ELECTROCHEMISTRY (B)

Solutions containing Fe^{3+} can be reduced to Fe^{2+} using zinc.

Half cells for the following redox half equations were connected using a wire and salt bridge under standard conditions. The Fe^{3+}/Fe^{2+} half cell also contained a piece of platinum.

$$Zn^{2+}(aq) + 2e^- \rightleftharpoons Zn(s) \qquad E^\circ = -0.76\ V$$
$$Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(aq) \qquad E^\circ = +0.77\ V$$

a Write the standard cell notation (cell representation) for this cell.

$Zn(s)\ |\ Zn^{2+}(aq)\ ||\ Fe^{3+}(aq), Fe^{2+}(aq)\ |\ Pt(s)$ (2)

b Calculate the emf of this cell. **+1.53 V** (1)

c What was the role of the platinum in the Fe^{3+}/Fe^{2+} half cell? **to provide a surface for electron transfer** (1)

d What was the role of the salt bridge in this cell and how does it work?

to complete the circuit; inert ions move through the salt bridge (2)

e Write a balanced equation for the reaction that takes place in this cell. **$Zn + 2Fe^{3+} \rightarrow Zn^{2+} + 2Fe^{2+}$** (2)

f The Fe^{3+}/Fe^{2+} half cell contained a mixture of iron(III) sulfate and iron(II) sulfate. Give the concentration of each reagent in the mixture for this to be done under standard conditions.

iron(III) sulfate **0.5 mol dm^{-3} $Fe_2(SO_4)_3$**

iron(II) sulfate **1.0 mol dm^{-3} $FeSO_4$** (2)

g If the concentration of Zn^{2+} ions was changed from 1.0 mol dm^{-3} to 0.5 mol dm^{-3}, how would this affect the emf of the cell. Explain your answer.

Zn^{2+}/Zn equilibrium moves left
releasing more electrons so making Zn^{2+}/Zn potential more negative
making emf greater (3)