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

$$4\,NH_3(g) + 5\,O_2(g) \rightleftharpoons 4\,NO(g) + 6\,H_2O(g)$$

at equilibrium?

1. $[NO]^4\,[H_2O]^6$

2. $[NH_3]^4\,[O_2]^5$

3. $\dfrac{[NO]^4\,[H_2O]^6}{[NH_3]^4\,[O_2]^5}$ **correct**

4. $\dfrac{[NH_3]^4\,[O_2]^5}{[NO]^4\,[H_2O]^6}$

5. $\dfrac{[NO]^4\,[H_2O]}{[NH_3]^4}$

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

$$2\,H_2(g) + S_2(g) \rightleftharpoons 2\,H_2S(g)$$

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_2S?

1. 10 M

2. 1.02 M **correct**

3. 0.10 M

4. 0.0010 M

Explanation:

$K_c = 2.6 \times 10^8$ $\qquad [H_2]_{eq} = 0.0020$ M

$[S_2]_{eq} = 0.0010$ M

$$2\,H_2(g) + S_2 \rightleftharpoons 2\,H_2S$$

$$K_c = \frac{[H_2S]^2}{[H_2]^2\,[S_2]}$$

$$[H_2S] = \sqrt{K_c\,[H_2]^2\,[S_2]}$$

$$= \sqrt{(2.6 \times 10^8)\,(0.0020\text{ M})^2\,(0.0010\text{ M})}$$

$$= 1.0\text{ M}$$

Msci 17 0503

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

003 (part 1 of 1) 5 points

Suppose the reaction

$$A \rightleftharpoons B$$

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:

$K = 1.0$ $\qquad [A]_{ini} = 0.5$ M

$[B]_{ini} = 0$ M

	A	$\rightleftharpoons$	B
ini, M	0.5		0.0
Δ, M	$-x$		x
eq, M	$0.5 - x$		x

$$K = \frac{[B]}{[A]} = 1.0$$

$$\frac{x}{0.5 - x} = 1.0$$

$$x = 0.25\text{ M}$$

$$[\mathrm{A}] = 0.5 - x = 0.25\ \mathrm{M}$$

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

$$\mathrm{CO} + \mathrm{H_2O} \rightleftharpoons \mathrm{CO_2} + \mathrm{H_2}$$

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_2O. 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:

$K = 4.0$ $\qquad [\mathrm{CO}]_{\mathrm{ini}} = 2.0$ mol/L

$[\mathrm{H_2O}]_{\mathrm{ini}} = 2.0$ mol/L

	CO	+ H_2O	$\rightleftharpoons$ CO_2	+ H_2
Ini, M	2	2	−	−
Δ, M	$-x$	$-x$	$+x$	$+x$
Final, M	$2-x$	$2-x$	x	x

Subsitute the final concentrations into the equation for K:

$$K = \frac{[\mathrm{CO_2}]\,[\mathrm{H_2}]}{[\mathrm{CO}]\,[\mathrm{H_2O}]}$$

$$4 = \frac{(x)\,(x)}{(2-x)\,(2-x)}$$

$$4 = \frac{x^2}{4 - 4x + x^2}$$

$$x^2 = 4(4 - 4x + x^2)$$

$$= 16 - 16x + 4x^2$$

$$03x^2 - 16x + 16$$

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

$$2\,\mathrm{SO_2(g)} + \mathrm{O_2(g)} \rightarrow 2\,\mathrm{SO_3(g)}$$

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. $SO_2(g)$ and $O_2(g)$ will be formed until equilibrium is reached. **correct**

2. $[SO_3] = 0.045$ M at equilibrium.

3. $[SO_3] = 0.015$ M at equilibrium.

4. $SO_3(g)$ will be formed until equilibrium is reached.

5. $[SO_3] = [SO_2] = [O_2]$ at equilibrium.

Explanation:

Mlib 06 0003

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

006 (part 1 of 1) 5 points

For the system

$$\mathrm{H_2(g)} + \mathrm{CO_2(g)} \rightleftharpoons \mathrm{H_2O(g)} + \mathrm{CO(g)}$$

at equilibrium, the addition of $H_2(g)$ would cause (according to LeChatelier's principle)

1. only more $H_2O(g)$ to form.

2. only more CO(g) to form.

3. more $H_2O(g)$ and CO(g) to form. **correct**

4. only more $CO_2(g)$ to form.

5. no change in amounts of products or reactants.

Explanation:
LeChatelier's 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. $H_2(g)$ is the stress, so the reaction moves to the right to relieve the stress, forming more H_2O and CO.

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. $2\,BrCl(g) \rightarrow Br_2(g) + Cl_2(g)$ **correct**

2. $H_2(g) + Br_2(\ell) \rightarrow 2\,HBr(g)$

3. $2\,H_2O_2(\ell) \rightarrow 2\,H_2O(\ell) + O_2(g)$

4. $H_2(g) + I_2(s) \rightarrow 2\,HI(g)$

5. $2\,CO_2(g) \rightarrow 2\,CO(g) + O_2(g)$

Explanation:

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

008 (part 1 of 1) 5 points
If $\Delta G^\circ = 27.1$ kJ at 25°C for the reaction
$CH_3COOH(aq) + H_2O(\ell) \rightarrow$
$CH_3COO^-(aq) + H_3O^+(aq)$,
calculate K_a for this reaction at 298 K.

1. 1.15×10^{-11}

2. 5.63×10^{4}

3. 1.78×10^{-5} **correct**

4. 1.01

5. 9.89×10^{-1}

Explanation: