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.