Chemistry 12   **Name:**

Acid-Base Equilibrium Part I Practice Test

Date:

I. Multiple Choice.

_____ 1. Water will act as an acid with which of the following?

        I. H_2CO_3
        II. HCO_3^-
        III. CO_3^{2-}

A. I only.
B. III only.
C. I and II only.
D. II and III only.

_____ 2. Which of the following describes the relationship between acid strength and K_a value for weak acids?

	Acid Strength	K_a
A.	decreases	increases
B.	decreases	remains constant
C.	increases	increases
D.	increases	decreases

_____ 3. Which of the following are amphiprotic?

        I. H_2O
        II. NH_4^+
        III. HCO_3^-

A. I and II only.
B. I and III only.
C. II and III only.
D. I, II and III.

_____ 4. What is the pOH of a 0.10M $Sr(OH)_2$ solution?

A. 0.70
B. 1.00
C. 13.00
D. 13.30

5. Show your calculation for the question above:

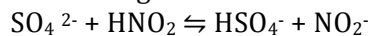_____ 6. Which of the following 0.10M solutions will have the highest electrical conductivity?

A. H_3PO_4
B. H_2S
C. HIO_3
D. CH_3COO^-

_____ 7. After the following pairs of substances react and reach equilibrium, which will favour reactants?

A. HSO_4^- + $HCOO^-$
B. HPO_4^{2-} + HSO_3^-
C. HIO_3 + CN^-
D. SO_4^{2-} + HNO_2

8. Briefly explain your answer to the question above:

_____ 9. Consider the following:

$$SO_4^{2-} + HNO_2 \rightleftharpoons HSO_4^- + NO_2^-$$

Equilibrium would favour:
    A. the products since HSO_4^- is a weaker acid than HNO_2 .
    B. the reactants since HSO_4^- is a weaker acid than HNO_2 .
    C. the products since HSO_4^- is a stronger acid than HNO_2 .
    D. the reactants since HSO_4^- is a stronger acid than HNO_2

_____ 10. The concentration, K_a and pH values of four acids are given in the following table:

Acid	Concentration	K_a	pH
HA	3.0 M	2.0×10^{-5}	2.1
HB	0.7 M	4.0×10^{-5}	2.3
HC	4.0 M	1.0×10^{-5}	2.2
HD	1.5 M	1.3×10^{-5}	2.4

Based on this data, the **strongest** acid is:
    A. HA   C. HC
    B. HB   D. HD

_____ 11. Which of the following K_a values represents the acid with the strongest conjugate base?

    A. 4.2×10^{-12} C. 2.0×10^{-5}
    B. 9.5×10^{-9} D. 7.8×10^{-3}

12. Briefly explain your answer to the question above:

_____ 13. The K_b for the dihydrogen phosphate ion $H_2PO_4^-$ is:

    A. 1.3×10^{-12} C. 1.6×10^{-7}
    B. 6.3×10^{-8} D. 7.1×10^{-3}

_____ 14. Calculate the pH of 0.01 M NaOH.

    A. 1.0×10^{-12} C. 2.0
    B. 1.0×10^{-2} D. 12.0

_____15. Consider the following data:

Chemical species	Ka Value
H_3AsO_4	5.0×10^{-5}
$H_2AsO_4^-$	8.0×10^{-8}
$HAsO_4^{2-}$	6.0×10^{-10}

The K_b value for $H_2AsO_4^-$ is:

    A. 2.0×10^{-10} C. 1.2×10^{-7}
    B. 8.0×10^{-8} D. 1.7×10^{-5}

16. Explain your answer to the question above:

17. Consider a Bronsted-Lowry acid-base equation where HNO_2 is a reactant and $H_2PO_4^-$ is a product.
    a) Complete the following equation:

$$HNO_2 + \underline{\hspace{3cm}} \rightleftharpoons H_2PO_4^- + \underline{\hspace{3cm}}$$
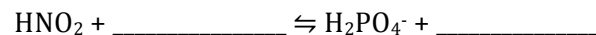
    b) Identify the weaker base in equilibrium in the above equation.

II. Problems:

1. Define the term amphiprotic. List 2 amphiprotic substances and write a chemical equation describing how it behaves in water.

2. Calculate the [H₃O⁺] and [OH-] in a saturated solution of magnesium hydroxide.

3. Determine the pH of a 0.75M solution of HSO_3^-.

4. What mass of HCl must be dissolved in 1.50 L of a NaOH solution having a pH of 11.176 to produce a solution with a pH of 10.750? (Assume no volume change)