This print-out should have 8 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering. V1:1, V2:1, V3:1, V4:1, V5:2.

You will have 20 minutes for the quiz. Please make sure you write your version numbers on your scantron. Good luck!

Mlib 07 1133
21:02, general, multiple choice, > 1 min, fixed.
001 (part 1 of 1) 5 points
What would be the expression for $K_c$ for the reaction

$$4 \text{NH}_3(g) + 5 \text{O}_2(g) \rightleftharpoons 4 \text{NO}(g) + 6 \text{H}_2\text{O}(g)$$

at equilibrium?

1. $[\text{NO}]^4 [\text{H}_2\text{O}]^6$

2. $[\text{NH}_3]^4 [\text{O}_2]^5$

3. $[\text{NO}]^4 [\text{H}_2\text{O}]^6$ correct

4. $[\text{NH}_3]^4 [\text{O}_2]^5$

5. $[\text{NO}]^4 [\text{H}_2\text{O}]^6$

Explanation:

Msci 17 0514
21:11, general, multiple choice, > 1 min, fixed.
002 (part 1 of 1) 5 points
$K_c = 2.6 \times 10^8$ at 825 K for the reaction

$$2 \text{H}_2(g) + \text{S}_2(g) \rightleftharpoons 2 \text{H}_2\text{S}(g)$$

The equilibrium concentration of H$_2$ is 0.0020 M and that of S$_2$ is 0.0010 M. What is the equilibrium concentration of H$_2$S?

1. 10 M

2. 0.250 M correct

3. 1.00 M

4. 1.50 M

5. None of these is correct.

Explanation:

Msci 17 0503
21:11, general, multiple choice, > 1 min, fixed.
003 (part 1 of 1) 5 points
Suppose the reaction

$$\text{A} \iff \text{B}$$

has an equilibrium constant of 1.0 and the initial concentrations of A and B are 0.5 M and 0.0 M, respectively. Which of the following is the correct value for the final concentration of A?

1. 0.500 M

2. 0.250 M correct

3. 1.00 M

4. 1.50 M

5. None of these is correct.

Explanation:
\[ [A] = 0.5 - x = 0.25 \text{ M} \]

**Msci 17 0509**

21:11, general, multiple choice, > 1 min, fixed.

**004** (part 1 of 1) 5 points

The equilibrium constant for the gaseous reaction

\[ \text{CO} + \text{H}_2\text{O} \rightleftharpoons \text{CO}_2 + \text{H}_2 \]

is 4.0 at a certain temperature. A reaction is carried out at this temperature starting with 2.0 mol/L of CO and 2.0 mol/L of H\(_2\)O. What will be the equilibrium concentration of H\(_2\)?

1. 2.0 M
2. 0.75 M
3. 1.33 M correct
4. 0.67 M
5. 1.5 M

**Explanation:**

\[
K = 4.0 \quad [\text{CO}]_{\text{ini}} = 2.0 \text{ mol/L} \\
[\text{H}_2\text{O}]_{\text{ini}} = 2.0 \text{ mol/L}
\]

\[
\begin{array}{ccc}
\text{Init, M} & 2 & 2 & - & - \\
\Delta, M & -x & -x & +x & +x \\
\text{Final, M} & 2 - x & 2 - x & x & x
\end{array}
\]

Substitute the final concentrations into the equation for \(K\):

\[
K = \frac{[\text{CO}_2][\text{H}_2]}{[\text{CO}][\text{H}_2\text{O}]} \\
4 = \frac{(x)(x)}{(2-x)(2-x)} \\
x^2 = 4(4-4x+x^2) \\
= 16 - 16x + 4x^2 \\
03x^2 - 16x + 16
\]

Solving the quadratic equation,

\[ x = 1.33 \text{ or } x = 4 \]

Since all of the ratios in the reaction are one to one, you cannot end up with a greater number of moles of H\(_2\) than 2 mol/L, so the correct value of \(x\) must be 1.33 M.

**ChemPrin3e T09 44**

21:10, general, multiple choice, < 1 min, fixed.

**005** (part 1 of 1) 5 points

The equilibrium constant \(K_c\) for the reaction

\[ 2\text{SO}_2(g) + \text{O}_2(g) \rightarrow 2\text{SO}_3(g) \]

is 11.7 at 1100 K. A mixture of SO\(_2\), O\(_2\), and SO\(_3\), each with a concentration of 0.015 M, was introduced into a container at 1100 K. Which of the following is true?

1. \(\text{SO}_2(g)\) and \(\text{O}_2(g)\) will be formed until equilibrium is reached. correct
2. \([\text{SO}_3] = 0.045\text{ M}\) at equilibrium.
3. \([\text{SO}_3] = 0.015\text{ M}\) at equilibrium.
4. \(\text{SO}_3(g)\) will be formed until equilibrium is reached.

**Explanation:**

\[
Mlib 06 0003
\]

21:15, general, multiple choice, > 1 min, fixed.

**006** (part 1 of 1) 5 points

For the system

\[ \text{H}_2(g) + \text{CO}_2(g) \rightleftharpoons \text{H}_2\text{O}(g) + \text{CO}(g) \]

at equilibrium, the addition of H\(_2\)(g) would cause (according to LeChatelier’s principle)

1. only more \(\text{H}_2\text{O}(g)\) to form.
2. only more \(\text{CO}(g)\) to form.
3. more \(\text{H}_2\text{O}(g)\) and \(\text{CO}(g)\) to form. correct
4. only more \(\text{CO}_2(g)\) to form.
5. no change in amounts of products or reactants.

**Explanation:**
LeChateliers Principle states that if a change in conditions occurs to a system at equilibrium, the system responds to relieve the stress and reach a new state of equilibrium. \( \text{H}_2(\text{g}) \) is the stress, so the reaction moves to the right to relieve the stress, forming more \( \text{H}_2\text{O} \) and \( \text{CO} \).

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**ChemPrin3e T09 71**
21:15, general, multiple choice, < 1 min, fixed.

007 (part 1 of 1) 5 points
Which of the following equilibrium reactions is NOT affected by changes in pressure?

1. \( 2 \text{BrCl}(\text{g}) \rightarrow \text{Br}_2(\text{g}) + \text{Cl}_2(\text{g}) \) **correct**
2. \( \text{H}_2(\text{g}) + \text{Br}_2(\ell) \rightarrow 2 \text{HBr}(\text{g}) \)
3. \( 2 \text{H}_2\text{O}(\ell) \rightarrow 2 \text{H}_2\text{O}(\ell) + \text{O}_2(\text{g}) \)
4. \( \text{H}_2(\text{g}) + \text{I}_2(\text{s}) \rightarrow 2 \text{HI}(\text{g}) \)
5. \( 2 \text{CO}_2(\text{g}) \rightarrow 2 \text{CO}(\text{g}) + \text{O}_2(\text{g}) \)

**Explanation:**

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**ChemPrin3e T09 12**
21:05, general, multiple choice, < 1 min, fixed.

008 (part 1 of 1) 5 points
If \( \Delta G^\circ = -27.1 \text{ kJ} \) at \( 25^\circ \text{C} \) for the reaction
\[
\text{CH}_3\text{COOH}(\text{aq}) + \text{H}_2\text{O}(\ell) \rightarrow \text{CH}_3\text{COO}^- (\text{aq}) + \text{H}_3\text{O}^+(\text{aq}),
\]
calculate \( K_a \) for this reaction at 298 K.

1. \( 1.15 \times 10^{-11} \)
2. \( 5.63 \times 10^4 \)
3. \( 1.78 \times 10^{-5} \) **correct**
4. 1.01
5. \( 9.89 \times 10^{-1} \)

**Explanation:**