Practice Quiz: Equilibrium

1. Consider the equilibrium reaction shown below.
   $B_2(g) \rightleftharpoons 2B(g)$
   If the rate constants are: $k_{fwd} = 7.00 \times 10^{-5}\ s^{-1}$ and $k_{rev} = 2.00 \times 10^{-5}\ L\ mol^{-1}\ s^{-1}$, what is the value of K_c under these conditions?
   - 1.75×10^{5}
   - 3.50
   - 0.286
   - 5.71×10^{-6}
   - 1.40×10^{-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 numbe 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.

5. Select the mass-action expression, Q_c, for the following chemical reaction equation.
$2C_6H_6(g) + 15O_2(g) \rightleftharpoons 12CO_2(g) + 6H_2O(g)$

- $\frac{[CO_2][H_2O]}{[C_6H_6][O_2]}$
- $\frac{[CO_2]^{12}[H_2O]^6}{[C_6H_6]^2[O_2]^{15}}$
- $\frac{[C_6H_6][O_2]}{[CO_2][H_2O]}$
- $\frac{[C_6H_6]^2[O_2]^{15}}{[CO_2]^{12}[H_2O]^6}$
- $\frac{[12CO_2][6H_2O]}{[2C_6H_6][15O_2]}$

6. The reaction of nitrogen with oxygen to form nitrogen monxide can be represented by the following equation.
$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$
At 2000°C, the equilibrium constant, K_c, has a value of 4.10×10^{-4}. What is the value of K_p?

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

7. At high temperatures, carbon reacts with O_2 to produce CO as follows:
$C(s) + O_2(g) \rightleftharpoons CO(g)$. When 0.350 mol of 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

8. At a certain temperature the reaction $CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g)$ 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 PH_3BCl_3 is introduced into a 3.0 L container at a certain temperature, 8.44×10^{-3} mol of PH_3 is present at equilibrium:
$PH_3BCl_3(s) \rightleftharpoons PH_3(g) + BCl_3(g)$
Construct a reaction table for the process, and use it to calculate K_c at this temperature.

Kc ={[(8.44 X 10E-3)]/3.0}^2 = 7.9

10. Consider the following gas-phase equilibrium reaction:
$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$, $K_c = 4.10 \times 10^{-4}$ at 2000°C
If 1.0 mol of NO is introduced into a 1.0 L container at 2000°C, what is the concentration of NO when equilibrium is reached?

[NO] = 1.0 X 10^{-2} mol L^{-1}