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.

\[
\begin{align*}
\text{Zn}^{2+}(aq) & \to \text{Zn(s)} \quad E^\circ = -0.76 \text{ V} \\
\text{Fe}^{3+}(aq) & \to \text{Fe}^{2+}(aq) \quad E^\circ = +0.77 \text{ V}
\end{align*}
\]

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

\[
\text{Zn(s)} \mid \text{Zn}^{2+}(aq) \mid \text{Fe}^{3+}(aq), \text{Fe}^{2+}(aq) \mid \text{Pt}(s)
\]

b Calculate the emf of this cell. \(+1.53 \text{ V}\)

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

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

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

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 \(0.5 \text{ mol dm}^{-3} \text{Fe}_2(\text{SO}_4)_3\)
- iron(II) sulfate \(1.0 \text{ mol dm}^{-3} \text{FeSO}_4\)

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