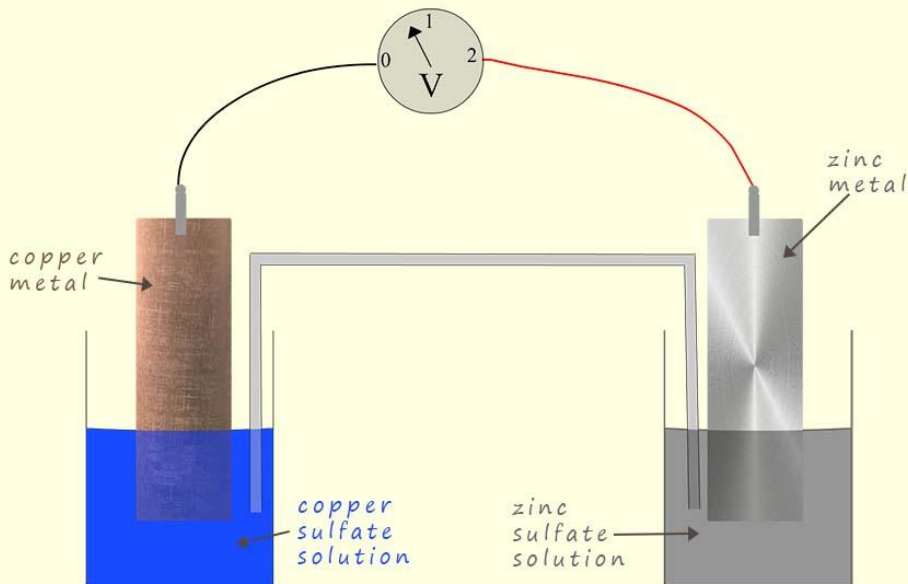# Redox Reactions

1.   Write a simple easy to remember definition for the following key words:

A). Oxidation   B). Reduction   C). Oxidising agent   D). Reducing agent

2. The diagram below shows a zinc/copper cell.

a. In this cell the zinc metal reduces the copper ions present.

i. Write a half-equation to show the oxidation of zinc to form zinc ions.

ii. Write a half-equation to show the reduction of copper ions to form copper atoms.

iii. Combine the two half-equation you have already written to write an overall equation for the redox reaction taking place in this cell.

iv. Name the oxidising and reducing agents in this cell.

3. In the reaction $2Fe^{3+} + Sn^{2+} \rightarrow 2Fe^{2+} + Sn^{4+}$, which species is the reducing agent?

A) Fe^{3+} B) Fe^{2+} C) Sn^{2+} D) Sn^{4+}

4. For each of the reactions below decide if it shows an oxidation or a reduction reaction.
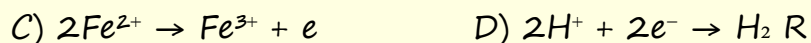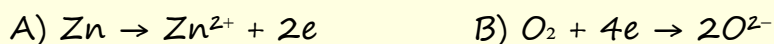
A) $Zn \rightarrow Zn^{2+} + 2e$ B) $O_2 + 4e \rightarrow 2O^{2-}$

C) $2Fe^{2+} \rightarrow Fe^{3+} + e$ D) $2H^+ + 2e^- \rightarrow H_2$ R

5. Lithium metal reacts violently with chlorine to form the ionic solid lithium chloride.

a. Write half-equations to show the oxidation and reduction reactions taking place here.

b. Write an overall equation for this redox reaction.

6. In a magnesium-zinc electrochemical cell:

a. Write the half-equations for oxidation and reduction.

b. Identify which metal is oxidized and which is reduced.

c. Write the overall balanced redox equation.

Answers

1.   Write a simple easy to remember definition for the following key words:

A). Oxidation   B). Reduction   C). Oxidising agent   D). Reducing agent

Answer:

Oxidation: Loss of electrons, or an increase in the oxidation state

Reduction: Gain of electrons, decrease in oxidation state

Reducing Agent: A substance that loses electrons (itself oxidized), causes reduction in another substance

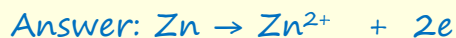Oxidizing Agent: A substance that gains electrons (itself reduced), causes oxidation in another substance

Recall the Mnemonic: OILRIG: oxidation is a loss of electrons, reduction is a gain of electrons
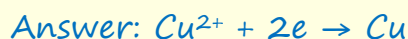
2. The diagram below shows a zinc/copper cell.
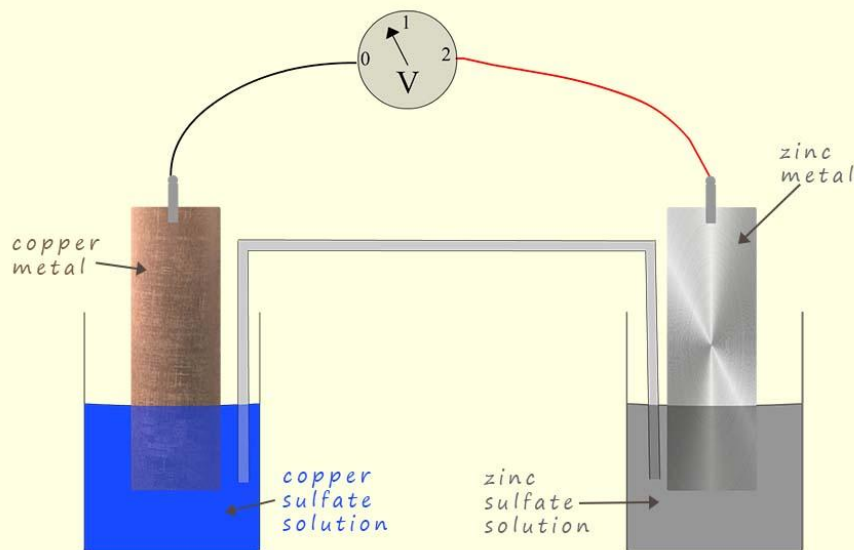
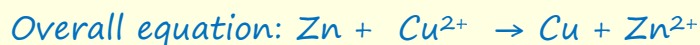a. In this cell the zinc metal reduces the copper ions present.

i. Write a half-equation to show the oxidation of zinc to form zinc ions.

Answer: $Zn \rightarrow Zn^{2+} + 2e$

ii. Write a half-equation to show the reduction of copper ions to form copper atoms.

Answer: $Cu^{2+} + 2e \rightarrow Cu$

iii. Combine the two half-equation you have already written to write an overall equation for the redox reaction taking place in this cell.

Answer: $Zn \rightarrow Zn^{2+} + \cancel{2e}$

$Cu^{2+} + \cancel{2e} \rightarrow Cu$

Overall equation: $Zn + Cu^{2+} \rightarrow Cu + Zn^{2+}$

iv. Name the oxidising and reducing agents in this cell.

Answer: The oxidising agent or the electron acceptor is the copper ions (Cu^{2+}) while the zinc atoms supply the electrons so they are the reducing agents.

3. In the reaction $2Fe^{3+} + Sn^{2+} \rightarrow 2Fe^{2+} + Sn^{4+}$, which species is the reducing agent?
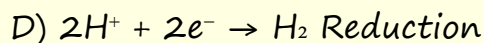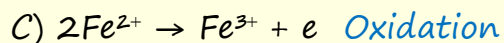
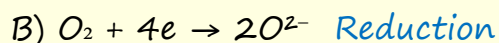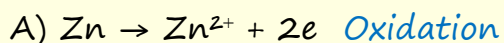A) Fe^{3+} B) Fe^{2+} C) Sn^{2+} D) Sn^{4+}

Answer: C) Sn^{2+}

4. For each of the reactions below decide if it shows an oxidation or a reduction reaction.

A) $Zn \rightarrow Zn^{2+} + 2e$ Oxidation   B) $O_2 + 4e \rightarrow 2O^{2-}$ Reduction

C) $2Fe^{2+} \rightarrow Fe^{3+} + e$ Oxidation   D) $2H^+ + 2e^- \rightarrow H_2$ Reduction

5. Lithium metal reacts violently with chlorine to form the ionic solid lithium chloride.

a. Write half-equations to show the oxidation and reduction reactions taking place here.

Oxidation: $Li \rightarrow Li^+ + e$

Reduction: $Cl_2 + 2e \rightarrow 2Cl^-$
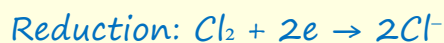
b. Write an overall equation for this redox reaction.

To obtain the overall equation the oxidation half-equation needs to be multiplied by x2, since the reduction of chlorine to chloride ions requires two electrons.
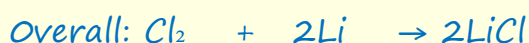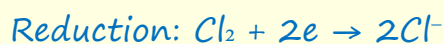
Oxidation: $2Li \rightarrow 2Li^+ + 2e$

Reduction: $Cl_2 + 2e \rightarrow 2Cl^-$

Overall: Cl_2 + $2Li$ $\rightarrow 2LiCl$

6. In a magnesium-zinc electrochemical cell:

a. Write the half-equations for oxidation and reduction.

b. Identify which metal is oxidized and which is reduced.

c. Write the overall balanced redox equation.

Answer:

Oxidation Half-Equation: $Mg \rightarrow Mg^{2+} + 2e$

Reduction Half-Equation: $Zn^{2+} + 2e \rightarrow Zn$

Oxidized Metal: Magnesium (Mg) is oxidized.

Reduced Metal: Zinc (Zn^{2+}) is reduced.

Overall Balanced Redox Equation: $Mg + Zn^{2+} \rightarrow Mg^{2+} + Zn$