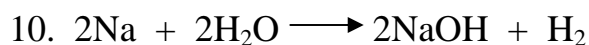
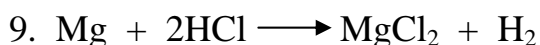
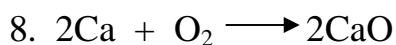
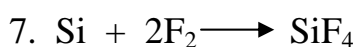
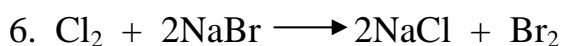
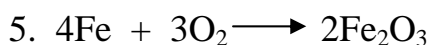
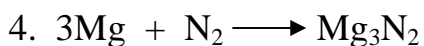
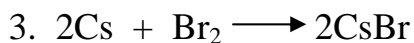
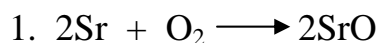


Chapter 20 Worksheet: Redox

I. Determine what is oxidized and what is reduced in each reaction. Identify the oxidizing agent and the reducing agent, also.



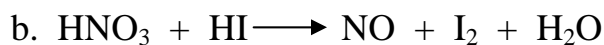
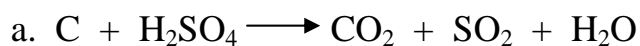
11. Give the oxidation number of each kind of atom or ion.

a. sulfate b. Sn c. S^{2-} d. Fe^{3+} e. Sn^{4+} f. nitrate g. ammonium

12. Calculate the oxidation number of chromium in each of the following.

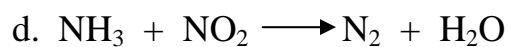
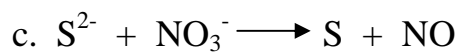
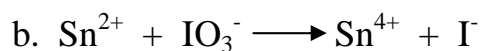
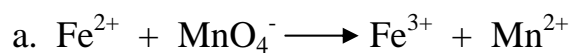
a. Cr_2O_3 b. $\text{Na}_2\text{Cr}_2\text{O}_7$ c. CrSO_4 d. chromate e. dichromate

13. Use the changes in oxidation numbers to determine which elements are oxidized and which are reduced in these reactions. (Note: it is not necessary to use balanced equations)

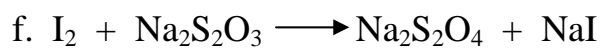
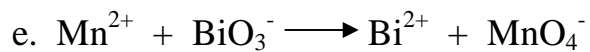
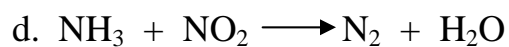
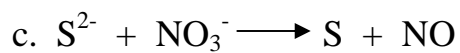
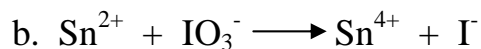
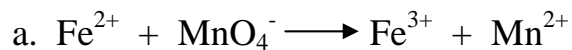


14. For each reaction in problem 13, identify the oxidizing agent and reducing agent.

15. Write half-reactions for the oxidation and reduction process for each of the following.

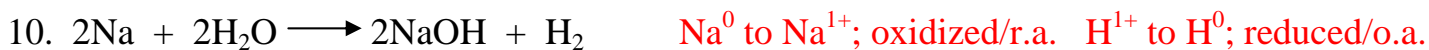


16. Complet and balance each reaction using the half-reaction method.



Chapter 20 Worksheet: Redox ANSWERS

I. Determine what is oxidized and what is reduced in each reaction. Identify the oxidizing agent and the reducing agent, also.



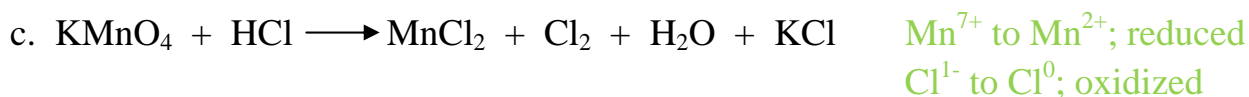
11. Give the oxidation number of each kind of atom or ion.

a. sulfate	b. Sn	c. S^{2-}	d. Fe^{3+}	e. Sn^{4+}	f. nitrate	g. ammonium
2-	0	2-	3+	4+	1-	1+

12. Calculate the oxidation number of chromium in each of the following.

a. Cr_2O_3	b. $\text{Na}_2\text{Cr}_2\text{O}_7$	c. CrSO_4	d. chromate	e. dichromate
3+	6+	2+	7+	6+

13. Use the changes in oxidation numbers to determine which elements are oxidized and which are reduced in these reactions. (Note: it is not necessary to use balanced equations)



14. For each reaction in problem 13, identify the oxidizing agent and reducing agent.

- oxidizing agent: sulfur reducing agent: carbon
- oxidizing agent: nitrogen reducing agent: iodine
- oxidizing agent: manganese reducing agent: chlorine
- oxidizing agent: nitrogen reducing agent: antimony

15. Write half-reactions for the oxidation and reduction process for each of the following.

- a. $\text{Fe}^{2+} + \text{MnO}_4^- \longrightarrow \text{Fe}^{3+} + \text{Mn}^{2+}$
 $\text{Fe}^{2+} \longrightarrow \text{Fe}^{3+}$; oxidation $\text{Mn}^{7+} \longrightarrow \text{Mn}^{2+}$; reduction
- b. $\text{Sn}^{2+} + \text{IO}_3^- \longrightarrow \text{Sn}^{4+} + \text{I}^-$
 $\text{Sn}^{2+} \longrightarrow \text{Sn}^{4+}$; oxidation $\text{I}^{5+} \longrightarrow \text{I}^{1-}$; reduction
- c. $\text{S}^{2-} + \text{NO}_3^- \longrightarrow \text{S} + \text{NO}$
 $\text{S}^{2-} \longrightarrow \text{S}$; oxidation $\text{N}^{5+} \longrightarrow \text{N}^{2+}$; reduction
- d. $\text{NH}_3 + \text{NO}_2 \longrightarrow \text{N}_2 + \text{H}_2\text{O}$
 $\text{N}^{3-} \longrightarrow \text{N}^0$; oxidation $\text{N}^{4+} \longrightarrow \text{N}^0$; reduction

16. Complete and balance each reaction using the half-reaction method.

- a. $\text{Fe}^{2+} + \text{MnO}_4^- \longrightarrow \text{Fe}^{3+} + \text{Mn}^{2+}$

$$\left. \begin{array}{l} [\text{Fe}^{2+} \longrightarrow \text{Fe}^{3+} + 1\text{e}^-] \times 5 \\ \text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \longrightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O} \end{array} \right\} 5\text{Fe}^{2+}_{(\text{aq})} + \text{MnO}_4^-_{(\text{aq})} + 8\text{H}^+_{(\text{aq})} \longrightarrow 5\text{Fe}^{3+}_{(\text{aq})} + \text{Mn}^{2+}_{(\text{aq})} + 4\text{H}_2\text{O}_{(\text{l})}$$
- b. $\text{Sn}^{2+} + \text{IO}_3^- \longrightarrow \text{Sn}^{4+} + \text{I}^-$

$$6\text{H}^+_{(\text{aq})} + 3\text{Sn}^{2+}_{(\text{aq})} + \text{IO}_3^-_{(\text{aq})} \longrightarrow 3\text{Sn}^{4+}_{(\text{aq})} + \text{I}^-_{(\text{aq})} + 3\text{H}_2\text{O}_{(\text{l})}$$
- c. $\text{S}^{2-} + \text{NO}_3^- \longrightarrow \text{S} + \text{NO}$

$$8\text{H}^+_{(\text{aq})} + 3\text{S}^{2-}_{(\text{aq})} + 2\text{NO}_3^-_{(\text{aq})} \longrightarrow 3\text{S}_{(\text{s})} + 2\text{NO}_{(\text{g})} + 4\text{H}_2\text{O}_{(\text{l})}$$
- d. $\text{NH}_3 + \text{NO}_2 \longrightarrow \text{N}_2 + \text{H}_2\text{O}$

$$8\text{NH}_{3(\text{g})} + 6\text{NO}_{2(\text{g})} \longrightarrow 7\text{N}_{2(\text{g})} + 12\text{H}_2\text{O}_{(\text{l})}$$
- e. $\text{Mn}^{2+} + \text{BiO}_3^- \longrightarrow \text{Bi}^{2+} + \text{MnO}_4^-$

$$3\text{Mn}^{2+}_{(\text{aq})} + 5\text{BiO}_3^-_{(\text{aq})} + 6\text{H}^+_{(\text{aq})} \longrightarrow 5\text{Bi}^{2+}_{(\text{aq})} + 3\text{MnO}_4^-_{(\text{aq})} + 3\text{H}_2\text{O}_{(\text{l})}$$
- f. $\text{I}_2 + \text{Na}_2\text{S}_2\text{O}_3 \longrightarrow \text{Na}_2\text{S}_2\text{O}_4 + \text{NaI}$

$$\text{Na}_2\text{S}_2\text{O}_{3(\text{aq})} + \text{H}_2\text{O}_{(\text{l})} + \text{I}_{2(\text{s})} + 2\text{Na}^+_{(\text{aq})} \longrightarrow \text{Na}_2\text{S}_2\text{O}_{4(\text{aq})} + 2\text{H}^+_{(\text{aq})} + 2\text{NaI}_{(\text{aq})}$$