

## Electrochemistry

Q. Predict if a reaction will occur and write the reaction when:

- hydrogen gas is bubbled through a solution of copper nitrate.
- magnesium metal is placed in calcium nitrate solution.
- lithium metal is placed in water.
- aluminium metal is placed in an acid solution.

Q. A piece of aluminum metal is placed in a solution containing iron(II)nitrate.

- Identify all the oxidizing agents present.
- Identify all the reducing agents.
- Write down the overall equation.

Q. Given the  $E^\circ$  cell for the reaction  $\text{Cu(s)} + 2\text{H}^+(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{H}_2(\text{g})$  is  $-0.34\text{V}$ , find the equilibrium constant ( $K$ ) for the reaction.

Q. Given the following reaction determine  $\Delta G$ ,  $K$ , and  $E^\circ$  cell for the following reaction at standard conditions? Is this reaction spontaneous?



Q. Calculate  $E^\circ$  cell for the reaction  $\text{CH}_3\text{OH(l)} + 3/2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O(l)}$ . The values of  $\Delta G^\circ_f$  for  $\text{CH}_3\text{OH(l)}$ ,  $\text{CO}_2(\text{g})$  and  $\text{H}_2\text{O(l)}$  are  $-166$ ,  $-394$  and  $-237$  kJ/mol respectively. The balanced reduction half-reactions are:  $\text{H}_2\text{O} + \text{CH}_3\text{OH} \rightarrow \text{CO}_2 + 6\text{H}^+ + 6\text{e}^-$  and  $\text{O}_2 + 4\text{H}^+ + 4\text{e}^- \rightarrow 2\text{H}_2\text{O}$ . Also, find the value of  $E^\circ$  for the first half reaction.

Q. The overall reaction of the lead storage battery ( $E^\circ = 2.04$  V at  $25^\circ\text{C}$ ) is:



Calculate  $E$  for a newly purchased cell at  $25^\circ\text{C}$  where the concentration of  $\text{H}_2\text{SO}_4$  is  $4.5$  M.

**Q. A copper plating cell operates for 20.0 minutes with a steady current of 25.0A. What mass of copper is deposited. MM of copper is 63.54 g/mol?**

**Q. 60.0g of silver (MM = 107.87 g/mol) must be evenly deposited on a serving tray. The iron serving tray is placed in a silver plating cell with a steady current of 45.5A. How long should the tray be left in the cell for?**

**Q. An unknown metal which forms ions with a charge of 3+ ( $X^{3+}$ ) was deposited on a small key ring in an electrolytic cell. A steady current of 4.60A was used for 34.0 minutes and a mass of 1.815 grams was deposited on the key ring. Calculate the relative atomic mass of the element (X) and attempt to identify it.**