2024 Higher Chemistry Paper 1 – Q4

Step 1 — Use the half-equations given

Oxidation: $2\ I^-(aq) \rightarrow I_2(aq) + 2\ e^-$

Reduction: $MnO_4^-(aq) + 8\ H^+(aq) + 5\ e^- \rightarrow Mn^{2+}(aq) + 4\ H_2O(l)$
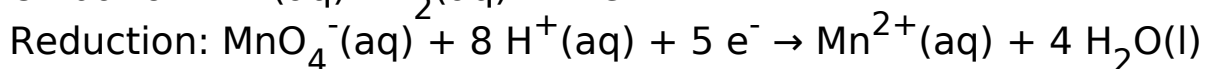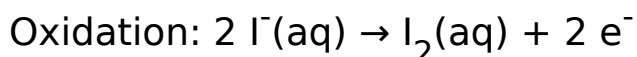
Step 2 — Balance electrons between the two halves

• One MnO_4^- needs 5 electrons.

• The iodide oxidation produces 1 electron per iodide (since $2\ I^- \rightarrow 2\ e^-$), so you need $5\ I^-$ to supply $5\ e^-$ to one MnO_4^-.

Step 3 — Eliminate distractors

• 1 or $2\ I^-$ would not provide enough electrons.

• $10\ I^-$ would provide too many for one permanganate (that would match two permanganate ions).

• $5\ I^-$ is the only value that provides exactly the required $5\ e^-$.

Final Answer: C — 5

Reason: In acidic solution, MnO_4^- gains $5\ e^-$ to become Mn^{2+}. Each iodide donates $1\ e^-$ when forming I_2. Therefore, one mole of permanganate oxidises five moles of iodide.