



### Chemistry 106 Fall 2006 Exam 3 Form A

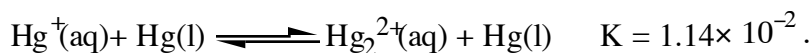
5. What is equal in an equilibrium?
- A. the rate constants for the forward and reverse reactions
  - B. the time that a particular atom or molecule spends as a reactant and product
  - C. the concentrations of reactant and products
  - D. the rate of the forward and reverse reaction
  - E. none of the above
6. If  $K$  for a reaction is very small
- A.  $\Delta H^\circ$  is definitely positive.
  - B.  $\Delta G^\circ$  is definitely positive.
  - C.  $\Delta G^\circ$  is definitely negative.
  - D.  $\Delta H^\circ$  is definitely negative.
  - E. none of the above
7. Consider the equilibrium:  
 $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \quad K_C = 2.62 \times 10^3$   
What is  $K_p$  for pressure units of atm at a temperature of 298 K?
- A. 107
  - B.  $6.41 \times 10^4$
  - C. 1.06
  - D.  $6.49 \times 10^6$
  - E. 4.38
8. For a particular hypothetical reaction  $A + 2B \rightarrow C$   $\Delta G^\circ = 137.0$  kJ/mol. What is the equilibrium constant for this reaction at 298 K?
- A.  $9.698 \times 10^{-25}$
  - B.  $2.724 \times 10^{21}$
  - C. 0.9462
  - D. 1.057
  - E.  $3.689 \times 10^{-3}$
9. Under what conditions are the values of  $K_c$  and  $K_p$  for a given gas phase equilibrium the same?
- A. same temperature
  - B. no change in moles of gas in the reaction
  - C. if the stoichiometric coefficients are the same on the reactant and product sides
  - D. all the above
  - E. none of the above
10. Given the two measurements below, calculate  $\Delta H^\circ$ .

T, °C	K
10	$2.5 \times 10^3$
25	$9.4 \times 10^4$

- A. 170 kJ/mol
- B. 452 J/mol
- C. -5.21 kJ/mol
- D. 5.21 kJ/mol
- E. -161 kJ/mol

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11. The equilibrium constant for an endothermic reaction
- A. is temperature independent.
  - B. increases with increasing temperature.
  - C. decreases with increasing temperature.
  - D. cannot be predicted.
  - E. cannot be predicted without knowing  $\Delta S$  too.
12. Mercury ions exist as the mercurous dimer  $\text{Hg}_2^{2+}$  and  $\text{Hg}^+$ . If  $\text{Hg}_2^{2+}$  is in contact with liquid mercury,  $\text{Hg}(l)$ , the equilibrium below is established:



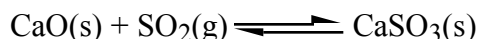
If a 0.100 M solution of  $\text{Hg}^+$  is put in contact with liquid mercury, what will be the resulting equilibrium concentration of  $\text{Hg}_2^{2+}$ ?

- A.  $1.14 \times 10^{-2}$  M
  - B.  $1.13 \times 10^{-3}$  M
  - C. 0.100 M
  - D. 0.0887 M
  - E. 0.1114 M
13. When can an "x" be ignored in solving an algebraic form of an equilibrium expression?
- A. whenever it simplifies the algebraic expression enough to allow calculation
  - B. whenever it is added to or subtracted from a concentration value
  - C. whenever it is in the denominator
  - D. whenever it is added to or subtracted from a concentration value that is large in comparison to it
  - E. whenever it is squared or raised to any power higher than 1
14. A catalyst
- A. lowers activation energies in both the forward and reverse reactions in a chemical equilibrium.
  - B. is necessary for any reaction to go to completion.
  - C. changes the value of an equilibrium constant by changing the forward and reverse activation energies.
  - D. stresses an equilibrium by consuming reactants.
  - E. none of the above
15. For a particular hypothetical reaction  $\text{A} + 2\text{B} \rightarrow \text{C}$  in the gas phase how does decreasing the pressure affect the equilibrium?
- A. It shifts the equilibrium towards more reactants.
  - B. It does not change the equilibrium concentrations.
  - C. The relative concentrations of B and C do not change.
  - D. It only changes the concentration of B.
  - E. It shifts the equilibrium towards more products.

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16. In equilibrium expressions, solids and solvents are ignored because they
- A. have the assigned value of zero.
  - B. are not necessary for the reaction
  - C. are treated with different rate constants.
  - D. do not change concentration.
  - E. have constant values,  $K_s$  and  $K_l$ .

17. The  $\text{SO}_2$  in the exhaust gas from coal burning power plants may be removed by the reaction:

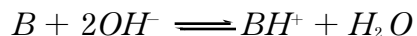


The equilibrium expression for this scrubbing reaction of calcium oxide and sulfur dioxide to make calcium sulfite is

- A.  $K_c = [\text{CaO}] + [\text{SO}_2]$ .
  - B.  $K_c = [\text{CaSO}_3]/[\text{SO}_2][\text{CaO}]$ .
  - C.  $K_c = 1/[\text{SO}_2]$ .
  - D.  $K_c = [\text{CO}_2]$ .
  - E.  $K_c = [\text{CaSO}_3]/\{[\text{SO}_2]+[\text{CaO}]\}$ .
18. The expression for  $K_a$  where HA represents a weak acid is:
- A.  $[\text{HA}]/\{[\text{H}^+]+[\text{A}^-]\}$
  - B.  $\{[\text{H}^+]+[\text{A}^-]\}/[\text{HA}]$
  - C.  $[\text{H}_2\text{A}^+][\text{OH}^-]/[\text{HA}]$
  - D.  $[\text{HA}]/\{[\text{H}^+][\text{A}^-]\}$
  - E.  $\{[\text{H}^+][\text{A}^-]\}/[\text{HA}]$
19. The degree of ionization of a weak acid is
- A. between 10 and 100%.
  - B. 100%.
  - C. between 1 and 10%.
  - D. dependent on the total concentration of the acid.
  - E. none of the above

20. The equilibrium constant  $K_b$  describes the following reaction for a weak base, B, in aqueous solution:

A.



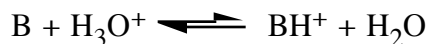
B.



C.



D.



E.



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21. What is the pH of a 0.010 M solution of acetic acid, given that the weak acids  $K_a$  is  $1.8 \times 10^{-5}$ ?
- A. 4.74                      B. 3.37                      C. 2.74                      D. 2.00
22. What is the concentration of the molecular form of HF in a 1.00 M solution of HF given that the  $K_a$  of the weak acid is  $6.8 \times 10^{-4}$ ?
- A. 0.97 M                      B.  $6.8 \times 10^{-4}$  M  
C. 1.59 M                      D. 1.00 M  
E.  $2.6 \times 10^{-2}$  M
23. Which of these is a strong acid that ionizes to make a weak acid?
- A.  $H_2SO_3$                       B. HCl                      C.  $HNO_3$                       D.  $H_2SO_4$                       E.  $H_3PO_4$
24. The weaker the acid,
- A. the weaker its conjugate base.  
B. the less concentrated the acid.  
C. the more concentrated the conjugate base.  
D. the stronger its conjugate base.  
E. none of the above
25. A solution with pH of 9.50 has a pOH of
- A. 9.50.                      B. 4.50.                      C. 23.50.                      D. 1.50                      E. 0.50.
26. A Lewis base is
- A. an electron pair acceptor  
B. a proton donor  
C. an electron pair donor  
D. a proton acceptor  
E. none of the above
27. An acidic solution has
- A. a pOH more than 7.                      B. a pH less than 7.  
C. more  $H^+$  than  $OH^-$ .                      D. all the above.
28. Lead(II) chloride salt is not very soluble in water. How does the solubility of lead chloride change as sodium chloride is added to the water in contact with solid lead(II) chloride?
- A. Sodium chloride increases the solubility of lead(II) chloride.  
B. Sodium chloride has no effect—it is an inert electrolyte.  
C. It depends on how vigorously you stir the solution.  
D. Sodium chloride has no effect—lead(II) chloride is insoluble in water and also insoluble in salt water.  
E. Sodium chloride decreases the solubility of lead(II) chloride.

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29. Which of the following is **NOT** a buffer system? A solution containing roughly equal concentrations of
- A. fluoride ion and hydrofluoric acid.
  - B. phosphate ion and monophosphate ion.
  - C. chloride ion and hydrochloric acid.
  - D. carbonate ion and bicarbonate ion.
  - E. they are all buffers
30. Compounds that are reactive as both an acid and base are called:
- A. amphibious
  - B. amphoteric
  - C. bacidic
  - D. androgynous
  - E. none of the above
31. A solution of sulfuric acid (25.00 mL) was titrated to completion (all protons reacted) with 34.55 mL of 0.1020 M sodium hydroxide. What was the concentration of the sulfuric acid?
- A. 0.2819 M
  - B. 0.1410 M
  - C. 0.07048 M
  - D. 0.0353 M
  - E. 1.418 M
32. A buffer system is set up with  $[HA] = 2[A^-]$ . If  $pK_a = 5.5$ , what is the pH of the buffer?
- A. 5.8
  - B. 7.0
  - C. 5.2
  - D. 3.5
  - E. 7.5
33. What is the pH of a 0.15 M solution of ammonium bromide? The  $K_b$  value of ammonia is  $1.8 \times 10^{-5}$ .
- A. 11.22
  - B. 7.00
  - C. 5.04
  - D. 2.78
  - E. 9.50
34. Which is **NOT** related to  $K_w$
- A.  $2 H_2O \rightleftharpoons H_3O^+ + OH^-$ .
  - B.  $1.0 \times 10^{-14}$  at 25° C.
  - C.  $[H_3O^+][OH^-]$ .
  - D.  $[H^+][A^-]/[HA]$
  - E.  $[H^+][OH^-]$

Answer Key for Test "Exam 3 F06 Form A.mte", 11/4/07

No. in Q-Bank	No. on Test	Correct Answer
15 19	1	D
15 13	2	B
15 16	3	E
15 111	4	E
15 6	5	D
15 113	6	B
15 112	7	A
15 114	8	A
15 31	9	D
15 116	10	A
15 74	11	B
15 63	12	B
15 70	13	D
15 51	14	A
15 115	15	A
15 82	16	D
15 83	17	C
16 111	18	E
16 18	19	D
16 27	20	E
16 11	21	B
16 12	22	A
16 15	23	D
16 112	24	D
16 46	25	B
16 113	26	C
16 49	27	D
16 94	28	E
16 64	29	C
16 102	30	B
16 90	31	C
16 71	32	C
16 57	33	C
16 114	34	D