

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. Br₂
- b. BrCl
- c. HBr
- e. CO₂
- 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 (CH₃CH₂OH) 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. N₂
- c. Cl₂
- 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. N₂
- c. Cl₂
- 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 $\text{H}_2\text{O}(\text{s})$ 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

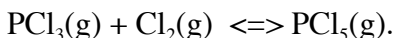
10. The value of the equilibrium constant for a chemical reaction with two gas phase reactants is dependent upon

- 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,



11. If the equilibrium is rewritten as $2\text{PCl}_3(\text{g}) + 2\text{Cl}_2(\text{g}) \rightleftharpoons 2\text{PCl}_5(\text{g})$, 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

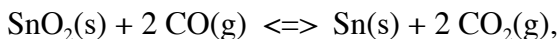
Answer: c

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,



$T = 500^\circ\text{C}$, 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 $\text{CO}(\text{g})$ at a pressure of 0.500 atm to a rigid vessel containing excess $\text{SnO}_2(\text{s})$. At equilibrium, the partial pressure of $\text{CO}_2(\text{g})$ will be

- a. 0.00625 atm

- b. 0.0125 atm
- c. 0.0790 atm
- d. 0.112 atm
- e. none of these

Answer: e

$$K = (P_{\text{CO}_2})^2 / (P_{\text{CO}})^2$$

$$\text{From ICE, } K \ 0.025 = (2y)^2 / (0.5 - 2y)^2 = (\text{aprox}) (2y)^2 / (0.5)^2 = > y = 3.9 \times 10^{-2}$$

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 $[\text{OH}^-] = 6.25 \times 10^{-9} \text{ M}$, then $[\text{H}^+] =$

- a. $6.25 \times 10^{-9} \text{ M}$
- b. $1.0 \times 10^{-7} \text{ M}$
- c. $1.6 \times 10^{-6} \text{ M}$
- d. $7.9 \times 10^{-5} \text{ M}$
- 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. $2.5 \times 10^{-10} \text{ M}$
- b. $5.6 \times 10^{-10} \text{ M}$
- c. $2.5 \times 10^{-9} \text{ M}$
- d. $9.6 \times 10^{-5} \text{ M}$
- 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. $5.6 \times 10^{-13} \text{ M}$
- b. $1.8 \times 10^{-12} \text{ M}$
- c. $1.8 \times 10^{-2} \text{ M}$
- d. $5.6 \times 10^{-1} \text{ M}$
- e. none of these

Answer: a

The next question concerns the weak base hydroxylamine ($HONH_2$), for which $K_b = 1.1 \times 10^{-8}$ 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 pK_a 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 K_a 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 $[\text{Cd}(\text{OH})_2]$, for which the solubility in water at 25°C is $1.7 \times 10^{-5} \text{ M}$.

25. The value of K_{sp} for $\text{Cd}(\text{OH})_2(\text{s})$ 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

$$K_{sp} = (1.7 \times 10^{-5})(3.4 \times 10^{-5})^2 = 2.0 \times 10^{-14}$$

For the next questions, consider the following solubility product data for various chromates at 25°C :

$$K_{sp} \text{ Ag}_2\text{CrO}_4 = 1.9 \times 10^{-12}$$

$$K_{sp} \text{ BaCrO}_4 = 2.1 \times 10^{-10}$$

$$K_{sp} \text{ PbCrO}_4 = 1.8 \times 10^{-14}$$

26. The chromate that is most soluble in water at 25°C is

- a. Ag_2CrO_4
- b. BaCrO_4
- c. PbCrO_4
- d. impossible to determine.
- e. none of these

Answer: a

27. The solubility of $\text{BaCrO}_4(\text{s})$ in water at 25°C is

- a. $1.0 \times 10^{-10} \text{ M}$
- b. $2.1 \times 10^{-10} \text{ M}$
- c. $7.2 \times 10^{-6} \text{ M}$
- d. $1.4 \times 10^{-5} \text{ M}$

e. none of these

Answer: d

28. The solubility of $\text{BaCrO}_4(\text{s})$ in an aqueous solution of 0.020 M barium chloride at 25°C is

- a. 4.2×10^{-12} M
- b. 2.1×10^{-10} M
- c. 1.0×10^{-8} M
- d. 1.0×10^{-4} M
- e. none of these

Answer: c

29. If 105 mL of 2.0×10^{-5} M aqueous barium chloride is combined with 105 mL of 2.0×10^{-5} M aqueous sodium chromate at 25°C , the result will be

- a. a sodium chloride precipitate.
- b. a BaCrO_4 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. $\text{NaNO}_3(\text{s})$
- b. $\text{Pb}(\text{NO}_3)_2(\text{s})$
- c. $\text{BaCrO}_4(\text{s})$
- d. $\text{PbCrO}_4(\text{s})$
- e. none of these

Answer: d

31. When 250 mL of 0.050 M $\text{K}_2\text{CrO}_4(\text{aq})$ is combined with 250 mL of 0.010 M $\text{Pb}(\text{NO}_3)_2(\text{aq})$, a precipitate is observed. When the mixture comes to equilibrium at 25°C , $[\text{Pb}^{2+}]$ will be

- a. 4.5×10^{-13} M
- b. 9.0×10^{-13} M
- c. 3.6×10^{-16} M
- d. 7.2×10^{-16} M
- e. none of these

Answer: b

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