes
- b** using platinum electrodes
- 5** Draw a labelled diagram of the apparatus that could be used to plate a steel spoon with silver. [3]
- 6** When water containing a small amount of sulfuric acid is electrolysed for 30 minutes, 22.0 cm^3 of oxygen is produced. Predict, with reasons, the volume of hydrogen that is produced. [3]
- 7** When a copper nitrate solution is electrolysed for 1 hour using platinum electrodes, 0.636 g of copper is produced. Calculate the volume of oxygen produced measured at STP. [5]