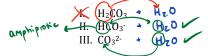
Acid-Base Equilibrium Part I Practice Test

Name: Keu

Date:

I. Multiple Choice.



- 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	$\underline{\mathbf{K}}_{\mathbf{a}}$	
A.	decreases	increases	
B.	decreases	remains constant	
(C.)	increases	increases	
D.	increases	decreases	

3. Which of the following are amphiprotic?

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

A 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:

$$S(OH)_2 \rightarrow Sr^{24} + 2OH^{-1}$$

0.10M 0.10M 0.20M
 $POH = -log(0.20M)$
= 0.70

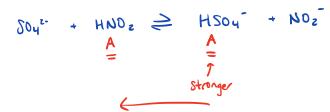
6. Which of the following 0.10M solutions will have the highest electrical conductivity?

A. H₃PO₄
B. H₂S
C. HIO₃
D. CH₃COO-

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

A. HSO₄- + HCOO-B. HPO₄²- + HSO₃-C. HIO₃ + CN-D. SO₄²- + HNO₂

8. Briefly explain your answer to the question above:



9. Consider the following:

ne following:
$$SO_4^{2-} + HNO_2 = HSO_4^{-} + NO_2^{-}$$

Equilibrium would favour:

A. the products since HSO₄- is a weaker acid than HNO₂.

B. the reactants since HSO₄- is a weaker acid than HNO₂.

<u>C</u>. the products since HSO₄- is a stronger acid than HNO₂.

D. the reactants since HSO₄- is a stronger acid than HNO₂

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

	ſ	/		1 /
Acid	Concen	tration	Ka	pH/
HA	3.0 M		2.0 x 10 ⁻⁵	2.1
HB	0.7 M	\	4.0 x 10 ⁻⁵	2/3
НС	4.0 M	1	1.0 x 10 ⁻⁵	2.2
HD	1.5 M		1.3 x 10 ⁻⁵	2.4

Based on this data, the strongest acid is:

A. HA B. HB

highest

C. HC D. HD

 $_$ 11. Which of the following K_a values represents the acid with the

A.4.2 x 10⁻¹²

strongest conjugate base?

C. 2.0 x 10⁻⁵

. 9.5 x 10⁻⁹ D. 7.8 x 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 x 10⁻¹²

C. 1.6 x 10⁻⁷ D. 7.1 x 10⁻³

 $K_b = \frac{K\omega}{K_{\alpha}(H_3PO_4)} = \frac{1.0 \times 10^{-14}}{7.5 \times 10^{-14}}$

 $_{ullet}$ 14. Calculate the pH of 0.01 M NaOH.

A. 1.0 x 10 -12 B. 1.0 x 10 -2

(D) 12.0

__15. Consider the following data:

Chemical species	Ka Value
H ₃ AsO ₄	5.0 x 10 ⁻⁵
H ₂ AsO ₄ -	8.0 x 10 ⁻⁸
HAsO ₄ ² -	6.0 x 10 ⁻¹⁰

The K_b value for H₂AsO₄- is:

C. 1.2 x10⁻⁷

D. 1.7 x10⁻⁵

16. Explain your answer to the question above:

$$K_b = \frac{K\omega}{K_a (H_3 Aso_4)} = \frac{1.0 \times 10^{-14}}{5.0 \times 10^{-5}}$$

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

$$HNO_2 + HPO_4^2 + H_2PO_4 + NO_2^2$$
 SA
 SB
 WA

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.

Amphiprotic = a Chemical Species that can act as an acid or a base (Multiple possible answers)

ex:
$$\frac{Acid}{HPOy^2}$$
 + $\frac{HzO}{HzOy^2}$ + $\frac{HzO}{HzOy^2}$

2. Calculate the $[H_3O^+]$ and [OH-] in a saturated solution of magnesium hydroxide.

Mg(0H)₂
$$\rightarrow$$
 Mg²⁺ + 20H⁻
 $S = 5.6 \times 10^{-12} = 4s^3$
 $S = 3\sqrt{5.6 \times 10^{-12}}$
 $= 1.12 \times 10^{-4}$
 $= 0.12 \times 10^{-4}$
 $= 2.24 \times 10^{-4}$
 $= 1.0 \times 10^{-14}$
 $= 1.0 \times 10^{-14}$
 $= 1.0 \times 10^{-14}$
 $= 1.0 \times 10^{-14}$
 $= 1.0 \times 10^{-14}$

3. Determine the pH of a 0.75M solution of HSO₃.

$$K_{0} = (.0 \times 10^{-7})$$

$$K_{0} = \frac{1.0 \times 10^{-13}}{1.5 \times 10^{-2}} = 6.7 \times 10^{-13}$$

$$K_{0} = \frac{1.0 \times 10^{-13}}{1.5 \times 10^{-2}} = 6.7 \times 10^{-13}$$

$$K_{0} = \frac{1.0 \times 10^{-13}}{1.5 \times 10^{-2}} = 6.7 \times 10^{-13}$$

$$0 \text{ M} \qquad 0 \text{ M}$$

$$0 \text{ M} \qquad 0 \text{ M}$$

$$0 \text{ C} = -x$$

$$0 \text{ C} = 0.75 - x$$

$$0 \text{ C} = 0.75 - x$$

Y

$$K_{\alpha} = 1.0 \times 10^{-7} = \frac{x^{2}}{0.75 - x}$$
 $X = \sqrt{(0.75)(1.0 \times 10^{-7})}$
 $[H_{30}^{+}]i$
 $= 2.7 \times 10^{-4} M = [H_{30}^{+}]$

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)

$$[OH^{-}]i$$
 $POH = 14 - 11.176$
 $[OH^{-}]_{i} = 10^{-2.824}$
 $= 1.50 \times 10^{-3} M$

$$[OH^{-}]_{f} = [OH^{-}]_{i} - [H_{3}O^{+}]_{i}$$

 $[H_{3}O^{+}]_{i} = [OH^{-}]_{i} - [OH^{-}]_{f}$
 $1.50 \times 10^{-3} - 5.62 \times 10^{-4}$
 $= 9.38 \times 10^{-4} M = [HCI]$

$$1.50L \times \frac{9.38 \times 10^{-4} \text{ mol}}{1 L} \times \frac{36.5g}{1 \text{ mol}} = \boxed{0.0514g}$$