

- 1) Specify which of the following are oxidation-reduction reactions, and identify the oxidizing agent, the reducing agent, the substance being oxidized, and the substance being reduced.
- $\text{Cu}_{(s)} + 2 \text{Ag}^+_{(aq)} \rightarrow 2 \text{Ag}_{(s)} + \text{Cu}^{2+}_{(aq)}$
 - $\text{HCl}_{(g)} + \text{NH}_3_{(g)} \rightarrow \text{NH}_4\text{Cl}_{(s)}$
 - $\text{SiCl}_4_{(l)} + 2 \text{H}_2\text{O}_{(l)} \rightarrow 4 \text{HCl}_{(aq)} + \text{SiO}_2_{(s)}$
 - $\text{SiCl}_4_{(l)} + 2 \text{Mg}_{(s)} \rightarrow 2 \text{MgCl}_2_{(s)} + \text{Si}_{(s)}$
 - $\text{Al}(\text{OH})_4^-_{(aq)} \rightarrow \text{AlO}_2^-_{(aq)} + 2 \text{H}_2\text{O}_{(l)}$
- 2) Specify which of the following equations represent oxidation-reduction reactions, and indicate the oxidizing agent, the reducing agent, the species being oxidized, and the species being reduced.
- $\text{CH}_4_{(g)} + \text{H}_2\text{O}_{(g)} \rightarrow \text{CO}_{(g)} + 3 \text{H}_2_{(g)}$
 - $2 \text{AgNO}_3_{(aq)} + \text{Cu}_{(s)} \rightarrow \text{Cu}(\text{NO}_3)_2_{(aq)} + 2 \text{Ag}_{(s)}$
 - $\text{Zn}_{(s)} + 2 \text{HCl}_{(aq)} \rightarrow \text{ZnCl}_2_{(aq)} + \text{H}_2_{(g)}$
 - $2 \text{H}^+_{(aq)} + 2 \text{CrO}_4^{2-}_{(aq)} \rightarrow \text{Cr}_2\text{O}_7^{2-}_{(aq)} + \text{H}_2\text{O}_{(l)}$
- 3) Balance the following oxidation-reduction reactions that occur in acidic solution.
- $\text{Zn}_{(s)} + \text{HCl}_{(aq)} \rightarrow \text{Zn}^{2+}_{(aq)} + \text{H}_2_{(g)} + \text{Cl}^-_{(aq)}$
 - $\text{I}^-_{(aq)} + \text{ClO}^-_{(aq)} \rightarrow \text{I}_3^-_{(aq)} + \text{Cl}^-_{(aq)}$
 - $\text{As}_2\text{O}_3_{(s)} + \text{NO}_3^-_{(aq)} \rightarrow \text{H}_3\text{AsO}_4_{(aq)} + \text{NO}_{(g)}$
 - $\text{Br}^-_{(aq)} + \text{MnO}_4^-_{(aq)} \rightarrow \text{Br}_{2(l)} + \text{Mn}^{2+}_{(aq)}$
 - $\text{CH}_3\text{OH}_{(aq)} + \text{Cr}_2\text{O}_7^{2-}_{(aq)} \rightarrow \text{CH}_2\text{O}_{(aq)} + \text{Cr}^{3+}_{(aq)}$
- 4) Balance the following oxidation-reduction reactions that occur in acidic solution using the half-reaction method.
- $\text{Cu}_{(s)} + \text{NO}_3^-_{(aq)} \rightarrow \text{Cu}^{2+}_{(aq)} + \text{NO}_{(g)}$
 - $\text{Cr}_2\text{O}_7^{2-}_{(aq)} + \text{Cl}^-_{(aq)} \rightarrow \text{Cr}^{3+}_{(aq)} + \text{Cl}_2_{(g)}$
 - $\text{Pb}_{(s)} + \text{PbO}_2_{(s)} + \text{H}_2\text{SO}_4_{(aq)} \rightarrow \text{PbSO}_4_{(s)}$
 - $\text{Mn}^{2+}_{(aq)} + \text{NaBiO}_3_{(s)} \rightarrow \text{Bi}^{3+}_{(aq)} + \text{MnO}_4^-_{(aq)}$
 - $\text{H}_3\text{AsO}_4_{(aq)} + \text{Zn}_{(s)} \rightarrow \text{AsH}_3_{(g)} + \text{Zn}^{2+}_{(aq)}$