1. Which of the following is an H^+ donor?

A. Lewis Acid
B. Lewis Base
C. Bronsted/Lowry Acid
D. Bronsted/Lowry Base
E. none of these

2. A solution is said to be <u>acidic</u> if _____.

A. the $[H_3O^+]$ for the solution is greater than 1.0×10^{-7} M.

B. the pOH for the solution is greater than 7.0.

C. if the solution contains large amounts of a weak base.

D. Both A and B

E. A, B, and C

3. The <u>conjugate acid</u> for HSO_4^- is

A. H_3O^+ B. OH^- C. H_2SO_4 D. SO_4^{2-} E. H_2O

4. Which of the following is a conjugate acid/base pair?

A. HCl , OCl^-

B. H_2SO_4 , SO_4^{2-}

C. NH_4^+ , NH_3

D. H_3O^+ , OH^-

E. all of these are conjugate acid/base pairs.

5. Because the bisulfate ion (HSO_4^-) _____ , it can act as either an acid or a base.

A. has a high buffer capacity.
B. is amphiprotic.
C. undergoes autoprotolysis.
D. is weak.
E. is diprotic.

6. The K_a for $H_2PO_4^-$ is

A. 7.5×10^{-3}
B. 6.2×10^{-8}
C. 1.0×10^{-12}
D. 1.6×10^{-7}
E. 1.0×10^{-14}

7. What is the value of K_b for the HSO_3^- ion?
A. 3.6×10^{-8}
B. 1.0×10^{-14}
C. 2.8×10^{-7}
D. 1.2×10^{-2}
E. 8.3×10^{-13}

8. Which of the following acids will ionize the least in water?
A. HCl B. HBr C. HI D. HF E. all are about the same

9. A buffer is a solution which
A. resists large changes in temperature.
B. resists formation of gases.
C. resists large changes in $[H_3O^+]$.
D. resists large changes in $[O_2]$.
E. resists large changes in physique.

10. Calculate the $[H_3O^+]$ in a solution that has a pH = 9.7.
A. 2.0×10^{-10} M
B. 5.0×10^{-5} M
C. 3.6×10^{-9} M
D. 9.7×10^{-9} M
E. 6.3×10^{-10} M

11. HX is a weak monoprotic acid with $K_a = 1.0 \times 10^{-6}$. Calculate the pH of 0.10 M HX(aq).
A. 6.0
B. 3.5
C. 3.0
D. 2.5
E. 1.0

12. Which of the following 0.10 M aqueous solutions would be the most basic?

A. KF (aq)

B. KNO_3 (aq)

C. KNO_2 (aq)

D. KBr (aq)

E. none of these would be basic solutions.

13. Calculate the pH of a solution prepared by mixing 25.0 mL of 0.100 M HCl (aq) with 50.0 mL of 0.200 M $NaC_2H_3O_2$ (aq).

A. 5.04

B. 4.13

C. 5.34

D. 4.26

E. 5.22

14. If a weak monoprotic acid, HZ, is used to prepare a 0.36 M HZ (aq) solution. This acid is found to be 2.2% ionized in solution. What is the pH of the solution?

A. 0.44

B. 1.00

C. 1.66

D. 2.10

E. 3.60

15. When solutions of the following pairs of ions are mixed, which pair is most likely to have a good net reaction?

A. HCN , F^-

B. CO_3^{2-} , OH^-

C. H_3O^+ , H_2CO_3

D. HSO_4^- , NH_3

E. all of these will have good net reactions.

16. Which of the following represents the base ionization reaction of F^- (aq) ?

A. $F^-(aq) + OH^-(aq) \rightleftharpoons HF(aq) + O^{2-}(aq)$

B. $F^-(aq) + H_3O^+(aq) \rightleftharpoons HF(aq) + H_2O(l)$

C. $H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$

D. $HF(aq) + OH^-(aq) \rightleftharpoons F^-(aq) + H_2O(l)$

E. $F^-(aq) + H_2O(l) \rightleftharpoons HF(aq) + OH^-(aq)$

17. Which of the following represents the autoprotolysis reaction of water?

A. $H_3O^+(aq) + OH^-(aq) \rightleftharpoons H_2O(l) + H_2O(l)$

B. $H_2O(l) + H_2O(l) \rightleftharpoons 2\,H_2(g) + O_2(g)$

C. $H_2O(l) + H_2O(l) \rightleftharpoons 4\,H^+(aq) + 2O^{2-}(aq)$

D. $H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$

E. $4\,H^+(aq) + 2O^{2-}(aq) \rightleftharpoons H_2O(l) + H_2O(l)$

18. Which of the following shows the net ionic equation for the mixing of aqueous solutions of HBr (aq) and NaOH (aq)?

A. $H_3O^+(aq) + OH^-(aq) \rightleftharpoons H_2O(l) + H_2O(l)$

B. $HBr(aq) + NaOH(aq) \rightleftharpoons NaBr(aq) + H_2O(l)$

C. $HBr(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + Br^-(aq)$

D. $HBr(aq) + OH^-(aq) \rightleftharpoons H_2O(l) + Br^-(aq)$

E. $H_3O^+(aq) + NaOH(aq) \rightleftharpoons Na^+(aq) + 2\,H_2O(l)$

19. A solution contains 0.250 moles of H_3PO_4 and 0.450 moles of NaH_2PO_4 in 1.00 L of solution. Calculate the pH of this solution.

A. 1.86

B. 2.38

C. 6.95

D. 7.21

E. 7.47

20. Which of the following would be true concerning the pH at the equivalence point in a titration between a strong acid and and a strong base?

A. the pH at the equivalence point will be equal to 7.0.

B. the pH at the equivalence point will be greater than 7.0.

C. the pH at the equivalence point will be less than 7.0.

Use the following information for questions 21 and 23:
A 50.0 mL sample of 0.100 M HNO_2 (aq) is titrated with 0.100 M NaOH (aq).

21. Which of the following shows the net ionic equation for the mixing of aqueous solutions of HNO_2 (aq) and NaOH (aq)?

A. H_3O^+ (aq) + OH^- (aq) $\rightleftharpoons$ H_2O (l) + H_2O (l)

B. H_3O^+ (aq) + NO_2^- (aq) $\rightleftharpoons$ HNO_2 (aq) + H_2O (l)

C. HNO_2 (aq) + OH^- (aq) $\rightleftharpoons$ H_2O (l) + NO_2^- (aq)

D. HNO_2 (aq) + H_2O (l) $\rightleftharpoons$ H_3O^+ (aq) + NO_2^- (aq)

E. H_3O^+ (aq) + NaOH (aq) $\rightleftharpoons$ Na^+ (aq) + 2 H_2O (l)

22. The pH after 25.0 mL of NaOH have been added will be:

A. 7.00

B. 1.00

C. 4.74

D. 3.35

E. 5.25

23. The pH after 75.0 mL of NaOH have been added will be:

A. 7.00

B. 8.02

C. 11.9

D. 12.3

E. 12.8

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24. Saccharin, the artificial sweetner, is a weak monoprotic acid. If a 0.0150 M solution of saccharin has a pH of 5.53, what is the K_a of saccharin?

A. 2.0×10^{-4}

B. 2.9×10^{-6}

C. 5.8×10^{-10}

D. 8.4×10^{-12}

E. 1.0×10^{-14}

25. Pyridine, is a weak base with $K_b = 1.7 \times 10^{-9}$. Calculate the pH of a 0.10 M solution of pyridine.

A. 8.15

B. 5.88

C. 13.0

D. 8.77

E. 9.12

26. Ascorbic acid (H_2Asc)is a weak diprotic acid with the following acid ionization constants:

$$K_{a1} = 7.9 \times 10^{-5} \text{ and } K_{a2} = 1.6 \times 10^{-12}$$

Calculate the pH of a 0.050 M solution of Ascorbic acid (aq).

A. 1.3

B. 2.7

C. 3.1

D. 5.4

E. 6.5

27. Which of the following acids (and their conjugate bases) would be the best choice for making a pH = 4.50 buffer solution?

A. HCOOH $K_a = 1.8 \times 10^{-4}$

B. C_6H_5COOH $K_a = 6.1 \times 10^{-5}$

C. $ClCH_2COOH$ $K_a = 1.4 \times 10^{-3}$

D. C_6H_5OH $K_a = 1.6 \times 10^{-10}$

E. all of these would be equally good.