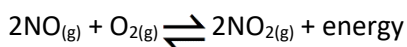
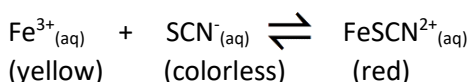


1. Nitrogen monoxide, a major air pollutant, is formed in automobile engines from the endothermic reaction of nitrogen and oxygen gases.
 - a. Write the equilibrium reaction equation including the term "energy" to indicate heat flow in the equation.
 - b. Describe the direction of the equilibrium shift if the concentration of oxygen is increased.
 - c. Describe the direction of the equilibrium shift if the pressure is increased.
 - d. Gasoline burns better at higher temperatures. What are some disadvantages of the operation of automobile engines at higher temperatures?
2. In a sealed container, nitrogen monoxide and oxygen gases are in equilibrium with nitrogen dioxide gas. The reaction of nitrogen monoxide and oxygen is exothermic.



Predict the equilibrium shift when the following changes are made.

- a. The temperature is decreased.
 - b. The concentration of $\text{NO}_{(g)}$ is decreased.
 - c. The concentration of $\text{NO}_{2(g)}$ is increased.
 - d. The volume of the system is decreased.
3. Based on the equilibrium reaction equation, predict the color change in the equilibrium mixture when each of the following changes are made.



- a. A crystal of $\text{KSCN}_{(s)}$ is added to the system, which breaks apart into K^{+} and SCN^{-} ions when mixed.
- b. A crystal of $\text{FeCl}_{3(s)}$ is added to the system, which breaks apart into Fe^{3+} and Cl^{-} ions when mixed.
- c. A crystal of $\text{NaOH}_{(s)}$ is added to the system, which reacts with existing Fe^{3+} ions to form an additional aqueous solution, iron(III) hydroxide.