

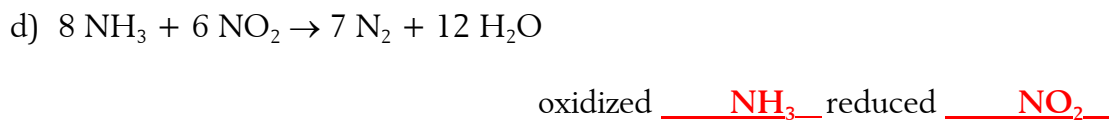
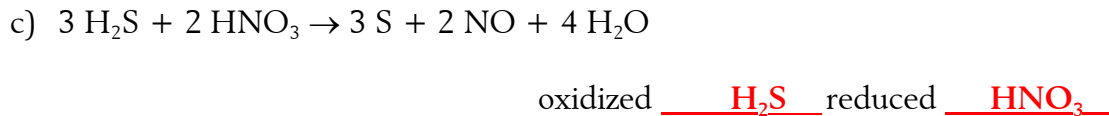
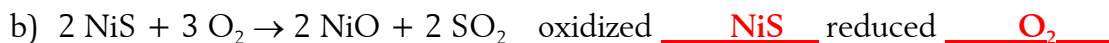
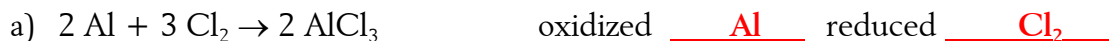
REDOX REACTONS

Chapters 4 & 20

1. In the compounds below, assign oxidation numbers to each element:



2. Identify which substance is oxidized and which substance is reduced in each of the following redox reactions.



BALANCING REDOX REACTIONS

Half-Reaction Method

1. Assign oxidation number to each element and identify the substance being oxidized and the substance being reduced.
2. Write oxidation and reduction half-reactions. In oxidation half-reaction electrons should appear on the product side, and in the reduction half-reaction they should appear on the reactant side.
3. Balance each half-reaction with respect to all elements, except H and O.

For Acid Solutions:

4. Add the appropriate number of H₂O molecules to the deficient side to balance O.
5. Add H⁺ to the deficient side to balance H.

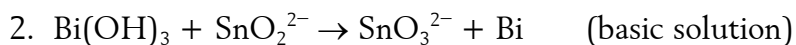
For Basic Solutions:

4. For each deficient O:
Add two (2) hydroxides, OH⁻, to the deficient side.
Add one (1) water, H₂O, to the other side.
5. For each deficient H:
Add one (1) water, H₂O, to the deficient side.
Add one (1) hydroxide, OH⁻, to the other side.

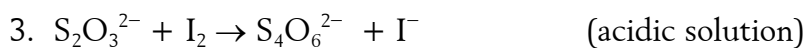
Balance each of the following redox reactions using the half-reaction method:



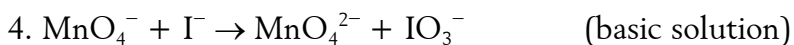
Oxidation <u> </u> Cu <u> </u> <u> </u> 2 <u> </u> element # of e ⁻	HALF-REACTION 3 x [Cu → Cu²⁺ + 2 e⁻] 3 Cu → 3 Cu²⁺ + 6 e⁻
Reduction <u> </u> N <u> </u> <u> </u> 3 <u> </u> element # of e ⁻	HALF-REACTION HNO₃ + 3 e⁻ → NO 2 x [3 H⁺ + HNO₃ + 3 e⁻ → NO + 2 H₂O] 6 H⁺ + 2 HNO₃ + 6 e⁻ → 2 NO + 4 H₂O
Balanced total reaction	6 H⁺ + 3 Cu + 2 HNO₃ → 3 Cu²⁺ + 2 NO + 4 H₂O



<p>Oxidation</p> <p><u>Sn</u> <u>2</u> element # of e^-</p>	<p>HALF-REACTION</p> <p>$\text{SnO}_2^{2-} \rightarrow \text{SnO}_3^{2-} + 2 e^-$ $3 \times [2 \text{OH}^- + \text{SnO}_2^{2-} \rightarrow \text{SnO}_3^{2-} + 2 e^- + \text{H}_2\text{O}]$ $6 \text{OH}^- + 3 \text{SnO}_2^{2-} \rightarrow 3 \text{SnO}_3^{2-} + 6 e^- + 3 \text{H}_2\text{O}$</p>
<p>Reduction</p> <p><u>Bi</u> <u>3</u> element # of e^-</p>	<p>HALF-REACTION</p> <p>$\text{Bi}(\text{OH})_3 + 3 e^- \rightarrow \text{Bi}$ $2 \times [\text{Bi}(\text{OH})_3 + 3 e^- \rightarrow \text{Bi} + 3 \text{OH}^-]$ $2 \text{Bi}(\text{OH})_3 + 6 e^- \rightarrow 2 \text{Bi} + 6 \text{OH}^-$</p>
<p>Balanced total reaction</p>	<p>$2 \text{Bi}(\text{OH})_3 + 3 \text{SnO}_2^{2-} \rightarrow 2 \text{Bi} + 3 \text{SnO}_3^{2-} + 3 \text{H}_2\text{O}$</p>



<p>Oxidation</p> <p><u>S</u> <u>0.5</u> element # of e^-</p>	<p>HALF-REACTION</p> <p>$2 \text{S}_2\text{O}_3^{2-} \rightarrow \text{S}_4\text{O}_6^{2-} + 2 e^-$</p>
<p>Reduction</p> <p><u>I</u> <u>1</u> element # of e^-</p>	<p>HALF-REACTION</p> <p>$\text{I}_2 + 2 e^- \rightarrow 2 \text{I}^-$</p>
<p>Balanced total reaction</p>	<p>$2 \text{S}_2\text{O}_3^{2-} + \text{I}_2 \rightarrow \text{S}_4\text{O}_6^{2-} + 2 \text{I}^-$</p>



<p>Oxidation</p> <p><u>1</u> element</p> <p><u>6</u> # of e^-</p>	<p>HALF-REACTION</p> <p>$\text{I}^- \rightarrow \text{IO}_3^- + 6 e^-$</p> <p>$6 \text{OH}^- + \text{I}^- \rightarrow \text{IO}_3^- + 6 e^- + 3 \text{H}_2\text{O}$</p>
<p>Reduction</p> <p><u>Mn</u> element</p> <p><u>1</u> # of e^-</p>	<p>HALF-REACTION</p> <p>$\text{MnO}_4^- + 1 e^- \rightarrow \text{MnO}_4^{2-}$</p> <p>$6 \times [\text{MnO}_4^- + 1 e^- \rightarrow \text{MnO}_4^{2-}]$</p> <p>$6 \text{MnO}_4^- + 6 e^- \rightarrow 6 \text{MnO}_4^{2-}$</p>
<p>Balanced total reaction</p>	<p>$6 \text{OH}^- + 6 \text{MnO}_4^- + \text{I}^- \rightarrow 6 \text{MnO}_4^{2-} + \text{IO}_3^- + 3 \text{H}_2\text{O}$</p>



<p>Oxidation</p> <p><u>Br</u> element</p> <p><u>5</u> # of e^-</p>	<p>HALF-REACTION</p> <p>$\text{Br}_2 \rightarrow 2 \text{BrO}_3^- + 10 e^-$</p> <p>$12 \text{OH}^- + \text{Br}_2 \rightarrow 2 \text{BrO}_3^- + 10 e^- + 6 \text{H}_2\text{O}$</p>
<p>Reduction</p> <p><u>Br</u> element</p> <p><u>1</u> # of e^-</p>	<p>HALF-REACTION</p> <p>$5 \times [\text{Br}_2 + 2 e^- \rightarrow 2 \text{Br}^-]$</p> <p>$5 \text{Br}_2 + 10 e^- \rightarrow 10 \text{Br}^-$</p>
<p>Balanced total reaction</p>	<p>$12 \text{OH}^- + 6 \text{Br}_2 \rightarrow 2 \text{BrO}_3^- + 10 \text{Br}^- + 6 \text{H}_2\text{O}$</p> <p>$6 \text{OH}^- + 3 \text{Br}_2 \rightarrow \text{BrO}_3^- + 5 \text{Br}^- + 3 \text{H}_2\text{O}$</p>