South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

17 • Acid-Base Equilibria

PRACTICE TEST

1. In the equation,
   $HCN(aq) + H_2O \leftrightarrows H_3O^+(aq) + CN^-(aq)$
   a) H_3O^+ is an acid and H_2O is its conjugate base.
   b) HCN is an acid and CN^- is its conjugate base.
   c) HCN is an acid and H_2O is its conjugate base.
   d) HCN is a base and H_2O is its conjugate acid.
   e) Both HCN and CN^- can function as acids.

2. Which of the following would not be expected to function as a Brønsted-Lowry base?
   a) NH_3
   b) NH_4^+
   c) O^{2-}
   d) H_2O
   e) OH^-

3. All of the following are acid-base conjugate pairs EXCEPT
   a) NH_3 and NH_2^-.
   b) OH^- and O^{2-}.
   c) NH_4^+ and NH_3.
   d) HCN and HOCN.
   e) H_3PO_4 and $H_2PO_4^-$.

4. Which is the strongest acid?
   a) Ascorbic acid, $K_a = 8.0 \times 10^{-5}$
   b) Benzoic acid, $K_a = 6.5 \times 10^{-5}$
   c) 3-chlorobenzoic acid, $K_a = 1.5 \times 10^{-4}$
   d) 2-hydroxybenzoic acid, $K_a = 1.1 \times 10^{-3}$
   e) Chloroacetic acid, $K_a = 1.4 \times 10^{-3}$

5. Which of the following is a weak electrolyte in aqueous solution?
   a) H_2CO_3
   b) H_2SO_4
   c) HI
   d) HNO_3
   e) $HClO_3$

6. What is the pH of a 4.2×10^{-4} M HBr solution?
   a) 2.80
   b) 3.38
   c) 3.80
   d) 4.20
   e) 4.62

7. The conjugate base of H_2O is
   a) H^+
   b) H_3O^+
   c) O^{2-}
   d) HOH
   e) OH^-

8. The hydronium ion concentration of a solution is 1.34×10^{-4} M. The pH of the solution is
   a) 3.00
   b) 3.40
   c) 3.87
   d) 4.00
   e) 4.13

9. A solution which has a pH of 12.8 would be described as
   a) very acidic
   b) slightly acidic
   c) neutral
   d) slightly basic
   e) very basic

10. Given that K_a for HNO_2 is 5.0×10^{-4}, calculate the equilibrium constant for the reaction
    $NO_2^-(aq) + H_2O \leftrightarrows HNO_2(aq) + OH^-(aq)$
    a) 2.0×10^{-11}
    b) 2.0×10^{-4}
    c) 5.0×10^{-4}
    d) 2.0×10^{3}
    e) 5.0×10^{10}

11. Under the Lewis concept of acids and bases, a base is
    a) a proton donor.
    b) a proton acceptor.
    c) an electron pair acceptor.
    d) an electron pair donor.
    e) a hydroxide ion donor.

12. Knowing that H_2S is a stronger acid than HCN, determine, if possible, in which direction the following equilibrium lies.
$HCN(aq) + HS^-(aq) \rightleftharpoons CN^-(aq) + H_2S(aq)$
a) equilibrium lies to the left (reactant-favored)
b) equilibrium lies to the right (product-favored)
c) equilibrium is perfectly balanced left & right
d) can be determined if the relative acidity of HS- is given
e) cannot be determined

13. A 0.20 M solution of an acid, HA, has a pH of 3.82 at 25°C. What is the K_a for this acid?
a) 7.6×10^{-4}
b) 4.5×10^{-5}
c) 1.1×10^{-7}
d) 2.3×10^{-8}
e) 4.5×10^{-9}

14. Hydrogen sulfide is a weak diprotic acid. What is the pH of a 0.10 M H_2S solution? ($K_{a1} = 1.0 \times 10^{-7}$ and $K_{a2} = 1.3 \times 10^{-13}$)
a) 1.0
b) 3.5
c) 4.0
d) 5.5
e) 10.4

15. Consider the following acids:
$HClO_3$, $HClO_4$, HIO_3, HIO_2
When listed from **weakest** to **strongest**, the order would be:
a) $HIO_2 < HIO_3 < HClO_3 < HClO_4$
b) $HClO_4 < HClO_3 < HIO_3 < HIO_2$
c) $HIO_2 < HClO_3 < HIO_3 < HClO_4$
d) $HClO_3 < HClO_4 < HIO_2 < HIO_3$
e) $HIO_3 < HIO_2 < HClO_4 < HClO_3$

16. Calculate the dissociation constant, K_a, of an acid if a 1.00 M solution of the acid has a pH of 3.18.
a) 4.4×10^{-7}
b) 4.4×10^{-6}
c) 6.6×10^{-4}
d) 6.6×10^{-3}
e) 3.2×10^{-3}

17. What is the pH of a 0.054 M NaOH solution?
a) 1.14
b) 1.27
c) 8.64
d) 12.73
e) 13.95

18. What is the pH of a 0.144 M solution of NaF? K_a for HF = 7.1×10^{-4}
a) 5.85
b) 7.00
c) 7.15
d) 8.15
e) 9.12

19. Of the following salts, which one forms a 0.1 M solution with the lowest pH?
a) NH_4Cl
b) $KC_2H_3O_2$
c) KBr
d) $NaNO_2$
e) NaCl

20. What is the pH of 0.200 M HCN ($K_a = 4.0 \times 10^{-10}$)?
a) 4.70
b) 5.05
c) 5.20
d) 5.70
e) 10.10

21. Which one of the following salts when added to pure water will not change the pH?
a) $NaHCO_3$
b) $NaHSO_4$
c) NaCN
d) NH_4NO_3
e) NaBr

22. Hydrogen sulfide is a weak diprotic acid. What is the $[S^{2-}]$ in a 0.10 M H_2S solution? ($K_{a1} = 1.0 \times 10^{-7}$ and $K_{a2} = 1.3 \times 10^{-13}$)
a) 1.0×10^{-5}
b) 1.0×10^{-7}
c) 1.3×10^{-13}
d) 1.3×10^{-14}
e) 1.3×10^{-20}

Answers:

1.	6.	11.	16.	21.
2.	7.	12.	17.	22.
3.	8.	13.	18.	
4.	9.	14.	19.	
5.	10.	15.	20.	