

QUESTIONS on Oxidation Reduction Equations

Oxidation involves an increase in oxidation number (state)

Reduction involves a decrease in oxidation number (state)

Set 1:

Q1. Which of the following equations are oxidation–reduction reactions and which are not? Explain your decisions.

- A. $\text{Zn(s)} + 2 \text{MnO}_2\text{(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Zn(OH)}_2\text{(s)} + \text{Mn}_2\text{O}_3\text{(s)}$
- B. $\text{HCl(aq)} + \text{NaOH(aq)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$
- C. $\text{CH}_4\text{(g)} + 2 \text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)} + 2 \text{H}_2\text{O(g)}$
- D. $\text{Na(s)} + \text{Fe}_2\text{O}_3\text{(s)} \rightarrow \text{Na}_2\text{O(s)} + \text{Fe(s)}$
- E. $\text{Ag}^+\text{(aq)} + \text{I}^-\text{(aq)} \rightarrow \text{AgI(s)}$
- F. $\text{HNO}_3\text{(aq)} + \text{H}_3\text{AsO}_3\text{(aq)} \rightarrow \text{NO(g)} + \text{H}_3\text{AsO}_4\text{(aq)} + \text{H}_2\text{O(l)}$
- G. $2\text{Cu}^{2+}\text{(aq)} + 4 \text{I}^-\text{(aq)} \rightarrow 2 \text{CuI(s)} + \text{I}_2\text{(s)}$
- H. $\text{CaCO}_3\text{(s)} + 2\text{H}^+\text{(aq)} \rightarrow \text{Ca}^{2+}\text{(aq)} + \text{CO}_2\text{(g)} + \text{H}_2\text{O(l)}$
- I. $\text{SO}_2\text{(g)} + 2\text{H}_2\text{S(g)} \rightarrow 2\text{H}_2\text{O(l)} + 3\text{S(s)}$
- J. $\text{H}^+\text{(aq)} + \text{OH}^-\text{(aq)} \rightarrow \text{H}_2\text{O(l)}$
- K. $\text{Ca(OH)}_2\text{(aq)} + \text{CO}_2\text{(g)} \rightarrow \text{CaCO}_3\text{(s)} + \text{H}_2\text{O(l)}$
- L. $3\text{SO}_2\text{(g)} + \text{Cr}_2\text{O}_7^{2-}\text{(aq)} + 2\text{H}^+\text{(aq)} \rightarrow 3\text{SO}_4^{2-}\text{(aq)} + 2\text{Cr}^{3+}\text{(aq)} + \text{H}_2\text{O(l)}$
- M. $\text{BaO(s)} + \text{SO}_2\text{(g)} \rightarrow \text{BaSO}_3\text{(s)}$
- N. $\text{SO}_2\text{(g)} + 2\text{NO}_3^-\text{(aq)} \rightarrow \text{SO}_4^{2-}\text{(aq)} + 2\text{NO}_2\text{(g)}$
- O. $2\text{NaHCO}_3\text{(s)} \rightarrow \text{Na}_2\text{CO}_3\text{(s)} + \text{CO}_2\text{(g)} + \text{H}_2\text{O(l)}$
- P. $2\text{Mg(s)} + \text{SO}_2\text{(g)} \rightarrow 2\text{MgO(s)} + \text{S(s)}$
- Q. $\text{MnO}_4^-\text{(aq)} + 5\text{Fe}^{2+}\text{(aq)} + 8\text{H}^+\text{(aq)} \rightarrow \text{Mn}^{2+}\text{(aq)} + 5\text{Fe}^{3+}\text{(aq)} + 4\text{H}_2\text{O(l)}$

Q2. Which of these half-reactions represent oxidation and which reduction? Explain your reasoning.

- A. $\text{Fe(s)} \rightarrow \text{Fe}^{2+}\text{(aq)} + 2 \text{e}^-$
- B. $\text{Ni}^{4+}\text{(aq)} + 2 \text{e}^- \rightarrow \text{Ni}^{2+}\text{(aq)}$
- C. $2 \text{H}_2\text{O(l)} + 2 \text{e}^- \rightarrow \text{H}_2\text{(g)} + 2 \text{OH}^-\text{(aq)}$
- D. $\text{Cu(s)} \rightarrow \text{Cu}^{2+}\text{(aq)} + 2 \text{e}^-$
- E. $\text{Pb}^{2+}\text{(aq)} + 2\text{e}^- \rightarrow \text{Pb(s)}$
- F. $\text{Cl}_2\text{(g)} + 2 \text{e}^- \rightarrow 2 \text{Cl}^-\text{(aq)}$
- G. $\text{Cr}^{3+}\text{(aq)} + 3\text{e}^- \rightarrow \text{Cr(s)}$
- H. $\text{Cr}_2\text{O}_7^{2-}\text{(aq)} + 14 \text{H}^+\text{(aq)} + 6 \text{e}^- \rightarrow 2 \text{Cr}^{3+}\text{(aq)} + 7 \text{H}_2\text{O(l)}$

Q3. How many electrons are in the following $\frac{1}{2}$ equations

- A. $\text{Al} \rightarrow \text{Al}^{3+} + ? \text{e}^-$
- B. $\text{MnO}_4^- + 8 \text{H}^+ + ? \text{e}^- \rightarrow \text{Mn}^{2+}\text{(aq)} + 4 \text{H}_2\text{O(l)}$
- C. $\text{H}_2\text{O}_2 \rightarrow 2 \text{H}^+ + \text{O}_2 + ? \text{e}^-$
- D. $\text{H}_2\text{O}_2 + ? \text{e}^- \rightarrow 2 \text{OH}^-$
- E. $\text{S}_8 + ? \text{e}^- \rightarrow 8 \text{S}^{2-}$
- F. $\text{NO}_3^- + 2 \text{H}^+ + ? \text{e}^- \rightarrow \text{NO}_2 + \text{H}_2\text{O}$

Q4. Identify the reducing agent (reductant) in the following reactions.

- A. $2 \text{Cr}^{3+} + \text{H}_2\text{O} + 6 \text{ClO}_3^- \rightarrow \text{Cr}_2\text{O}_7^{2-} + 6 \text{ClO}_2 + 2 \text{H}^+$
- B. $\text{Cr}_2\text{O}_7^{2-} + \text{HCHO} \rightarrow \text{HCOOH} + \text{Cr}^{3+}$
- C. $7 \text{CN}^- + 2 \text{OH}^- + 2 \text{Cu(NH}_3)_4^{2+} \rightarrow 2 \text{Cu(CN)}_3^{2-} + 8 \text{NH}_3 + \text{CNO}^- + \text{H}_2\text{O}$
- D. $2 \text{Li} + 2 \text{H}_2\text{O} \rightarrow 2 \text{LiOH} + \text{H}_2$
- E. $\text{Cl}_2 + 2 \text{KI} \rightarrow 2 \text{KCl} + \text{I}_2$
- F. $\text{SO}_2 + 2\text{H}_2\text{S} \rightarrow 2\text{H}_2\text{O} + 3\text{S}$

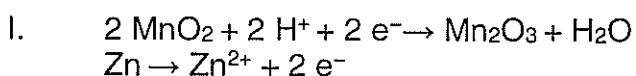
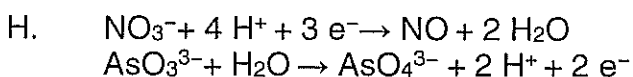
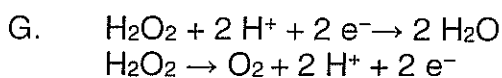
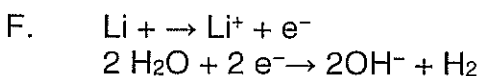
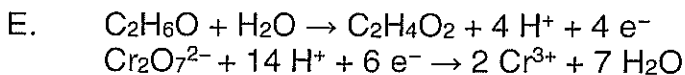
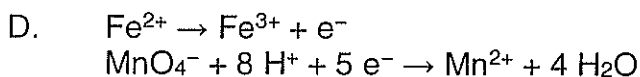
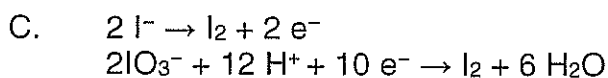
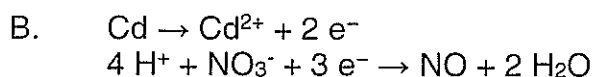
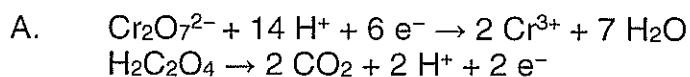
Q5. Identify the oxidising agent (oxidant) in the following reactions.

- A. $\text{Ni} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{Ni}(\text{NO}_3)_2(\text{aq}) + \text{Pb}(\text{s})$
- B. $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
- C. $\text{Cr}_2\text{O}_3 + \text{Al} \rightarrow \text{Cr} + \text{Al}_2\text{O}_3$
- D. $\text{FeO} + \text{H}_2 \rightarrow \text{Fe} + \text{H}_2\text{O}$
- E. $\text{MnO}_4^- + 5\text{Fe}^{2+} + 8\text{H}^+ \rightarrow \text{Mn}^{2+} + 5\text{Fe}^{3+} + 4\text{H}_2\text{O}$
- F. $2\text{Cu}^{2+} + 4\text{I}^- \rightarrow 2\text{CuI} + \text{I}_2$

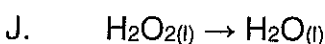
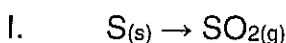
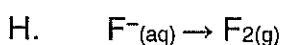
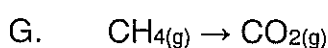
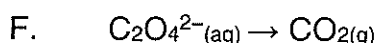
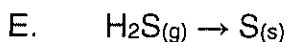
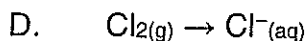
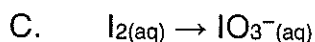
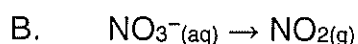
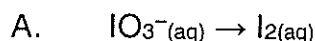
Q6. Write the full oxidation-reduction equation from the following two half-reactions:

number of e⁻s lost = number of e⁻s gained

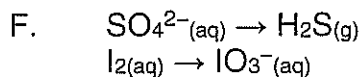
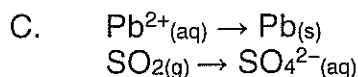
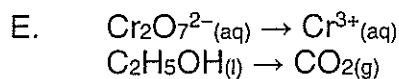
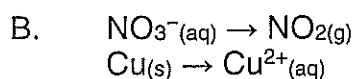
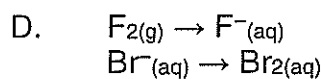
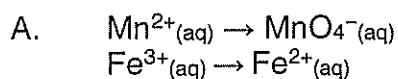
- Since charge is conserved, one or both $\frac{1}{2}$ equations may need to be multiplied by an integer so that number of e⁻s lost = number of e⁻s gained.
- Like terms such as H⁺ ions and H₂O molecules may need to be collected if they appear on both sides of the equation



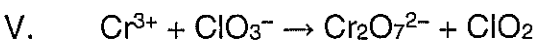
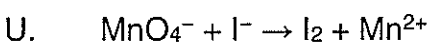
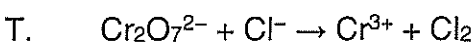
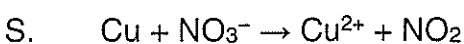
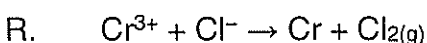
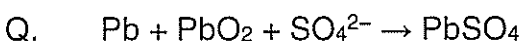
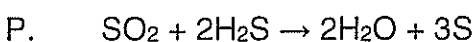
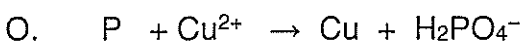
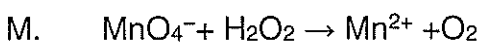
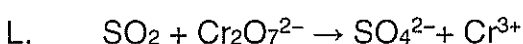
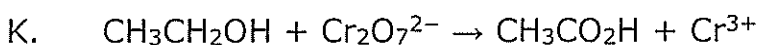
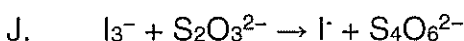
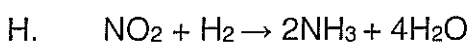
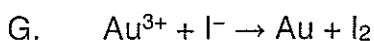
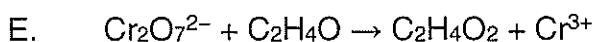
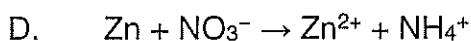
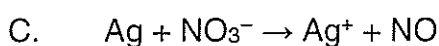
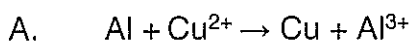
Q7. Balance each of the following ionic half-equations

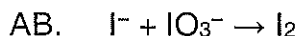
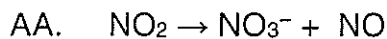
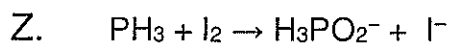
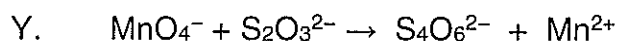
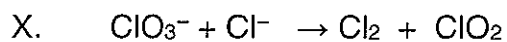
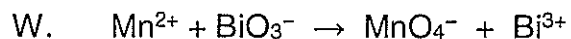


Q8. Balance the following pairs of ionic equations and then write the overall net ionic equation.



Q9. Balance the following equations





Q10. For each of the following reactions, write the two ionic half-equations involved in the process, the overall equation, the oxidizing agent (oxidant) and the reducing agent (reductant).

- A. Zinc reacting with hydrogen ions to produce zinc ions and hydrogen gas.
- B. The sulfide ion reacting with iodine to produce sulfur and iodide ions.
- C. Silver ions reacting with copper metal to produce silver metal and copper ions.
- D. The silver ion oxidizing zinc metal.
- E. Fluorine gas reacting with chloride ions to produce chlorine gas and fluoride ions.
- F. Iron metal reacting with bromine to produce iron(II) ions and bromide ions.
- G. Hydrogen ions reacting with magnesium metal.
- H. Iodide ions reacting with iron(III) ions to give iodine and iron(II) ions.

- Q9. A. $\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^-$] x 2
 $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$] x 3
 $2\text{Al} + 3\text{Cu}^{2+} \rightarrow 2\text{Al}^{3+} + 3\text{Cu}$ check that the charges are balanced
- B. $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$] x 2
 $\text{NO}_2^- + \text{H}_2\text{O} \rightarrow \text{NO}_3^- + 2\text{H}^+ + 2\text{e}^-$] x 5
 $2\text{MnO}_4^- + 6\text{H}^+ + 5\text{NO}_2^- \rightarrow 2\text{Mn}^{2+} + 5\text{NO}_3^- + 3\text{H}_2\text{O}$ collect like terms (H_2O and H^+)
- C. $\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$] x 3
 $\text{NO}_3^- + 4\text{H}^+ + 3\text{e}^- \rightarrow \text{NO} + 2\text{H}_2\text{O}$
 $3\text{Ag} + \text{NO}_3^- + 4\text{H}^+ \rightarrow 3\text{Ag}^+ + \text{NO} + 2\text{H}_2\text{O}$ check that the charges are balanced
- D. $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$] x 4
 $\text{NO}_3^- + 10\text{H}^+ + 8\text{e}^- \rightarrow \text{NH}_4^+ + 3\text{H}_2\text{O}$
 $4\text{Zn} + \text{NO}_3^- + 10\text{H}^+ \rightarrow 4\text{Zn}^{2+} + \text{NH}_4^+ + 3\text{H}_2\text{O}$ check that the charges are balanced
- E. $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$
 $\text{C}_2\text{H}_4\text{O} + \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_4\text{O}_2 + 2\text{H}^+ + 2\text{e}^-$] x 3
 $\text{Cr}_2\text{O}_7^{2-} + 8\text{H}^+ + 3\text{C}_2\text{H}_4\text{O} \rightarrow 2\text{Cr}^{3+} + 3\text{C}_2\text{H}_4\text{O}_2 + 4\text{H}_2\text{O}$ collect like terms (H_2O and H^+)
- F. $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$] x 2
 $\text{H}_2\text{C}_2\text{O}_4 \rightarrow 2\text{CO}_2 + 2\text{H}^+ + 2\text{e}^-$] x 5
 $2\text{MnO}_4^- + 6\text{H}^+ + 5\text{H}_2\text{C}_2\text{O}_4 \rightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 10\text{CO}_2$ collect like terms (H_2O and H^+)
- G. $2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^-$] x 3
 $\text{Au}^{3+} + 3\text{e}^- \rightarrow \text{Au}$] x 2
 $2\text{Au}^{3+} + 6\text{I}^- \rightarrow 2\text{Au} + 3\text{I}_2$ check that the charges are balanced
- H. $2\text{NO}_2 + 14\text{H}^+ + 14\text{e}^- \rightarrow 2\text{NH}_3 + 4\text{H}_2\text{O}$
 $\text{H}_2\text{O} + \text{H}_2 \rightarrow \text{H}_2\text{O} + 2\text{H}^+ + 2\text{e}^-$] x 7
 $2\text{NO}_2 + 7\text{H}_2 \rightarrow 2\text{NH}_3 + 11\text{H}_2\text{O}$ collect like terms (H_2O and H^+)
- I. $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$
 $\text{NO}_2^- + \text{H}_2\text{O} \rightarrow \text{NO}_3^- + 2\text{H}^+ + 2\text{e}^-$] x 3
 $\text{Cr}_2\text{O}_7^{2-} + 8\text{H}^+ + 3\text{NO}_2^- \rightarrow 2\text{Cr}^{3+} + 4\text{H}_2\text{O} + 3\text{NO}_3^-$ collect like terms (H_2O and H^+)
- J. $\text{I}_3^- + 2\text{e}^- \rightarrow 3\text{I}^-$
 $2\text{S}_2\text{O}_3^{2-} \rightarrow \text{S}_4\text{O}_6^{2-} + 2\text{e}^-$
 $\text{I}_3^- + 2\text{S}_2\text{O}_3^{2-} \rightarrow 3\text{I}^- + \text{S}_4\text{O}_6^{2-}$ check that the charges are balanced
- K. $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$] x 2
 $\text{CH}_3\text{CH}_2\text{OH} + \text{H}_2\text{O} \rightarrow \text{CH}_3\text{CO}_2\text{H} + 4\text{H}^+ + 4\text{e}^-$] x 3
 $2\text{Cr}_2\text{O}_7^{2-} + 16\text{H}^+ + 3\text{CH}_3\text{CH}_2\text{OH} \rightarrow 4\text{Cr}^{3+} + 3\text{CH}_3\text{CO}_2\text{H} + 11\text{H}_2\text{O}$
- L. $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$
 $\text{SO}_2 + 2\text{H}_2\text{O} \rightarrow \text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^-$] x 3
 $3\text{SO}_2 + \text{Cr}_2\text{O}_7^{2-} + 2\text{H}^+ \rightarrow 2\text{Cr}^{3+} + \text{H}_2\text{O} + 3\text{SO}_4^{2-}$ collect like terms (H_2O and H^+)
- M. $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$] x 2
 $\text{H}_2\text{O}_2 \rightarrow \text{O}_2 + 2\text{H}^+ + 2\text{e}^-$] x 5
 $2\text{MnO}_4^- + 6\text{H}^+ + 5\text{H}_2\text{O}_2 \rightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 5\text{O}_2$ collect the H^+ ions
- N. $2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^-$
 $\text{OCl}^- + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{Cl}^- + \text{H}_2\text{O}$
 $\text{OCl}^- + 2\text{H}^+ + 2\text{I}^- \rightarrow \text{Cl}^- + \text{H}_2\text{O} + \text{I}_2$ check that the charges are balanced
- O. $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$] x 5
 $\text{P} + 4\text{H}_2\text{O} \rightarrow \text{H}_2\text{PO}_4^- + 6\text{H}^+ + 5\text{e}^-$] x 2
 $2\text{P} + 8\text{H}_2\text{O} + 5\text{Cu}^{2+} \rightarrow 2\text{H}_2\text{PO}_4^- + 12\text{H}^+ + 5\text{Cu}$ check that the charges are balanced
- P. $\text{SO}_2 + 4\text{H}^+ + 4\text{e}^- \rightarrow \text{S} + 2\text{H}_2\text{O}$
 $\text{H}_2\text{S} \rightarrow \text{S} + 2\text{H}^+ + 2\text{e}^-$] x 2
 $\text{SO}_2 + 2\text{H}_2\text{S} \rightarrow 2\text{H}_2\text{O} + 3\text{S}$ collect the H^+ ions and the S atoms
- Q. $\text{Pb} + \text{SO}_4^{2-} \rightarrow \text{PbSO}_4 + 2\text{e}^-$
 $\text{PbO}_2 + \text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^- \rightarrow \text{PbSO}_4 + 2\text{H}_2\text{O}$
 $\text{Pb} + \text{PbO}_2 + 2\text{SO}_4^{2-} + 4\text{H}^+ \rightarrow 2\text{PbSO}_4 + 2\text{H}_2\text{O}$ collect the PbSO_4
- R. $\text{Cr}^{3+} + 3\text{e}^- \rightarrow \text{Cr}$] x 2
 $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$] x 3
 $2\text{Cr}^{3+} + 6\text{Cl}^- \rightarrow 2\text{Cr} + 3\text{Cl}_2$ check that the charges are balanced
- S. $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
 $\text{NO}_3^- + 2\text{H}^+ + \text{e}^- \rightarrow \text{NO}_2 + \text{H}_2\text{O}$] x 2
 $\text{Cu} + 2\text{NO}_3^- + 4\text{H}^+ \rightarrow \text{Cu}^{2+} + 2\text{NO}_2 + 2\text{H}_2\text{O}$ check that the charges are balanced

T.	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^- \quad] \times 3$ $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$ $\text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{Cl}^- \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O} + 3\text{Cl}_2$	check that the charges are balanced
U.	$2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^- \quad] \times 5$ $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O} \quad] \times 2$ $2\text{MnO}_4^- + 16\text{H}^+ + 10\text{I}^- \rightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 5\text{I}_2$	check that the charges are balanced
V.	$2\text{Cr}^{3+} + 7\text{H}_2\text{O} \rightarrow \text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ + 6\text{e}^-$ $\text{ClO}_3^- + 2\text{H}^+ + \text{e}^- \rightarrow \text{ClO}_2 + \text{H}_2\text{O} \quad] \times 6$ $2\text{Cr}^{3+} + \text{H}_2\text{O} + 6\text{ClO}_3^- \rightarrow \text{Cr}_2\text{O}_7^{2-} + 6\text{ClO}_2 + 2\text{H}^+$	collect like terms (H_2O and H^+)
W.	$\text{BiO}_3^- + 6\text{H}^+ + 2\text{e}^- \rightarrow \text{Bi}^{3+} + 3\text{H}_2\text{O}$ $\text{Mn}^{2+} + 4\text{H}_2\text{O} \rightarrow \text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^-$ $\text{Mn}^{2+} + \text{H}_2\text{O} + \text{BiO}_3^- \rightarrow \text{MnO}_4^- + 2\text{H}^+ + \text{Bi}^{3+}$	check that the charges are balanced
X.	$\text{ClO}_3^- + 2\text{H}^+ + \text{e}^- \rightarrow \text{ClO}_2 + \text{H}_2\text{O} \quad] \times 2$ $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ $2\text{ClO}_3^- + 4\text{H}^+ + 2\text{Cl}^- \rightarrow 2\text{ClO}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$	check that the charges are balanced
Y.	$2\text{S}_2\text{O}_3^{2-} \rightarrow \text{S}_4\text{O}_6^{2-} + 2\text{e}^- \quad] \times 5$ $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O} \quad] \times 2$ $2\text{MnO}_4^- + 16\text{H}^+ + 10\text{S}_2\text{O}_3^{2-} \rightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 5\text{S}_4\text{O}_6^{2-}$	
Z.	$\text{PH}_3 + 2\text{H}_2\text{O} \rightarrow \text{H}_3\text{PO}_2^- + 4\text{H}^+ + 3\text{e}^- \quad] \times 2$ $\text{I}_2 + 2\text{e}^- \rightarrow 2\text{I}^- \quad] \times 3$ $2\text{PH}_3 + 4\text{H}_2\text{O} + 3\text{I}_2 \rightarrow 2\text{H}_3\text{PO}_2^- + 8\text{H}^+ + 6\text{I}^-$	check that the charges are balanced
AA.	$\text{NO}_2 + \text{H}_2\text{O} \rightarrow \text{NO}_3^- + 2\text{H}^+ + \text{e}^- \quad] \times 2$ $\text{NO}_2 + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{NO} + \text{H}_2\text{O}$ $3\text{NO}_2 + \text{H}_2\text{O} \rightarrow 2\text{NO}_3^- + \text{NO} + 2\text{H}^+$	collect like terms (H_2O and H^+)
AB.	$2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^- \quad] \times 5$ $2\text{IO}_3^- + 12\text{H}^+ + 10\text{e}^- \rightarrow \text{I}_2 + 6\text{H}_2\text{O}$ $2\text{IO}_3^- + 12\text{H}^+ + 10\text{I}^- \rightarrow 5\text{I}_2 + \text{I}_2 + 6\text{H}_2\text{O}$ $2\text{IO}_3^- + 12\text{H}^+ + 10\text{I}^- \rightarrow 6\text{I}_2 + 6\text{H}_2\text{O} \quad]$ $\text{IO}_3^- + 6\text{H}^+ + 5\text{I}^- \rightarrow 3\text{I}_2 + 3\text{H}_2\text{O}$	collect the I_2 molecules $\div 2$ to get the smallest coefficients check that the charges are balanced
Q10.	<p>A.</p> $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^- \quad \text{oxidation } \frac{1}{2} \text{ equation}$ $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2 \quad \text{reduction } \frac{1}{2} \text{ equation}$ $\text{Zn} + 2\text{H}^+ \rightarrow \text{Zn}^{2+} + \text{H}_2 \quad \text{overall equation}$ <p>B.</p> $\text{S}^{2-} \rightarrow \text{S} + 2\text{e}^- \quad \text{oxidation } \frac{1}{2} \text{ equation}$ $\text{I}_2 + 2\text{e}^- \rightarrow 2\text{I}^- \quad \text{reduction } \frac{1}{2} \text{ equation}$ $\text{S}^{2-} + \text{I}_2 \rightarrow \text{S} + 2\text{I}^- \quad \text{overall equation}$ <p>C.</p> $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^- \quad \text{oxidation } \frac{1}{2} \text{ equation}$ $2\text{Ag}^+ + 2\text{e}^- \rightarrow 2\text{Ag} \quad \text{reduction } \frac{1}{2} \text{ equation}$ $\text{Cu} + 2\text{Ag}^+ \rightarrow \text{Cu}^{2+} + 2\text{Ag} \quad \text{overall equation}$ <p>D.</p> $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^- \quad \text{oxidation } \frac{1}{2} \text{ equation}$ $2\text{Ag}^+ + 2\text{e}^- \rightarrow 2\text{Ag} \quad \text{reduction } \frac{1}{2} \text{ equation}$ $\text{Zn} + 2\text{Ag}^+ \rightarrow \text{Zn}^{2+} + 2\text{Ag} \quad \text{overall equation}$ <p>E.</p> $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^- \quad \text{oxidation } \frac{1}{2} \text{ equation}$ $\text{F}_2 + 2\text{e}^- \rightarrow 2\text{F}^- \quad \text{reduction } \frac{1}{2} \text{ equation}$ $2\text{Cl}^- + \text{F}_2 \rightarrow \text{Cl}_2 + 2\text{F}^- \quad \text{overall equation}$ <p>F.</p> $\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^- \quad \text{oxidation } \frac{1}{2} \text{ equation}$ $\text{Br}_2 + 2\text{e}^- \rightarrow 2\text{Br}^- \quad \text{reduction } \frac{1}{2} \text{ equation}$ $\text{Fe} + \text{Br}_2 \rightarrow \text{Fe}^{2+} + 2\text{Br}^- \quad \text{overall equation}$ <p>G.</p> $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^- \quad \text{oxidation } \frac{1}{2} \text{ equation}$ $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2 \quad \text{reduction } \frac{1}{2} \text{ equation}$ $\text{Mg} + 2\text{H}^+ \rightarrow \text{Mg}^{2+} + \text{H}_2 \quad \text{overall equation}$ <p>H.</p> $2\text{I}^- \rightarrow \text{I}_2 + 2\text{e}^- \quad \text{oxidation } \frac{1}{2} \text{ equation}$ $\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+} \quad \text{reduction } \frac{1}{2} \text{ equation}$ $2\text{Fe}^{3+} + 2\text{I}^- \rightarrow 2\text{Fe}^{2+} + \text{I}_2 \quad \text{overall equation}$	<p>Zn: reducing agent (reductant) H^+: oxidizing agent (oxidant)</p> <p>S^{2-}: reducing agent (reductant) I_2: oxidizing agent (oxidant)</p> <p>Cu: reducing agent (reductant) Ag^+: oxidizing agent (oxidant)</p> <p>Zn: reducing agent (reductant) Ag^+: oxidizing agent (oxidant)</p> <p>Cl^-: reducing agent (reductant) F_2: oxidizing agent (oxidant)</p> <p>Fe: reducing agent (reductant) Br_2: oxidizing agent (oxidant)</p> <p>Mg: reducing agent (reductant) H^+: oxidizing agent (oxidant)</p> <p>I^-: reducing agent (reductant) Fe^{3+}: oxidising agent (oxidant)</p>

