Answers to Exercise 9.3
Electrochemical Cells: Components and Cell Notation

1. The half-reactions for an electrochemical cell are written below. There is a salt bridge connecting the two half-cells.

$$Co^{2+}_{(aq)} + 2e^- \rightarrow Co_{(s)}$$
$$Mn_{(s)} \rightarrow Mn^{2+}_{(aq)} + 2e^-$$

(a) Co

$Co^{2+}_{(aq)} + 2\,e^- \rightarrow Co_{(s)}$ is the reduction half reaction. The cathode is the electrode in the reduction half reaction.

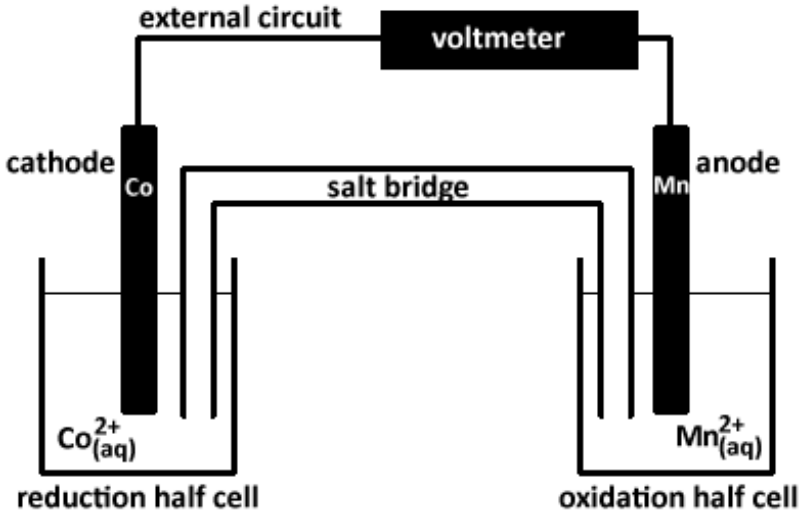
(b) Mn

$Mn_{(s)} \rightarrow Mn^{2+}_{(aq)} + 2\,e^-$ is the oxidation half reaction. The anode is the electrode in the oxidation half reaction.

(c) $Mn_{(s)}|Mn^{2+}_{(aq)} \,\|\, Co^{2+}_{(aq)}|Co_{(s)}$

*The oxidation half reaction is written on the left side of the salt bridge (the two vertical lines). The reduction half reaction is written on the right side of the salt bridge. A useful mnemonic device is "right red cat" – the **red**uction happens at the **cat**hode which is written on the **right** in cell notation.*

(d)



2. Consider the following cell:

$$Pt_{(s)}|Cr^{2+}_{(aq)}, Cr^{3+}_{(aq)} \,\|H^{+}_{(aq)}|H_{2(g)}|Pt_{(s)}$$

(a) $2\ Cr^{2+}_{(aq)} + 2\ H^{+}_{(aq)} \rightarrow 2\ Cr^{3+}_{(aq)} + H_{2(g)}$

The half reactions are:

$Cr^{2+}_{(aq)} \rightarrow 2\ Cr^{3+}_{(aq)} + e^{-}$ *(oxidation)*

$2\ H^{+}_{(aq)} + 2\ e^{-} \rightarrow H_{2(g)}$ *(reduction)*

(b)