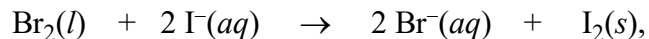


Chapter 18 Study Questions

1. Calculate the oxidation state for nitrogen in the following substances:

- a) NH_3 b) N_2 c) NO_2 d) NO_3^-

2. In the oxidation-reduction reaction,



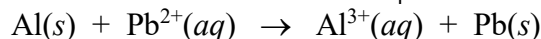
- a) which substance is being reduced?
b) which element is increasing in oxidation number?
c) which element is gaining electrons?
d) which substance is the oxidizing agent?
e) which substance is the reducing agent?

3. For each of the following reactions:

- 1) indicate the oxidation state of each atom on each side of equation,
- 2) identify the oxidation and reduction half-equations, and
- 3) balance the equation (adding H^+ and H_2O as needed).

- a) $\text{Li}(s) + \text{Cu}^{2+}(aq) \rightarrow \text{Li}^+(aq) + \text{Cu}(s)$
b) $\text{Ni}(s) + \text{MnO}_4^-(aq) \rightarrow \text{Ni}^{2+}(aq) + \text{Mn}^{2+}(aq)$
c) $\text{Mn}^{2+}(aq) + \text{NO}_3^-(aq) \rightarrow \text{MnO}_2(s) + \text{NO}(g)$

4. A voltaic cell has an aluminum electrode in $\text{Al}_2(\text{SO}_4)_3$ solution in one compartment and the other compartment has a lead electrode in PbSO_4 solution. The overall reaction is:



- a) Which element is being oxidized? Which element is being reduced?
b) Write the oxidation and reduction half-equations for this reaction.
c) Balance the overall equation for this reaction.
d) Draw a diagram of the voltaic cell, including
 1. the anode and cathode
 2. the direction of flow of electrons, positive ions and negative ions
- e) Which electrode will increase in mass?

Summary of Chapter 18: Oxidation-Reduction Reactions & Electrochemistry

definitions

- oxidation and reduction

- oxidizing and reducing agents

- oxidation state (number)

- oxidation-reduction reactions

balancing oxidation-reduction reactions

voltaic cells

- anode and cathode

- direction of electron and ion flow

- porous barrier/salt bridge

electrolytic cells