Name _____ AP Chemistry

Chapter 14_HW 5: Due 11/18/16
Circle and write the letter of the correct answer on the line in front of each question.

1._____ $HC_2H_3O_2(aq) + CN^-(aq) \rightleftharpoons HCN(aq) + C_2H_3O_2^-(aq)$
The reaction represented above has an equilibrium constant equal to 3.7×10^4. Which of the following can be concluded from this information?

a. $CN^-(aq)$ is a stronger base than $C_2H_3O_2^-(aq)$
b. $HCN(aq)$ is a stronger acid than $HC_2H_3O_2(aq)$
c. The conjugate base of $CN^-(aq)$ is $C_2H_3O_2^-(aq)$
d. The equilibrium constant will increase with an increase in temperature.
e. The pH of a solution containing equimolar amounts of $CN^-(aq)$ and $HC_2H_3O_2(aq)$ is 7.0.

2. _____ The strengths of five acids are listed below in decreasing order: $HBr > HF > HCN > H_2O > NH_3$
Which one of the following reactions will have an equilibrium constant less than one?

a. $HBr + H_2O \rightleftharpoons H_3O^+ + Br^-$ b. $HF + OH^- \rightleftharpoons H_2O + F^-$
c. $H_2O + NH_2^- \rightleftharpoons NH_3 + OH^-$ d. $HCN + F^- \rightleftharpoons HF + CN^-$
e. $HBr + NH_3 \rightleftharpoons NH_4^+ + Br^-$

3-5 refer to the following.

Concentration (*M*)	pH of Acid 1	pH of Acid 2	pH of Acid 3	pH of Acid 4
0.010	3.44	2.00	2.92	2.20
0.050	3.09	1.30	2.58	1.73
0.10	2.94	1.00	2.42	1.55
0.50	2.69	0.30	2.08	1.16
1.00	2.44	0.00	1.92	0.98

The pH of solutions of four acids prepared at various concentrations were measured and recorded in the table above. The four acids are, in no particular order, chlorous, hydrochloric, lactic, and propanoic.

3. _____ For which acid is the value of the acid dissociation constant, K_a, the smallest?
a. Acid 1 b. Acid 2 c. Acid 3 d. Acid 4

4. _____ Which of the four acids listed in the table is hydrochloric acid?
a. Acid 1 b. Acid 2 c. Acid 3 d. Acid 4

5. _____ Of the following species, which has the greatest concentration in a 1.0 *M* solution of acid 1 at equilibrium?
a. OH^- b. H_3O^+ c. Acid 1 d. The conjugate base of acid 1

6. _____ Which of the following can function as both a Brønsted-Lowry acid and Brønsted-Lowry base?
a. HCl b. H_2SO_4 c. HSO_3^- d. SO_4^{2-} e. H^+

7. _____ The acid dissociation constant for HClO is 3.0×10^{-8}. What is the hydrogen ion concentration in 0.12 M solution of HClO?
a. 3.6×10^{-9} M b. 3.6×10^{-8} M c. 6.0×10^{-8} M d. 2.0×10^{-5} M e. 6.0×10^{-5} M

8. _____ $HSO_4^- + H_2O \rightleftharpoons H_3O^+ + SO_4^{2-}$
In the equilibrium represented above, the species that act as bases include which of the following?
I. HSO_4^- II. H_2O III. SO_4^{2-}

a. II only b. III only c. I and II d. I and III e. II and III

9. _____ How many milliliters of water must be added to 10 milliliters of an HCl solution with a pH of 1 to produce a solution with a
pH of 2?
a. 10 mL b. 90 mL c. 100 mL d. 990 mL e. 1000 mL

10. _____ Which of the following statements is correct?
a. $HClO_2$ is a stronger acid than $HClO_3$ b. HI is a weaker acid than HCl
c. H_3PO_4 is a stronger acid than $HClO_4$ d. HNO_3 is a stronger acid than HNO_2
e. CH_3COOH is a stronger acid than $CH_2BrCOOH$

11. _____ What is the conjugate base of HSO_4^-?
a. H^+ b. H_2SO_4 c. OH^- d. SO_4^{2-} e. H_3O^+

12. _____ Which of the following is the acid anhydride of a monoprotic acid?
a. CaO b. SO_3 c. FeO d. CO_2 e. N_2O_5

13. _____ In aqueous solution the amphiprotic substance is:
a. H_2O b. Cl^- c. NH_4^+ d. $Cr_2O_7^{2-}$ e. CH_3CH_2COOH

14. _____ K_a of hydrocyanic acid, HCN, is 5.0×10^{-10}. What is the pH of 0.050 M HCN(aq)?
a. below 3.5 b. between 3.5 and 4.5 c. between 5.0 and 5.5
d. between 9.0 and 9.5 e. between 10.5 and 11.0

15. _____ The K_a for hydrofluoric acid is 6.8×10^{-4}. What percentage of HF is dissociated in a 0.080 M solution where the hydronium ion concentration is 7.4×10^{-3} M?
a. 12.3% b. 4.25% c. 9.2 % d. 1.12% e. 23.6%

16. _____ Which of the following is not a conjugate acid-base pair?
a. H_2SO_4 and SO_4^{2-} b. HCl and Cl^- c. NH_3 and NH_2^-
d. HPO_4^{2-} and PO_4^{3-} e. H_2S and HS^-

17. _____ The pH of 0.01 M acetic acid ($K_a = 1.8 \times 10^{-5}$) is closest to:
a. 1 b. 2 c. 3 d. 7 e. 11

18. _____ The only acid that is both a strong acid and a weak acid on dissociation is:
a. sulfuric acid b. perchloric acid c. nitric acid
d. hydrochloric acid e. phosphoric acid

19. _____ How many mL of 10.0 M HCl are needed to prepare 500. mL of 2.00 M HCl?
a. 1.00 mL b. 10.0 mL c. 20.0 mL d. 100. mL e. 200. mL

20. _____ As the pH of a solution is changed from 3 to 6, the concentration of hydronium ions
a. increases by a factor of 3 b. increases by a factor of 1000
c. decreases by a factor of 3 d. decreases by a factor of 1000

21. _____ Which substance is an Arrhenius acid?
a. $Ba(OH)_2$ b. CH_3COOCH_3 c. H_3PO_4 d. NaCl

22. _____ Which compound releases hydroxide ions in an aqueous solution?
a. CH_3COOH b. CH_3OH c. HCl d. KOH

23. _____ The pH of an aqueous solution changes from 4 to 3 when the hydrogen ion concentration in the solution is
a. decreased by a factor of 3/4 b. decreased by a factor of 10
c. increased by a factor of 4/3 d. increased by a factor of 10

24. _____ An Arrhenius base yields which ion as the only negative ion in an aqueous solution?
a. hydride ion b. hydrogen ion c. hydronium ion d. hydroxide ion

25. _____ According to one acid-base theory, a water molecule acts as an acid when the water molecule
a. accepts an H^+ b. accepts an OH^- c. donates an H^+ d. donates an OH^-

26. _____ Which two formulas represent Arrhenius acids?
a. CH_3COOH and CH_3CH_2OH b. $HC_2H_3O_2$ and H_3PO_4 c. $KHCO_3$ and $KHSO_4$ d. NaSCN and $Na_2S_2O_3$

27. _____ Which formula represents a hydronium ion?
a. H_3O^+ b. NH_4^+ c. OH^- d. HCO_3^-

28. _____ What is the pH of a solution that has a hydronium ion concentration 100 times greater than a solution with a pH of 4?
a. 5 b. 2 c. 3 d. 6