

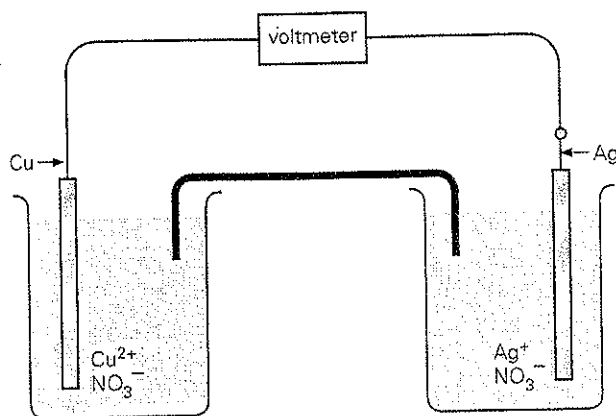
ELECTROCHEMISTRY PROBLEMS

Syllabus reference 9.2.4

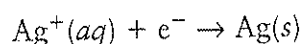
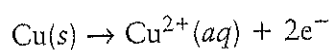
1 Check your understanding by completing the following.

- a A _____ cell is a device in which a chemical reaction occurs in such a way that it generates _____. Conversely, _____ cells use electrical energy to make _____ reactions occur. In either type of cell the electrode at which oxidation occurs is the _____ and the electrode at which reduction occurs is the _____.
- b In a galvanic cell the _____ reactions occur at different locations. The solution in a half cell is called an _____. The half cell solutions are connected by a _____ bridge which permits the passage of _____ between them. The positive ions or _____ flow towards the _____ while the _____ ions or anions flow towards the _____.
- c The conductors of a cell which get connected to the external circuit are called _____. Reduction occurs at the _____, the positively charged electrode while _____ occurs at the _____, the _____ charged electrode. Electrons flow via an external circuit from the _____ to the _____. The cell voltage is the difference between the _____ potential of the half cells.
- d There are many different types of galvanic cells in everyday use. The common dry cell, often referred to as a _____ cell, is used in torches and radios. Disadvantages of this cell are that it cannot be _____ and it may develop leaks when it goes flat. The _____ battery is used in cars and trucks and is rechargeable.

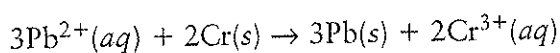
- 2 On the diagram below, given that Ag is the positive electrode, label the cathode, anode, direction of electron flow and salt bridge.



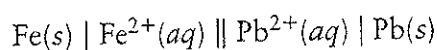
- 3 Given the following two half cell reactions, write the balanced overall reaction.



- 4 Given the overall cell reaction, write the two half cell reactions and identify the oxidation and reduction reactions.



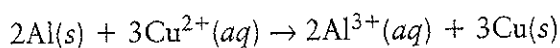
- 5 From the following shorthand representation identify the anode and cathode. Write the oxidation and reduction half-reactions given that Pb is positive.



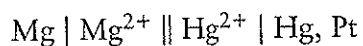
- 6 Write the half-reactions, the overall reaction and the shorthand representation for the following electrochemical cell.

One electrode consists of a piece of silver dipping into a silver nitrate solution. It is connected by a salt bridge to another electrode consisting of a piece of platinum dipping into a chloride solution with chlorine gas bubbling through the solution over the inert platinum electrode. The platinum is the positive electrode.

- 7 Draw a diagram of an electrochemical cell with the following overall reaction. Identify the anode, cathode, direction of electron flow, migration of ions, and write the half cell reactions.

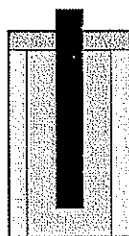


- 8 Draw a diagram of the electrochemical cell represented by:

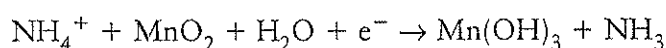
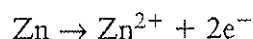


Use your knowledge of the reactivity of metals to determine which metal will reduce (displace) which metal ion. Hence write equations for the half-reactions and the overall reaction that occur in this cell. Indicate which electrode is positive and show the direction of electron flow and migration of ions. Identify the anode and cathode.

- 9 The ordinary dry cell is the most common and cheapest of the commercially available cells.
- a Complete the following diagram of a dry cell using the terms: zinc cylinder, NH_4Cl paste, MnO_2 , carbon rod, anode, cathode, positive terminal, negative terminal.



- b The half cell reactions are:

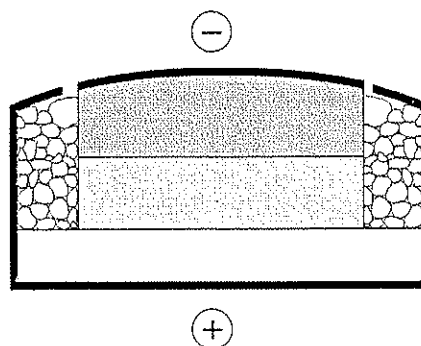


- i Identify the oxidation and reduction half-reactions.

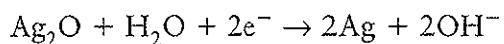
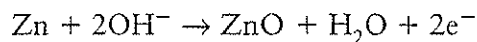
- ii Write the overall cell reaction.

- 10 The silver oxide cell is referred to as a 'button' cell.

- a Complete the following diagram using the terms: zinc + ZnO , insulating sealant, KOH , Ag_2O + Ag , anode, cathode, positive terminal, negative terminal.



b The half cell reactions are:



Write the overall cell reaction.

11 Use your textbook or a reference book to complete the following table.

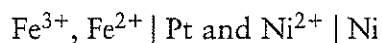
CELL TYPE	ANODE	CATHODE	USE	ADVANTAGES	DISADVANTAGES
Dry cell					
Silver oxide (button) cell					

12 Use the table of standard reduction potentials to answer the following.

a Rank the following in order of decreasing tendency to be reduced: Cu^{2+} , Sn^{2+} , Ba^{2+} , Ag^+ , Na^+ .

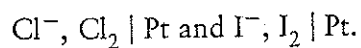
b Rank the following in decreasing tendency to be oxidised: Cr, Mg, Au, Pb.

13 Write down the cell reaction and E° for a galvanic cell composed of the half cells



(You will need to refer to the table of standard reduction potentials.)

- 14 Write the anode and cathode half cell equations and determine the EMF for the cell formed by linking the half cells



- 15 Write the half-reactions that make up the following overall reaction, then use a table of standard electrode potentials to decide whether or not the reaction occurs as written.

