

16 • Chemical Equilibrium

P R A C T I C E T E S T

1. Consider the reaction system,
 $\text{CoO(s)} + \text{H}_2\text{(g)} \rightleftharpoons \text{Co(s)} + \text{H}_2\text{O(g)}$.
 The equilibrium constant expression is
- a) $\frac{[\text{CoO}][\text{H}_2]}{[\text{Co}][\text{H}_2\text{O}]}$ d) $\frac{[\text{H}_2]}{[\text{H}_2\text{O}]}$
 b) $\frac{[\text{Co}][\text{H}_2\text{O}]}{[\text{CoO}][\text{H}_2]}$ e) $\frac{[\text{H}_2\text{O}]}{[\text{H}_2]}$
 c) $\frac{[\text{Co}][\text{H}_2\text{O}]}{[\text{H}_2]}$
2. Given the equilibrium,
 $2\text{SO}_2\text{(g)} + \text{O}_2\text{(g)} \rightleftharpoons 2\text{SO}_3\text{(g)}$, if this equilibrium
 is established by beginning with equal number of
 moles of SO_2 and O_2 in a 1.0 Liter bulb, then
 the following **must** be true at equilibrium:
- a) $[\text{SO}_2] = [\text{SO}_3]$ d) $[\text{SO}_2] < [\text{O}_2]$
 b) $2[\text{SO}_2] = 2[\text{SO}_3]$ e) $[\text{SO}_2] > [\text{O}_2]$
 c) $[\text{SO}_2] = [\text{O}_2]$

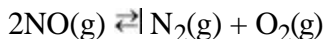
Questions 3 & 4 refer to the following:

At a given temperature, 0.300 mole NO , 0.200
 mol Cl_2 and 0.500 mol ClNO were placed in a
 25.0 Liter container. The following equilibrium is
 established: $2\text{ClNO(g)} \rightleftharpoons 2\text{NO(g)} + \text{Cl}_2\text{(g)}$

3. At equilibrium, 0.600 mol of ClNO was present.
 The number of **moles** of Cl_2 present at
 equilibrium is
- a) 0.050 d) 0.200
 b) 0.100 e) 0.250
 c) 0.150

4. The equilibrium constant, K_c , is:
- a) 4.45×10^{-4} d) 0.167
 b) 6.67×10^{-4} e) 1500
 c) 0.111
5. At 985°C , the equilibrium constant for the
 reaction,
 $\text{H}_2\text{(g)} + \text{CO}_2\text{(g)} \rightleftharpoons \text{H}_2\text{O(g)} + \text{CO(g)}$
 is 1.63. What is the equilibrium constant for the
 reverse reaction?
- a) 1.63 d) 0.613
 b) 0.815 e) 1.00
 c) 2.66
6. What is the relationship between K_p and K_c for
 the reaction, $2\text{ICl(g)} \rightleftharpoons \text{I}_2\text{(g)} + \text{Cl}_2\text{(g)}$?
- a) $K_p = K_c(\text{RT})^{-1}$ d) $K_p = K_c$
 b) $K_p = K_c(\text{RT})$ e) $K_p = K_c(2\text{RT})$
 c) $K_p = K_c(\text{RT})^2$
7. For the reaction $2\text{NO}_2\text{(g)} \rightleftharpoons \text{N}_2\text{O}_4\text{(g)}$, K_p at
 25°C is 7.3, when all partial pressures are
 expressed in atmospheres. What is K_c for this
 reaction? [$R=0.0821 \text{ L}\cdot\text{atm}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$]
- a) 4270 d) 179
 b) 0.0119 e) 2.06
 c) 0.291

8. 0.200 mol NO is placed in a one liter flask at 2273 K. After equilibrium is attained, 0.0863 mol N₂ and 0.0863 mol O₂ are present. What is K_c for this reaction?



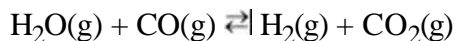
- a) 9.92 d) 39.7
b) 3.15 e) 0.576
c) 0.0372

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

At 25°C, 0.11 mole of N₂O₄ reacts to form 0.10 mol of N₂O₄ and 0.02 mole of NO₂. At 90°C, 0.11 mole of N₂O₄ forms 0.050 mole of N₂O₄ and 0.12 mole of NO₂. From these data we can conclude

- a) N₂O₄ molecules react by a second order rate law.
b) N₂O₄ molecules react by a first order rate law.
c) the reaction is exothermic.
d) N₂O₄ molecules react faster at 25°C than at 90°C.
e) the equilibrium constant for the reaction above increases with an increase in temperature.

10. For the equilibrium system

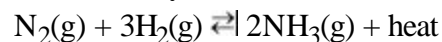


$$\Delta H = -42 \text{ kJ/mol}$$

K_c equals 0.62 at 1260 K. If 0.10 mole each of H₂O, CO, H₂ and CO₂ (each at 1260 K) were placed in a 1.0-Liter flask at 1260 K, when the system came to equilibrium...

| | The temperature would | The mass of CO would |
|----|-----------------------|----------------------|
| a) | decrease | increase |
| b) | decrease | decrease |
| c) | remain constant | increase |
| d) | increase | decrease |
| e) | increase | increase |

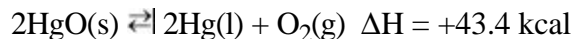
11. For the reaction system,



the conditions that would favor maximum conversion of the reactants to products would be

- a) high temperature and high pressure
b) high temperature, pressure unimportant
c) high temperature and low pressure
d) low temperature and high pressure
e) low temperature and low pressure

12. Solid HgO, liquid Hg, and gaseous O₂ are placed in a glass bulb and are allowed to reach equilibrium at a given temperature.



The mass of HgO in the bulb could be increased by

- a) adding more Hg.
b) removing some O₂.
c) reducing the volume of the bulb.
d) increasing the temperature.
e) removing some Hg.

Answers: (Please use **CAPITAL** letters)

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Answers: 1E 2D 3C 4B 5D 6D 7D 8A 9E 10A 11D 12C