

Laboratory Report

Table A. Reactions of Iron(II) Ions with Oxidizing Agents

Well	Reactants	Observations (Initial Color)	Color After Adding KSCN
A1	$\text{Fe}^{2+}(\text{aq})$		
A2	$\text{Fe}^{3+}(\text{aq})$		
B1	$\text{Fe}^{2+} + \text{HCl} + \text{H}_2\text{O}_2$		
B2			
B3			

Table B. Reactions of Iron(III) Ions with Reducing Agents

Well	Reactants	Observations (Initial Color)	Color After Adding $\text{K}_3\text{Fe}(\text{CN})_6$
C1	$\text{Fe}^{2+}(\text{aq})$		
C2	$\text{Fe}^{3+}(\text{aq})$		
D1	$\text{Fe}^{3+} + \text{HCl} + \text{Na}_2\text{SO}_3$		
D2			
D3			
D4			
D5			

1. How can potassium thiocyanate be used to confirm that Fe^{2+} ions have been oxidized to Fe^{3+} in Part A?

2. Use the oxidation state rules to assign oxidation states for the indicated atoms in each oxidizing agent and its product (Part A).

Atom	Oxidizing Agent	Oxidation State	Product	Oxidation State
Mn	MnO_4^-		Mn^{2+}	
O	H_2O_2		H_2O	
Cl	OCl^-		Cl^-	

3. Fill in the blanks to show the number of electrons involved in each half-reaction for the oxidizing agents identified in Question 2.
- a. $\text{MnO}_4^-(\text{aq}) + 8\text{H}^+(\text{aq}) + \square e^- \rightarrow \text{Mn}^{2+}(\text{aq}) + 4\text{H}_2\text{O}(\text{l})$
- b. $\text{H}_2\text{O}_2(\text{aq}) + 2\text{H}^+(\text{aq}) + \square e^- \rightarrow 2\text{H}_2\text{O}(\text{l})$
- c. $\text{OCl}^-(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \square e^- \rightarrow \text{Cl}^-(\text{aq}) + 2\text{OH}^-(\text{aq})$
4. Combine the oxidation half-reaction for Fe^{2+} (see the *Background* section) with the appropriate half-reaction from Question 3 and write the balanced equation for the overall redox reaction of Fe^{2+} with (a) permanganate ion, (b) hydrogen peroxide, and (c) hypochlorite ion.
5. Choose the correct terms to complete the following sentence: A(n) **oxidizing/reducing** agent is a substance that causes the **oxidation/reduction** of another reactant in a redox reaction. The oxidation state of the oxidizing agent **increases/decreases** and the oxidizing agent itself undergoes **oxidation/reduction** during the reaction.
6. How can potassium ferricyanide be used to confirm that Fe^{3+} ions have been reduced to Fe^{2+} in Part B?
7. a. Sulfite ion (SO_3^{2-}) is a strong reducing agent. Assign oxidation states to the sulfur atom in SO_3^{2-} and its product, sulfate ion (SO_4^{2-}).
- b. Fill in the blank to show the number of electrons in the following half-reaction.
- $$\text{SO}_3^{2-}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{SO}_4^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) + \square e^-$$
- c. Write the balanced equation for the overall redox reaction of Fe^{3+} with sulfite ion.

8. Choose the correct terms to complete the following sentence: A(n) **oxidizing/reducing** agent is a substance that causes the **oxidation/reduction** of another substance in a redox reaction. The oxidation state of the reducing agent **increases/decreases** and the reducing agent itself undergoes **oxidation/reduction** during the reaction.
9. Based on the observations in Part B, which halide—bromide ion or iodide ion—is the stronger reducing agent? Explain your reasoning.
10. Iron(II) compounds in foods are more easily absorbed by the body than iron(III) compounds. Vitamin C improves the absorption of dietary iron. Explain based on your observations in this experiment.
11. Suggest a possible reason for the results obtained using pineapple juice in this experiment.
12. Which of the following reactions are **not** redox reactions?
- a.* $\text{CH}_4(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
- b.* $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$
- c.* $\text{CaCO}_3(\text{s}) \xrightarrow{\text{heat}} \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
- d.* $2\text{H}_2\text{O}_2(\text{aq}) \xrightarrow{\text{catalyst}} 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$