

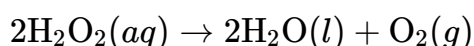
# Saitechinfo NEET-JEE Academy



A **disproportionation reaction** is a type of redox (reduction-oxidation) reaction in which a single substance undergoes both oxidation and reduction simultaneously, forming two different products. In other words, the same element in the reactant gets both oxidized and reduced in the products.

## Example of a Disproportionation Reaction:

The decomposition of hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) is a classic example:



In this reaction, oxygen in hydrogen peroxide is in the -1 oxidation state. It is simultaneously reduced to water (where oxygen is in the -2 oxidation state) and oxidized to oxygen gas (where oxygen is in the 0 oxidation state).

## Problems Based on Disproportionation Reaction:

- Problem 1:** Write a balanced equation for the disproportionation of chlorine gas in an alkaline medium.
- Problem 2:** Balance the disproportionation reaction of phosphorus from  $\text{P}_4$  to  $\text{H}_3\text{PO}_4$  and  $\text{PH}_3$ .
- Problem 3:** In the reaction where iron(III) is converted to iron(II) and iron(0), write the balanced disproportionation reaction.
- Problem 4:** Identify and balance the disproportionation reaction for the transformation of sodium hypochlorite ( $\text{NaOCl}$ ) in water.
- Problem 5:** Balance the disproportionation reaction of bromine in an acidic medium.
- Problem 6:** Determine the products and write the balanced disproportionation reaction for the decomposition of potassium manganate ( $\text{K}_2\text{MnO}_4$ ) in a neutral medium.

## Key for the Problems (next page):

- For Problem 1, chlorine gas in alkali ( $\text{Cl}_2 + 2\text{OH}^- \rightarrow \text{Cl}^- + \text{ClO}^- + \text{H}_2\text{O}$ ).
- For Problem 2, phosphorus undergoes disproportionation as:  $\text{P}_4 + 4\text{OH}^- + 8\text{H}_2\text{O} \rightarrow 4\text{H}_3\text{PO}_4 + 4\text{PH}_3$ .
- For Problem 3, iron disproportionates:  $2\text{Fe}^{3+} \rightarrow \text{Fe}^{2+} + \text{Fe}^0$ .
- For Problem 4, sodium hypochlorite disproportionates:  $\text{NaOCl} \rightarrow \text{NaCl} + \text{O}_2$ .
- For Problem 5, bromine disproportionates:  $\text{Br}_2 \rightarrow \text{Br}^- + \text{BrO}_3^-$ .
- For Problem 6, potassium manganate disproportionates:  $\text{K}_2\text{MnO}_4 \rightarrow \text{MnO}_2 + \text{O}_2$ .

These problems and answers focus on recognizing and balancing disproportionation reactions, essential in understanding redox chemistry.