

20.3

BALANCING REDOX REACTIONS**Section Review****Objectives**

- Balance a redox equation using the oxidation-number-change method
- Balance a redox equation by breaking a redox equation into oxidation and reduction half-reactions and then using the half-reaction method

Vocabulary

- oxidation-number-change method
- half-reaction
- half-reaction method

Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

One method for balancing redox equations involves _____ 1. _____
 determining the change in _____ 1 _____ of the substances that are _____ 2. _____
 oxidized and reduced. Coefficients are then used to make the _____ 3. _____
 increase in oxidation number equal to the decrease. _____ 4. _____

The _____ 2 _____ method is another way to write a _____ 3 _____ _____ 5. _____
 equation for a redox reaction. In this method, the net _____ 4 _____ _____ 6. _____
 equation is divided into _____ 5 _____ half-reactions. Each half-reaction _____ 7. _____
 is balanced independently. Finally, the half-reactions are _____ 6 _____.

The half-reaction method is particularly useful in balancing
 equations for _____ 7 _____ reactions.

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

- _____ 8. The reduction half-reaction in the reaction $\text{MnO}_4^- + \text{Cl}^- \rightarrow \text{Mn}^{2+} + \text{Cl}_2$ involves $\text{MnO}_4^- \rightarrow \text{Mn}^{2+}$

- _____ 9. In an oxidation half-reaction, electrons occur on the right side of the equation.
- _____ 10. Electrons never appear in a balanced redox reaction.
- _____ 11. $2e^- + 2Cl^- \rightarrow Cl_2$ is a balanced half-reaction.
- _____ 12. To balance the oxygen in a half reaction involving $MnO_4^- \rightarrow Mn^{2+}$, $2H_2O$ will be added to the product side of the equation.
- _____ 13. In the equation $2FeBr_2 + Br_2 \rightarrow 2FeBr_3$, the oxidation number of the iron doesn't change.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A	Column B
_____ 14. half-reaction method	a. ions that are present but do not participate in or change during the reaction
_____ 15. spectator ions	b. $Fe^{2+} \rightarrow Fe^{3+} + e^-$
_____ 16. anions	c. balancing a redox equation by first balancing the oxidation and reduction half-reactions
_____ 17. oxidation half-reaction	d. balancing a redox equation by comparing the increase and decrease in oxidation numbers
_____ 18. half-reaction	e. equation showing either the reduction or the oxidation of a species in an oxidation-reduction reaction
_____ 19. oxidation-number-change method	f. ions that can serve as reducing agents
_____ 20. reduction half-reaction	g. $2e^- + Br_2 \rightarrow 2Br^-$

Part D Questions and Problems

Answer the following in the space provided.

21. Balance these redox equations using the oxidation-number-change method.

- a. $HNO_3(aq) + HI(g) \rightarrow NO(g) + I_2(s) + H_2O$
- b. $HNO_3(aq) + I_2(s) \rightarrow HIO_3(aq) + NO_2(g) + H_2O(l)$

22. Balance these redox equations using the half-reaction method.

- a. $H_2S(aq) + HNO_3(aq) \rightarrow S(s) + NO(g) + H_2O(l)$
- b. $Fe^{2+} + Cr_2O_7^{2-} \rightarrow Fe^{3+} + Cr^{3+}$