

Core Worksheet – Chapter 9

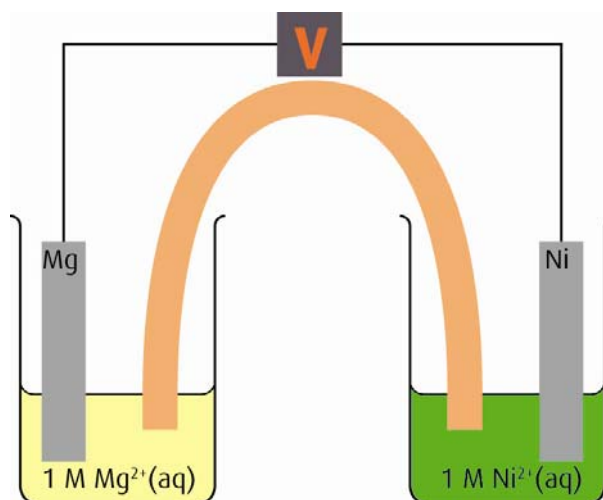
- 1 Work out the oxidation numbers for the element in bold in each of the following: [12]
- | | | | | | |
|---|--|---|--------------------------------------|---|--|
| a | CH ₄ | e | OF ₂ | i | NH ₃ |
| b | SO ₂ | f | KIO ₃ | j | Na ₂ Cr ₂ O ₇ |
| c | HClO | g | PO ₄ ³⁻ | k | MnO ₄ ⁻ |
| d | Na ₂ S O ₄ | h | NO ₂ ⁻ | l | VO ₂ ⁺ |
- 2 Define **oxidation** and **reduction** in terms of electrons. [2]
- 3 Complete the following equations by adding in the correct number of electrons and then state whether each half equation involves oxidation or reduction: [3]
- a $\text{O}_2 \rightarrow 2\text{O}^{2-}$
- b $\text{MnO}_4^- + 8\text{H}^+ \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$
- c $\text{Hg}_2^{2+} \rightarrow 2\text{Hg}^{2+}$
- 4 In each of the following state whether the element in bold has been oxidised or reduced: [4]
- a $6\text{Li} + \text{N}_2 \rightarrow 2\text{Li}_3\text{N}_2$
- b $\text{PbS} + 4\text{H}_2\text{O}_2 \rightarrow \text{PbSO}_4 + 4\text{H}_2\text{O}$
- c $8\text{HI} + \text{H}_2\text{SO}_4 \rightarrow \text{H}_2\text{S} + 4\text{H}_2\text{O} + 4\text{I}_2$
- d $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
- 5 In each of the following redox reactions identify the oxidising agent and the reducing agent: [4]
- a $\text{Cr}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Cr} + \text{Al}_2\text{O}_3$
- b $3\text{H}_2\text{S} + 2\text{HNO}_3 \rightarrow 4\text{H}_2\text{O} + 2\text{NO} + 3\text{S}$
- c $\text{ClO}_3^- + 3\text{SO}_3^{2-} \rightarrow \text{Cl}^- + 3\text{SO}_4^{2-}$
- d $2\text{NH}_3 + 3\text{CuO} \rightarrow \text{N}_2 + 3\text{H}_2\text{O} + 3\text{Cu}$
- 6 Balance the following half equations in acidic solution: [4]
- a $\text{U}^{4+} + \text{H}_2\text{O} \rightarrow \text{UO}_2^{2+} + \text{H}^+ + \text{e}^-$
- b $\text{O}_2 + \text{H}^+ + \text{e}^- \rightarrow \text{H}_2\text{O}_2$
- c $\text{XeO}_3 + \text{H}^+ + \text{e}^- \rightarrow \text{Xe} + \text{H}_2\text{O}$
- d $\text{HNO}_2 + \text{H}_2\text{O} \rightarrow \text{NO}_3^- + \text{H}^+ + \text{e}^-$
- 7 Balance the following half equations in acidic solution: [4]
- a $\text{Cr}_2\text{O}_7^{2-} \rightarrow \text{Cr}^{3+}$
- b $\text{HCOOH} \rightarrow \text{CO}_2$
- c $\text{HCHO} \rightarrow \text{HCOOH}$
- d $\text{H}_2\text{SO}_3 \rightarrow \text{S}_4\text{O}_6^{2-}$

8 Balance the following redox equations in acidic solution:

[4]

- a $\text{Fe}^{2+} + \text{MnO}_4^- + \text{H}^+ \rightarrow \text{Fe}^{3+} + \text{Mn}^{2+} + \text{H}_2\text{O}$
- b $\text{I}^- + \text{ClO}_3^- + \text{H}^+ \rightarrow \text{I}_2 + \text{Cl}_2 + \text{H}_2\text{O}$
- c $\text{MnO}_4^- + \text{H}^+ + \text{H}_2\text{O}_2 \rightarrow \text{Mn}^{2+} + \text{H}_2\text{O} + \text{O}_2$
- d $\text{NO}_2^- + \text{MnO}_4^- + \text{H}^+ \rightarrow \text{NO}_3^- + \text{Mn}^{2+} + \text{H}_2\text{O}$

9 The diagram shows a voltaic cell:



- a On the diagram label the following: [2]
anode cathode positive electrode negative electrode
- b Explain the function of the salt bridge. [2]
- c Indicate on the diagram the direction of electron flow in the external circuit. [1]
- d Indicate on the diagram the direction of flow of positive ions in the salt bridge. [1]
- e Explain whether the voltage will increase or decrease when the nickel half cell is replaced by a Cu/CuSO₄ half cell. [2]

10 The diagram shows the experimental set-up that could be used for the electrolysis of sodium chloride:

- a Explain why the sodium chloride must be heated. [2]
- b Label the anode, cathode and electrolyte on the diagram. [2]
- c Explain which products form at the anode and cathode. [4]
- d Write half equations for the formation of the products at the anode and cathode. [2]

