DEMONSTRATION 6.5
IRON(II) SULFATE AND POTASSIUM PERMANGANATE

Green iron(II) sulfate solution is oxidised by a purple potassium permanganate solution, to give a colourless solution of iron(III) and manganese(II).

EQUIPMENT
- 100 mL measuring cylinder
- 2 L conical flask
- long glass rod
- light box

REAGENTS
- potassium permanganate, KMnO$_4$ (a few crystals)
- iron(II) ammonium sulfate-6-water, (NH$_4$)$_2$Fe(SO$_4$)$_2$·6H$_2$O (50 g)
- sulfuric acid, H$_2$SO$_4$ (2 M, 100 mL)
- distilled water

PREPARATION
- Dissolve 50 g iron(II) ammonium sulfate-6-water in 100 mL of 2 M sulfuric acid.
- Set up the light box.
- Fill the conical flask with water and add crystals of potassium permanganate, sufficient to produce a solution which is strongly coloured without being opaque.
- Provide measuring cylinder and stirring rod.

PROCEDURE
- Add 100 mL of the iron(II) sulfate solution to the potassium permanganate solution.
- Stir.

RESULTS
Permanganate is reduced to Mn(II) and Fe(II) is oxidised to Fe(III).

The reactions are:

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\begin{align*}
\text{Fe}^{2+}(aq) & \rightarrow \text{Fe}^{3+}(aq) + e^- & E^\circ = -0.77 \text{ V} \\
\text{MnO}_4^- (aq) + 8\text{H}^+(aq) + 5e^- & \rightarrow \text{Mn}^{2+}(aq) + 4\text{H}_2\text{O}(l) & E^\circ = +1.51 \text{ V} \\
\end{align*}
\]

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\begin{align*}
\text{MnO}_4^- (aq) + 8\text{H}^+(aq) + 5\text{Fe}^{2+}(aq) & \rightarrow \text{Mn}^{2+}(aq) + 5\text{Fe}^{3+}(aq) + 4\text{H}_2\text{O}(l) & E^{\circ}_{\text{cell}} = +0.74 \text{ V}
\end{align*}
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