Student 2: High Merit

NZQA Intended for teacher use only

When fresh iron(II) sulfate solution is added to acidified potassium permanganate solution, a pale green solution and a purple solution react to form an orange solution.

Justify why this is an oxidation-reduction reaction. Your answer should include:

- Species linked to the provided observations
- An explanation of oxidation and reduction in terms of electron transfer or oxidation number change
- Balanced half and full equations

Answer:

(2) The purple potassium permanganate changes to colourless Mn^{2+}.

(1) Each MnO_4^- gains five electrons, so the MnO_4^- is reduced.

(3) $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$

(2) The pale green Fe^{2+} changes to orange Fe^{3+}.

(1) Each Fe^{2+} loses one electron, so the Fe^{2+} is oxidised.

(3) $Fe^{2+} \rightarrow Fe^{3+} + e^-$ (x 5)

The overall balanced equation for the redox reaction is:

(4) $MnO_4^- + 8H^+ + 5Fe^{2+} \rightarrow Mn^{2+} + 4H_2O + Fe^{3+}$