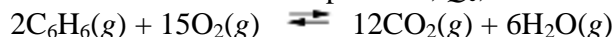


Practice Quiz: Equilibrium

1. Consider the equilibrium reaction shown below.  
 $B_2(g) \rightleftharpoons 2B(g)$   
If the rate constants are:  $k_{\text{fwd}} = 7.00 \times 10^{-5} \text{ s}^{-1}$  and  $k_{\text{rev}} = 2.00 \times 10^{-5} \text{ L mol}^{-1} \text{ s}^{-1}$ , what is the value of  $K_c$  under these conditions?
- $1.75 \times 10^5$
  - 3.50
  - 0.286
  - $5.71 \times 10^{-6}$
  - $1.40 \times 10^{-10}$
2. Which of the following has an effect on the magnitude of the equilibrium constant?
- removing products as they are formed
  - adding more of a reactant
  - adding a catalyst
  - increasing the pressure, in a gas-phase reaction
  - change in temperature
3. The two equilibrium constants for the same reaction,  $K_c$  and  $K_p$ , will always equal one another when
- all of the reactants and products are gases.
  - in the reaction equation, the number of moles of gaseous products equals the number of moles of gaseous reactants.
  - in the reaction equation, the number of moles of gaseous products is greater than the number of moles of gaseous reactants.
  - in the reaction equation, the number of moles of gaseous products is smaller than the number of moles of gaseous reactants.
  - in the reaction equation, the total number of moles of reactants equals that of the products.
4. The reaction quotient,  $Q_c$ , for a reaction has a value of 75 while the equilibrium constant,  $K_c$ , has a value of 195. Which of the following statements is accurate?
- The reaction must proceed to the left to establish equilibrium.
  - The reaction must proceed to the right to establish equilibrium.
  - The concentrations of the products will be much smaller than the concentrations of the reactants when the system is at equilibrium.
  - The concentrations of the products will be about the same as the concentrations of the reactants when the system is at equilibrium.
  - None of these choices is correct.

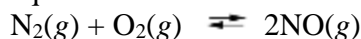
Practice Quiz: Equilibrium

5. Select the mass-action expression,  $Q_c$ , for the following chemical reaction equation.



- $\frac{[\text{CO}_2][\text{H}_2\text{O}]}{[\text{C}_6\text{H}_6][\text{O}_2]}$
- $\frac{[\text{CO}_2]^{12}[\text{H}_2\text{O}]^6}{[\text{C}_6\text{H}_6]^2[\text{O}_2]^{15}}$
- $\frac{[\text{C}_6\text{H}_6][\text{O}_2]}{[\text{CO}_2][\text{H}_2\text{O}]}$
- $\frac{[\text{C}_6\text{H}_6]^2[\text{O}_2]^{15}}{[\text{CO}_2]^{12}[\text{H}_2\text{O}]^6}$
- $\frac{[12\text{CO}_2][6\text{H}_2\text{O}]}{[2\text{C}_6\text{H}_6][15\text{O}_2]}$

6. The reaction of nitrogen with oxygen to form nitrogen monoxide can be represented by the following equation.



At 2000°C, the equilibrium constant,  $K_c$ , has a value of  $4.10 \times 10^{-4}$ . What is the value of  $K_p$ ?

- $2.17 \times 10^{-8}$
- $4.10 \times 10^{-4}$
- $7.65 \times 10^{-2}$
- 7.75
- None of these choices is correct.

7. At high temperatures, carbon reacts with  $\text{O}_2$  to produce CO as follows:

$\text{C}(s) + \text{O}_2(g) \rightleftharpoons \text{CO}(g)$ . When 0.350 mol of  $\text{O}_2$  and excess carbon were placed in a 5.00-L container and heated, the equilibrium concentration of CO was found to be 0.060 M. What is the equilibrium constant,  $K_c$ , for this reaction?

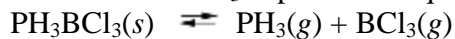
- 0.010
- 0.072
- 0.090
- 0.17
- 1.2

Practice Quiz: Equilibrium

8. At a certain temperature the reaction  $\text{CO}_2(g) + \text{H}_2(g) \rightleftharpoons \text{CO}(g) + \text{H}_2\text{O}(g)$  has  $K_c = 2.50$ . If 2.00 mol of carbon dioxide and 1.5 mol of hydrogen are placed in a 5.00 L vessel and equilibrium is established, what will be the concentration of carbon monoxide?

- 0.091 M  
 0.191 M  
 0.209 M  
 0.913 M  
 1.05 M

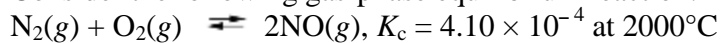
9. When 0.152 mol of solid  $\text{PH}_3\text{BCl}_3$  is introduced into a 3.0 L container at a certain temperature,  $8.44 \times 10^{-3}$  mol of  $\text{PH}_3$  is present at equilibrium:



Construct a reaction table for the process, and use it to calculate  $K_c$  at this temperature.

$$K_c = \frac{[(8.44 \times 10^{-3})/3.0]^2}{0.152/3.0} = 7.9$$

10. Consider the following gas-phase equilibrium reaction:



If 1.0 mol of NO is introduced into a 1.0 L container at  $2000^\circ\text{C}$ , what is the concentration of NO when equilibrium is reached?

$$[\text{NO}] = 1.0 \times 10^{-2} \text{ mol L}^{-1}$$