

# REDOX EQUILIBRIA PROBLEMS



Name ..... Form .....

You will need to refer to a copy of the electrochemical series to complete these questions.

- Write an equation for the reaction that would take place and calculate  $E_{\text{cell}}$  if the  $\text{Zn}^{2+}(\text{aq})/\text{Zn}(\text{s})$  and  $\text{Ni}^{2+}(\text{aq})/\text{Ni}(\text{s})$  half-cells were connected together.
- What reaction would take place if a piece of silver and copper was placed in a solution containing a mixture of silver nitrate and copper sulphate. Justify this using  $E_{\text{cell}}$  data.
- For each of the following questions, predict whether the reaction will take place or not in aqueous solution. Give clear reasons for your prediction. **If the reaction does occur**, write the representation of a standard cell in which the reaction would occur and determine the emf.
  - Will Mg reduce  $\text{V}^{3+}$  to  $\text{V}^{2+}$ ?
  - Will  $\text{Cl}^-$  reduce  $\text{Fe}^{3+}$  to  $\text{Fe}^{2+}$ ?
  - Will  $\text{Cl}_2$  oxidise  $\text{Br}^-$  to  $\text{Br}_2$ ?
  - Will Sn reduce  $\text{Fe}^{3+}$  to  $\text{Fe}^{2+}$ ?
  - Will  $\text{Cr}_2\text{O}_7^{2-}/\text{H}^+$  oxidise  $\text{Cl}^-$  to  $\text{Cl}_2$ ?
  - Will  $\text{MnO}_4^-/\text{H}^+$  oxidise  $\text{Cl}^-$  to  $\text{Cl}_2$ ?
  - Will  $\text{H}^+$  oxidise Fe to  $\text{Fe}^{2+}$ ?
  - Will  $\text{H}^+$  oxidise Cu to  $\text{Cu}^{2+}$ ?
- Which of the species  $\text{MnO}_4^-(\text{aq})$ ,  $\text{Cr}_2\text{O}_7^{2-}(\text{aq})$  and  $\text{Fe}^{3+}(\text{aq})$  are able to liberate  $\text{Cl}_2$  from an acidic solution of sodium chloride? Explain your reasoning.
- Calculate standard electrode potentials for the electrodes shown. Also, write an equation to show the reaction that takes place in the cell.
  - $\text{Be}^{2+}(\text{aq})/\text{Be}(\text{s})$      $\text{Be}(\text{s}) \mid \text{Be}^{2+}(\text{aq}) \parallel \text{Cu}^{2+}(\text{aq}) \mid \text{Cu}(\text{s})$      $E_{\text{cell}} = +2.19 \text{ V}$
  - $\text{Th}^{4+}(\text{aq})/\text{Th}(\text{s})$      $\text{Pt}(\text{s}) \mid \text{H}_2(\text{g}) \mid \text{H}^+(\text{aq}) \parallel \text{Th}^{4+}(\text{aq}) \mid \text{Th}(\text{s})$      $E_{\text{cell}} = -1.90 \text{ V}$
- For each of the following cells with the redox equilibria for each electrode shown:
  - Give the cell diagram.
  - Calculate the cell emf.
  - Write a balanced equation for the reaction that will take place in the cell.
  - $\text{Br}_2(\text{l}) + 2 \text{e}^- \rightleftharpoons 2 \text{Br}^-(\text{aq})$                        $2 \text{H}^+(\text{aq}) + 2 \text{e}^- \rightleftharpoons \frac{3}{4} \text{H}_2(\text{g})$
  - $\text{Cu}^{2+}(\text{aq}) + 2 \text{e}^- \rightleftharpoons \frac{3}{4} \text{Cu}(\text{s})$                        $\text{Fe}^{3+}(\text{aq}) + \text{e}^- \rightleftharpoons \frac{3}{4} \text{Fe}^{2+}(\text{aq})$