Sample Questions for Exam 2. Chem 1310 A/B, Dr. Williams, Revised 10/27/2005
-------chapter 6----------

1. Which of the following molecules is nonpolar?
a. Br_2
b. BrCl
c. HBr
e. CO_2
e. all of these

Answer: a

2. Which of the following generalizations can be made about intermolecular forces?
a. Intermolecular forces are generally stronger than covalent bonds.
b. Intermolecular forces are less directional than covalent bonds.
c. Intermolecular forces operate at shorter ranges than covalent bonds.
d. All of these are valid generalizations.
e. None of these is a valid generalization.

Answer: b, revised

3. In the mixing of ethanol (CH_3CH_2OH) and water, an important role is played by attractive
a. ion-ion interactions.
b. ion-dipole interactions.
c. dipole-dipole.
d. dispersion interactions.
e. c & d.

Answer: e
4. In which of the following liquids are intermolecular interactions due to dispersion forces only?
a. Ne
b. N_2
c. Cl_2
d. all of these
e. none of these

Answer: d

5. In which of the following liquids do hydrogen bonding contribute significantly to the attractive interactions between molecules?
a. Ne
b. N_2
c. Cl_2
d. all of these

e. none of these

Answer: e

6. In which of the following liquids do hydrogen bonding contribute significantly to the attractive interactions between molecules?
a. H_2O
b. HF
c. NH_3
d. all of these
e. none of these

Answer: d

7. As the temperature of $H_2O(s)$ is reduced from –30°C to –50°C, its vapor pressure must
a. increase.
b. decrease.
c. remain constant.
d. This question has no meaning, because solid water has no vapor pressure.

Answer: b

8. The vapor pressure of a dilute solution of a nonvolatile solute is
a. less than that of the pure solvent.
b. greater than that of the pure solvent.
c. equal to that of the pure solvent.
d. equal to that of the pure solute.
e. none of these

Answer: a

-------chapter 7----------
9. As the equilibrium state of a chemical reaction is approached,
a. the rate of the forward reaction approaches zero.
b. the rate of the backward reaction approaches zero.
c. the rates of the forward and backward reactions approach the same value.
d. Both a and b are correct.
e. none of these

Answer: c

10. The value of the equilibrium constant for a chemical reaction with two gas phase reactants is dependent upon
a. initial amounts of reactants.
b. final amounts of reactants.
c. total pressure.

d. all of these
e. none of these

Answer: e, revised

For the next two questions consider the chemical reaction,

$PCl_3(g) + Cl_2(g) \iff PCl_5(g)$.

11. If the equilibrium is rewritten as 2PCl3(g) + 2Cl2(g) <=> 2PCl5(g), the equilibrium constant would change from its original value K to
a. K/2
b. 2K
c. K^2
d. $K^{1/2}$
e. none of these

Answer: c

12. If at equilibrium a nonreacting gas is added without changing the volume or temperature, the response to the stress will be
a. a shift to the right.
b. a shift to the left.
c. no change.
d. unpredictable.
e. none of these
Answer: c
For the next three questions, consider the reaction,

$SnO_2(s) + 2\ CO(g) \iff Sn(s) + 2\ CO_2(g)$,

T = 500°C, equilibrium constant K = 0.025.

13. At equilibrium, if the partial pressure of CO_2 is 0.050 atm, then the partial pressure of CO must be
a. 0.100 atm
b. 0.316 atm
c. 1.41 atm
d. 2.00 atm
e. none of these

Answer: b

14. The reaction is initiated by adding CO(g) at a pressure of 0.500 atm to a rigid vessel containing excess $SnO_2(s)$. At equilibrium, the partial pressure of $CO_2(g)$ will be
a. 0.00625 atm

b. 0.0125 atm
c. 0.0790 atm
d. 0.112 atm
e. none of these
Answer: e
$K = (P_{CO2})^2/(P_{CO})^2$
From ICE, $K\ 0.025 = (2y)^2/(0.5\text{-}2y)^2 = (\text{aprox})\ (2y)^2/(0.5)^2 = > y = 3.9\text{x}10^{-2}$

15. With the system at equilibrium, if the amount of Sn(s) is doubled, the partial pressure of CO(g) will
a. increase.
b. decrease.
c. remain unchanged.
d. change unpredictably.
e. none of these
Answer: c

-------chapter 8----------

16. The conjugate base of H_3PO_4 is
b. $H_2PO_4^-$
a. HPO_4^{2-}
c. PO_4^{3-}
d. PO_3^-
e. none of these

Answer: b, revised

17. For an aqueous solution at 25°C, if $[OH^-] = 6.25 \times 10^{-9}$ M, then $[H^+] =$
a. 6.25×10^{-9} M
b. 1.0×10^{-7} M
c. 1.6×10^{-6} M
d. 7.9×10^{-5} M
e. none of these

Answer: c

18. For a 2.3 M solution of the strong acid, nitric acid, at 25°C, the calculated pH is
a. –0.83
b. –0.36
c. 0.00
d. 0.36
e. none of these

Answer: b

19. What is the concentration of H^+ in an aqueous solution with a pH of 9.25?
a. 2.5×10^{-10} M
b. 5.6×10^{-10} M
c. 2.5×10^{-9} M
d. 9.6×10^{-5} M
e. none of these

Answer: b

20. What is the concentration of OH^- in an aqueous solution with a pH of 1.75 at 25°C?
a. 5.6 x 10–13 M
b. 1.8 x 10–12 M
c. 1.8 x 10–2 M
d. 5.6 x 10–1 M
e. none of these

Answer: a

The next question concerns the weak base hydroxylamine ($HONH_2$), for which Kb = 1.1×10^{-8} at 25°C.

21. What is the pH of a 0.04 M aqueous hydroxylamine solution at 25°C?
a. 4.7×10^{-10}
b. 2.1×10^{-5}
c. 4.7
d. 9.3
e. none of these

Answer: d
22. At which pH would hydroxylamine be the best buffer?
a. 6.0
b. 7.4
c. 8.5
d. 9.9
e. none of these
Answer: a

23. Which of the following pKa values belongs to the weakest acid?
a. 3.18
b. 3.35
c. 7.04
d. 7.53
e. This cannot be determined from the given information.

Answer: d

24. Which of the following Ka values belongs to the acid with the strongest conjugate base?
a. 4.3×10^{-7}
b. 5.0×10^{-7}
c. 1.9×10^{-5}
d. 6.5×10^{-5}
e. This cannot be determined from the given information.

Answer: a

-------chapter 9----------
Consider cadmium hydroxide [$Cd(OH)_2$], for which the solubility in water at 25°C is 1.7×10^{-5} M .

25. The value of Ksp for $Cd(OH)_2(s)$ at 25°C is
a. 4.9×10^{-15}
b. 2.0×10^{-14}
c. 2.9×10^{-10}
d. 1.2×10^{-9}
e. none of these

Answer: b
Ksp $= (1.7 \times 10^{-5})(3.4 \times 10^{-5})^2 = 2.0 \times 10^{-14}$

For the next questions, consider the following solubility product data for various chromates at 25°C:
Ksp $Ag_2CrO_4 = 1.9 \times 10^{-12}$
Ksp $BaCrO_4 = 2.1 \times 10^{-10}$
Ksp $PbCrO_4 = 1.8 \times 10^{-14}$

26. The chromate that is most soluble in water at 25°C is
a. Ag2CrO4
b. BaCrO4
c. PbCrO4
d. impossible to determine.
e. none of these

Answer: a

27. The solubility of BaCrO4(s) in water at 25°C is
a. 1.0 x 10–10 M
b. 2.1 x 10–10 M
c. 7.2 x 10–6 M
d. 1.4 x 10–5 M

e. none of these

Answer: d

28. The solubility of BaCrO4(s) in an aqueous solution of 0.020 M barium chloride at 25°C is
a. 4.2 x10–12 M
b. 2.1 x10–10 M
c. 1.0 x10–8 M
d. 1.0 x10–4 M
e. none of these

Answer: c

29. If 105 mL of 2.0 x10–5 M aqueous barium chloride is combined with 105 mL of 2.0 x10–5 M aqueous sodium chromate at 25°C, the result will be
a. a sodium chloride precipitate.
b. a BaCrO4 precipitate.
c. a barium chloride precipitate.
d. a sodium chromate precipitate.
e. no precipitate

Answer: e

30. What solid will precipitate first if an aqueous solution of sodium chromate at 25°C is slowly added to an aqueous solution containing 0.0010 M lead nitrate and 0.100 M barium nitrate at 25°C?
a. NaNO3(s)
b. Pb(NO3)2(s)
c. BaCrO4(s)
d. PbCrO4(s)
e. none of these

Answer: d

31. When 250 mL of 0.050 M K_2CrO_4(aq) is combined with 250 mL of 0.010 M $Pb(NO_3)_2$(aq), a precipitate is observed. When the mixture comes to equilibrium at 25°C, $[Pb^{2+}]$ will be
a. 4.5 x10–13 M
b. 9.0 x10–13 M
c. 3.6 x10–16 M
d. 7.2 x10–16 M
e. none of these
Answer: b

-------chapter 10----------