

## CHE 107 MID-TERM EXAMINATION I

13 Feb 19

University of Kentucky

Department of Chemistry

Name: \_\_\_\_\_ SID: \_\_\_\_\_ Seat No.: \_\_\_\_\_ Room: \_\_\_\_\_

1.	<p>The equilibrium constant (<math>K_c</math>) for the reaction</p> $\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightleftharpoons 2 \text{NH}_3(\text{g})$ <p>is 0.650 at 375°C. What is the equilibrium constant, <math>K_c</math>, for the reaction</p> $\text{NH}_3(\text{g}) \rightleftharpoons \frac{1}{2} \text{N}_2(\text{g}) + \frac{3}{2} \text{H}_2(\text{g})$ <p>at 375°C?</p> <p>A. 1.54                      B. 0.420                      C. 1.24                      D. 0.810</p>
2.	<p>The equilibrium constant (<math>K_c</math>) for the reaction</p> $\text{N}_2(\text{g}) + 3 \text{H}_2(\text{g}) \rightleftharpoons 2 \text{NH}_3(\text{g})$ <p>is 0.650 at 375°C. What is the value of <math>K_p</math> for the same reaction?</p> <p>A. <math>2.30 \times 10^{-4}</math>      B. <math>1.84 \times 10^3</math>      C. <math>5.44 \times 10^{-4}</math>      D. <math>6.86 \times 10^{-4}</math></p>
3.	<p>Which of the following reactions would have the same value for <math>K_p</math> and <math>K_c</math>?</p> <p>A. <math>2 \text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})</math></p> <p>B. <math>\text{PbO}(\text{s}) + \text{C}(\text{s}) \rightleftharpoons \text{Pb}(\text{l}) + \text{CO}(\text{g})</math></p> <p>C. <math>2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2 \text{SO}_3(\text{g})</math></p> <p>D. <math>\text{H}_2(\text{g}) + \text{Br}_2(\text{g}) \rightleftharpoons 2 \text{HBr}(\text{g})</math></p>
4.	<p>Select the correct equilibrium constant expression for the following reaction.</p> $2 \text{ZnS}(\text{s}) + 3 \text{O}_2(\text{g}) \rightleftharpoons 2 \text{ZnO}(\text{s}) + 2 \text{SO}_2(\text{g})$

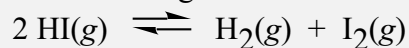
A. C.

B.

D.

5.

Hydrogen iodide decomposes according to the reaction



A 0.275 mol sample of HI was injected into a 1.00 L reaction vessel and allowed to come to equilibrium at a specified temperature. If the HI is found to be 20.0% dissociated at equilibrium, what is  $K_c$  for the above reaction?

A. 0.0156

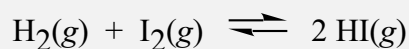
B. 0.125

C. 16.0

D. 0.444

6.

Calculate the concentrations of  $\text{H}_2$ ,  $\text{I}_2$  and HI at equilibrium if 0.0400 mol of HI is placed in a 1.00 L flask at 430 °C.  $K_c$  for the reaction



is 54.3 at this temperature.

[ $\text{H}_2$ ] (M)

[ $\text{I}_2$ ] (M)

[HI] (M)

A. 0.0200

0.0200

0.0200

B. 0.00427

0.00427

0.0315

C. 0.0315

0.0315

0.00850

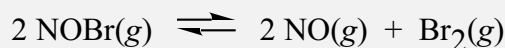
D. 0.00478

0.00478

0.0352

7.

At equilibrium nitrosyl bromide, NOBr, is 34% dissociated at 25°C and the total pressure inside the glass reaction vessel is 0.25 atm.



What is  $K_p$  at this temperature?

A. 0.25

B. 3.5

C.  $9.6 \times 10^{-3}$

4.  $1.4 \times 10^{-6}$

8.

A sample of pure  $\text{NO}_2$  gas decomposes at a given temperature according to the

	<p>reaction</p> $2 \text{NO}_2(\text{g}) \rightleftharpoons 2 \text{NO}(\text{g}) + \text{O}_2(\text{g})$ <p>with a <math>K_p = 206</math>. At equilibrium, <math>P_{\text{NO}} = 0.472</math> atm. Calculate <math>P_{\text{NO}_2}</math> at equilibrium.</p> <p>A. 0.236 atm      B. 0.0160 atm      C. 0.488 atm      D. 0.472 atm</p>
--	---

9.	<p>The equilibrium constant, <math>K_c</math>, for the reaction</p> $2 \text{NO}(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons 2 \text{NOCl}(\text{g})$ <p>is <math>6.5 \times 10^4</math> at <math>35^\circ\text{C}</math>. If <math>3.0 \times 10^{-2}</math> mol of NO, <math>6.3 \times 10^{-3}</math> mol of <math>\text{Cl}_2</math> and 5.4 mol of NOCl are mixed in a 3.0 L flask, in which direction will the system proceed to reach equilibrium?</p> <p>A. It will shift to the right.          B. It will shift to the left.          C. The system is at equilibrium so there will be no shift.          D. Insufficient information is given to determine the shift.</p>
----	---

10.	<p>The equilibrium concentrations of the species A(g), B(g) and C(g) in the reaction</p> $2 \text{A}(\text{g}) + \text{B}(\text{g}) \rightleftharpoons 2 \text{C}(\text{g})$ <p>will not change</p> <p>A. when the temperature is changed.      C. when the volume is changed.          B. when the pressure is changed.      D. when a catalyst is added.</p>
-----	--

11.	<p>Suppose that the volume of the container of an equilibrium mixture of the gases NO, <math>\text{O}_2</math>, and <math>\text{NO}_2</math> is suddenly doubled at constant temperature. When the system</p> $2 \text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2 \text{NO}_2(\text{g})$ <p>returns to equilibrium,</p> <p>A. the concentration of <math>\text{NO}_2</math> will have increased.          B. the value of the equilibrium constant, <math>K_c</math>, will have increased.          C. the concentrations of NO and <math>\text{O}_2</math> will have increased.          D. the value of the equilibrium constant, <math>K_p</math>, will have decreased.</p>
-----	---

12.	<p>Heating solid sodium bicarbonate in a closed vessel established the following</p>
-----	--



17.	To which one of the following would addition of an equal volume of 0.60 M NaOH solution lead to a final solution having the <b>lowest</b> pH? A. 0.30 M HCl    B. 0.40 M NaNO <sub>3</sub> C. 0.70 M KOH    D. pure water
-----	--

18.	What is the % ionization of hydrofluoric acid in a 0.0046 M HF solution? (K <sub>a</sub> of HF is 7.0 x 10 <sup>-4</sup> ) A. 5.3%    B. 74%    C. 17%    D. 32%
-----	--

19.	The pH of a HF solution is 6.20. The K <sub>a</sub> for HF is 7.1 x 10 <sup>-4</sup> . What is the ratio [F <sup>-</sup> ]/[HF] at this pH? A. 1.4 x 10 <sup>-4</sup> B. 8.9 x 10 <sup>-4</sup> C. 1.1 x 10 <sup>3</sup> D. 8.7 x 10 <sup>3</sup>
-----	--

20.	When 2.0 x 10 <sup>-2</sup> moles of a monoprotic acid is dissolved in 350.0 mL of water, the pH is 3.05. Calculate K <sub>a</sub> for this acid. A. 1.6 x 10 <sup>-2</sup> B. 5.7 x 10 <sup>-2</sup> C. 8.9 x 10 <sup>-4</sup> D. 1.4 x 10 <sup>-5</sup>
-----	--

21.	A 0.30 M solution of a weak base has a pH of 10.66. Calculate K <sub>b</sub> of the base. A. 7.0 x 10 <sup>-7</sup> B. 7.3 x 10 <sup>-11</sup> C. 8.5 x 10 <sup>-6</sup> D. 1.7 x 10 <sup>-5</sup>
-----	---

22.	Calculate the pH of a 0.28 M sodium acetate, CH <sub>3</sub> COONa, solution. K <sub>a</sub> for CH <sub>3</sub> COOH is 1.8 x 10 <sup>-5</sup> . A. 2.66    B. 4.90    C. 9.10    D. 11.34
-----	--

23.	Predict the pH of the following salt solutions: CaCl <sub>2</sub> ,    K <sub>3</sub> PO <sub>4</sub> ,    NaF,    NH <sub>4</sub> NO <sub>3</sub> A.    neutral    basic    basic    acidic B.    basic    neutral    acidic    basic C.    acidic    acidic    neutral    basic D.    basic    acidic    acidic    neutral
-----	---

24.	P <sub>4</sub> O <sub>10</sub> is classified as an acidic oxide because it A. is insoluble in water. B. is amphoteric. C. reacts with acids to produce a salt. D. gives a solution of phosphoric acid, H <sub>3</sub> PO <sub>4</sub> , in water.
-----	---

	25. Which of the following is a Lewis acid but <u>not</u> a Brønsted acid?
A. HClO <sub>4</sub> B. Fe <sup>3+</sup> C. HCN    D. NH	