

1. For the reaction:



At a certain temperature,  $K_c=2.0$ . The initial concentrations are:

- $[\text{CO}]=0.50 \text{ M}$
- $[\text{Cl}_2]=0.50 \text{ M}$
- $[\text{COCl}_2]=0.20 \text{ M}$

What is the reaction quotient ( $Q_c$ ) and will the reaction proceed forward or backward?

- (A)  $Q_c=1.6$ , the reaction proceeds forward  
(B)  $Q_c=0.8$ , reaction proceeds forward  
(C)  $Q_c=0.8$ , reaction proceeds in reverse  
(D)  $Q_c=1.6$ , the reaction proceeds in reverse  
(E)  $Q_c=2.0$ , the system is at equilibrium

2.  $2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})$

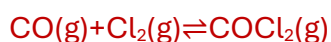
**At equilibrium, the concentrations are given as:**

- $[\text{NO}_2]=0.10\text{M}$
- $[\text{N}_2\text{O}_4]=0.15\text{M}$

Calculate the equilibrium constant  $K_c$  for the reaction.

3. **Calculating Q and Comparing to Kc**

**Reaction:**



Equilibrium constant,  $K_c=5.0$

**Initial concentrations:**  $[\text{CO}]=0.20\text{M}$ ;  $[\text{Cl}_2]=0.20\text{M}$ ;  $[\text{COCl}_2]=0.10\text{M}$

- Calculate the reaction quotient  $Q$ .
- Determine whether the reaction will shift to the right (toward products) or to the left (toward reactants) to reach equilibrium.