

Redox Reactions — Assignment 1

Class 11 Chemistry · Topic-wise question bank covering every concept of the chapter · Narayan Gurukul Academy

Instructions: (1) Attempt all questions. This worksheet walks through every concept of the chapter, topic by topic.
(2) The interactive MCQ version of these questions (with instant answer reveal) is available on the notes page.
(3) Universal values: $g = 10 \text{ m/s}^2$ unless stated. Give answers with correct SI units.

Oxidation and Reduction

MCQ Questions (choose the correct option)

- Oxidation, in terms of electrons, is
 - loss of electrons
 - gain of electrons
 - gain of protons
 - loss of neutrons
- Reduction is
 - gain of electrons
 - loss of electrons
 - gain of oxygen
 - loss of hydrogen
- An oxidising agent is a substance that
 - accepts electrons
 - donates electrons
 - accepts protons
 - donates protons
- In the reaction $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$, the oxidising agent is
 - Cu^{2+}
 - Zn
 - Zn^{2+}
 - Cu

1 Mark Questions

- Define oxidation in terms of electrons.
- Define reduction in terms of electrons.
- What is an oxidising agent?

2 Mark Questions

- Define oxidation and reduction in terms of electrons and identify the oxidising and reducing agents in $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$.
- Explain the terms oxidant and reductant with one example each.

3 Mark Questions

- Explain oxidation and reduction in terms of electrons, oxygen and hydrogen transfer, and identify the oxidising and reducing agents in a given reaction.
- Explain the concept of redox reactions and show that oxidation and reduction always occur together.

Oxidation Number and Its Rules

MCQ Questions (choose the correct option)

1. The oxidation number of an element in its free state is
 - (A) zero
 - (B) +1
 - (C) -1
 - (D) +2
2. The oxidation number of hydrogen in most of its compounds is
 - (A) +1
 - (B) -1
 - (C) 0
 - (D) +2
3. The oxidation number of oxygen in most compounds is
 - (A) -2
 - (B) +2
 - (C) 0
 - (D) -1
4. The oxidation number of Mn in KMnO_4 is
 - (A) +7
 - (B) +4
 - (C) +6
 - (D) +2

1 Mark Questions

1. Define oxidation number.
2. State the oxidation number of oxygen in peroxides.
3. What is the oxidation number of sulphur in H_2SO_4 ?

2 Mark Questions

1. State the rules for assigning oxidation numbers.
2. Calculate the oxidation number of Cr in $\text{K}_2\text{Cr}_2\text{O}_7$.

3 Mark Questions

1. State the rules for assigning oxidation numbers and use them to calculate the oxidation number of Fe in Fe_3O_4 and of S in H_2SO_4 .
2. Calculate the oxidation number of the underlined element in KMnO_4 , H_2SO_4 and CrO_5 .

Balancing Redox Equations — Oxidation-Number Method

MCQ Questions (choose the correct option)

1. In the oxidation-number method of balancing, the increase in oxidation number is equal to the
 - (A) decrease in oxidation number
 - (B) number of electrons
 - (C) number of atoms

- (D) number of molecules
2. The oxidation-number method is particularly useful for balancing
- (A) molecular redox equations
 - (B) ionic equations
 - (C) nuclear equations
 - (D) acid-base equations
3. The first step in the oxidation-number method is to
- (A) identify the elements whose oxidation numbers change
 - (B) balance oxygen
 - (C) balance hydrogen
 - (D) add water

1 Mark Questions

1. State the principle used in the oxidation-number method of balancing.
2. Which reactions is the oxidation-number method suitable for?
3. What is the first step in the oxidation-number method?

2 Mark Questions

1. Explain the steps of the oxidation-number method of balancing a redox equation.
2. Balance the equation $\text{Fe}^{2+} + \text{MnO}_4^- + \text{H}^+ \rightarrow \text{Fe}^{3+} + \text{Mn}^{2+} + \text{H}_2\text{O}$ using the oxidation-number method.

3 Mark Questions

1. Describe the oxidation-number method of balancing redox equations and apply it to balance $\text{MnO}_4^- + \text{Fe}^{2+} + \text{H}^+ \rightarrow \text{Mn}^{2+} + \text{Fe}^{3+} + \text{H}_2\text{O}$.
2. Balance the redox reaction $\text{Cu} + \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{NO} + \text{H}_2\text{O}$ using the oxidation-number method and explain each step.

Ion-Electron (Half-Reaction) Method

MCQ Questions (choose the correct option)

1. In the ion-electron method, a redox reaction is split into
 - (A) two half-reactions
 - (B) three half-reactions
 - (C) one reaction
 - (D) four half-reactions
2. In an acidic medium, the half-reactions are balanced using
 - (A) H^+ and H_2O
 - (B) OH^- and H_2O
 - (C) only H_2O
 - (D) only O_2
3. In a basic medium, oxygen atoms are balanced by adding
 - (A) H_2O and then H^+/OH^- appropriately
 - (B) only H^+
 - (C) only electrons
 - (D) only OH^-

1 Mark Questions

1. What is the first step of the ion-electron method?
2. How are oxygen atoms balanced in an acidic medium?
3. How are hydrogen atoms balanced in an acidic medium?

2 Mark Questions

1. Explain the ion-electron method of balancing redox equations.
2. Balance the half-reaction $\text{MnO}_4^- \rightarrow \text{Mn}^{2+}$ in acidic medium.

3 Mark Questions

1. Describe the ion-electron method with an example, balancing the reaction $\text{MnO}_4^- + \text{Fe}^{2+} \rightarrow \text{Mn}^{2+} + \text{Fe}^{3+}$ in acidic medium.
2. Balance the equation $\text{Cr}_2\text{O}_7^{2-} + \text{Fe}^{2+} + \text{H}^+ \rightarrow \text{Cr}^{3+} + \text{Fe}^{3+} + \text{H}_2\text{O}$ by the ion-electron method.

Types of Redox Reactions

MCQ Questions (choose the correct option)

1. The reaction $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$ is an example of
 - (A) combination
 - (B) decomposition
 - (C) displacement
 - (D) disproportionation
2. A reaction in which the same element is both oxidised and reduced is called
 - (A) disproportionation
 - (B) combination
 - (C) displacement
 - (D) decomposition
3. The reaction $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ is an example of
 - (A) metal displacement
 - (B) combination
 - (C) disproportionation
 - (D) decomposition

1 Mark Questions

1. Name three types of redox reactions.
2. What is a disproportionation reaction?
3. Give one example of a metal displacement reaction.

2 Mark Questions

1. Classify the following as combination, decomposition, displacement or disproportionation: (i) $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$, (ii) $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$.
2. Explain disproportionation with one example.

3 Mark Questions

1. Explain the different types of redox reactions with one example of each: combination, decomposition, displacement, metal displacement, non-metal displacement and disproportionation.

2. Classify the following reactions and justify: (i) $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$, (ii) $\text{Cl}_2 + 2\text{NaOH} \rightarrow \text{NaCl} + \text{NaClO} + \text{H}_2\text{O}$.

Electrochemical Cells and Electrode Potentials

MCQ Questions (choose the correct option)

1. In an electrochemical cell, oxidation occurs at the
 - (A) anode
 - (B) cathode
 - (C) salt bridge
 - (D) voltmeter
2. The standard electrode potential of the standard hydrogen electrode is
 - (A) 0 V
 - (B) 1 V
 - (C) -1 V
 - (D) 0.5 V
3. The salt bridge is used to
 - (A) maintain electrical neutrality and complete the circuit
 - (B) supply electrons
 - (C) act as an oxidising agent
 - (D) prevent reaction
4. A metal with a more negative standard electrode potential is
 - (A) more reactive
 - (B) less reactive
 - (C) inert
 - (D) a good cathode

1 Mark Questions

1. Define the standard electrode potential.
2. What is the role of the salt bridge in an electrochemical cell?
3. At which electrode does oxidation occur?

2 Mark Questions

1. Describe the construction and working of a Daniell cell.
2. Define the standard electrode potential and explain the significance of a negative value.

3 Mark Questions

1. Describe the construction and working of the Daniell cell, write the cell reactions, and explain the function of the salt bridge.
2. Explain standard electrode potential, describe the standard hydrogen electrode, and state how electrode potentials are used to predict the feasibility of a reaction.

Nernst Equation and Gibbs Energy

MCQ Questions (choose the correct option)

1. The Nernst equation gives the dependence of the electrode potential on

- (A) concentration
 - (B) temperature only
 - (C) pressure only
 - (D) volume
2. The relation between standard Gibbs energy and standard cell potential is
- (A) $\Delta G^\circ = -nFE^\circ$
 - (B) $\Delta G^\circ = nFE^\circ$
 - (C) $\Delta G^\circ = -E^\circ/nF$
 - (D) $\Delta G^\circ = nF/E^\circ$
3. At equilibrium, the cell potential is
- (A) zero
 - (B) maximum
 - (C) infinite
 - (D) negative
4. The Nernst equation can be written as
- (A) $E = E^\circ - (0.059/n)\log Q$
 - (B) $E = E^\circ + (0.059/n)\log Q$
 - (C) $E = E^\circ$
 - (D) $E = (0.059/n)\log Q$

1 Mark Questions

1. Write the Nernst equation for an electrode.
2. Write the relation between ΔG° and E° .
3. What is the value of the cell potential at equilibrium?

2 Mark Questions

1. Write the Nernst equation and derive the relation $\Delta G^\circ = -nFE^\circ$.
2. Calculate the emf of a cell at 298 K given $E^\circ = 1.10$ V and $Q = 0.01$.

3 Mark Questions

1. Write the Nernst equation and derive the relation between the standard Gibbs energy and the standard cell potential.
2. Derive the relation between the equilibrium constant and the standard cell potential, and use it to calculate K for a cell with $E^\circ = 1.10$ V and $n = 2$.