Oxidation Numbers and Redox Balancing

Student Worksheet | g10_u06_w21

I can: use oxidation numbers and charge conservation to identify redox partners and balance a supplied reaction in acidic aqueous conditions.
Rules for this model: an element alone has oxidation number 0; a monatomic ion has its ion charge; oxygen is usually -2 and hydrogen is usually $+1$; oxidation-number sums equal the species charge. "Usually" signals exceptions outside this card. Use the acidic half-reaction order shown below. Data/model only—no chemical handling.

oxidation-number card	redox-balancing card (acidic aqueous model)
$NaCl$, CO_2, SO_4^{2-}, MnO_4^-, Fe^{2+}, Fe^{3+}	$MnO_4^- + Fe^{2+} + H^+ \rightarrow Mn^{2+} + Fe^{3+} + H_2O$
order: other atoms, O with H_2O, H with H^+, charge with e^-	final check: each atom count and total charge

1. Assign the oxidation number of Cl in NaCl.

2. Assign the oxidation number of C in CO_2.

3. Assign the oxidation number of S in SO_4^{2-}. Show the sum equation.

4. Assign the oxidation number of Mn in MnO_4^-. Show the sum equation.

5. State the oxidation numbers of Fe in Fe^{2+} and Fe^{3+}.

6. In the supplied reaction, which atom is reduced? Cite its oxidation-number change.

7. Which atom is oxidized? Cite its oxidation-number change.

8. Identify the oxidizing agent and explain your choice.

9. Identify the reducing agent and explain your choice.

10. Write the unbalanced manganese half-reaction from the supplied redox card.

11. Balance O in the manganese half-reaction using H_2O.

12. Balance H in that half-reaction using H^+.

13. Balance charge in that half-reaction using electrons. State the electron side and coefficient.

14. Write and charge-balance the iron half-reaction.

15. How must the iron half-reaction be scaled before the two half-reactions can be combined?

16. Write the complete balanced net ionic equation for the stated acidic model.

17. Verify Mn, Fe, O, and H atom counts in your complete equation.

18. Verify the total charge on each side of your complete equation.

19. Why is this balancing procedure explicitly labeled acidic? What would need reconsideration in basic conditions?

20. Write a cautious CER statement using one oxidation-number change and one conservation check. Include one claim this equation alone cannot support.