

Name \_\_\_\_\_  
PHYS 0111 (Gen Chem 2)

Test 4  
Spring 2005

A few equations:

**$K_a$  values for a few acids**

$$K = \frac{[\text{products}]}{[\text{reactants}]}$$

$$Q = \frac{[\text{products}]_o}{[\text{reactants}]_o}$$

$$\text{pH} = -\log[\text{H}_3\text{O}^+]$$

$$\text{pOH} = -\log[\text{OH}^-]$$

$$\text{p}K_w = -\log(K_w)$$

$$\text{p}K_a = -\log(K_a)$$

$$K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$$

$$\text{p}K_w = \text{pH} + \text{pOH}$$

$$\text{pH} = \text{p}K_a + \log\left[\frac{[\text{A}^-]}{[\text{HA}]}\right]$$

A few constants:

$$K_w = 10^{-14}$$

$$\text{p}K_w = 14$$

Acid	$K_a$	$\text{p}K_a$
$\text{HSO}_4^-$	$1.2 \times 10^{-2}$	1.92
$\text{HClO}_2$	$1.2 \times 10^{-2}$	1.92
$\text{H}_3\text{PO}_4$	$7.5 \times 10^{-3}$	2.12
$\text{CClH}_2\text{CO}_2\text{H}$	$1.35 \times 10^{-3}$	2.780
$\text{HF}$	$7.2 \times 10^{-4}$	3.14
$\text{HNO}_2$	$4.0 \times 10^{-4}$	3.40
$\text{CH}_3\text{CO}_2\text{H}$	$1.8 \times 10^{-5}$	4.74
$[\text{Al}(\text{H}_2\text{O})_6]^{3+}$	$1.4 \times 10^{-5}$	4.85
$\text{H}_2\text{PO}_4^-$	$6.2 \times 10^{-8}$	7.21
$\text{HOCl}$	$3.5 \times 10^{-8}$	7.46
$\text{HCN}$	$6.2 \times 10^{-10}$	9.21
$\text{NH}_4^+$	$5.6 \times 10^{-10}$	9.25
$\text{HPO}_4^{2-}$	$4.8 \times 10^{-13}$	12.32

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

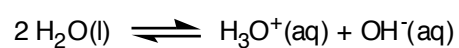
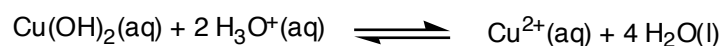
6. \_\_\_\_\_

7. \_\_\_\_\_

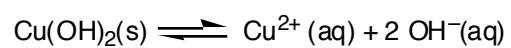
8. \_\_\_\_\_

1. (10 pts.) Determine the solubility of  $\text{BaCO}_3$ . For  $\text{BaCO}_3$ ,  $K_{\text{sp}} = 5.1 \times 10^{-9}$ .

2. a. (6 pts.) Using the information provided below, determine the K for the following reaction.



$$K_{\text{w}} = 10^{-14}$$



$$K_{\text{sp}} = 2.2 \times 10^{-22}$$

b. (6 pts.) Is  $\text{Cu(OH)}_2$  considered soluble in water?

c. (4 pts.) Will  $\text{Cu(OH)}_2$  dissolve in aqueous nitric acid? Explain.

3. a. (10 pts.) Determine the concentration of  $\text{OH}^-$  required to precipitate  $\text{Mg}(\text{OH})_2$  from a 0.105 M  $\text{Mg}(\text{NO}_3)_2$  solution. For  $\text{Mg}(\text{OH})_2$   $K_{\text{sp}} = 8.9 \times 10^{-2}$ .
4. A solution was made by combining 20.0 mL of a 0.0340 M KOH solution with 100.0 mL of a solution that has an initial  $\text{NH}_4\text{Cl}$  concentration of 0.100 M and an initial  $\text{NH}_3$  concentration of 0.110 M.
- (10 pts.) Determine the pH of the resulting solution, and make certain to write any balanced chemical equations that are needed to determine the pH.
5. (10 pts.) A solution was prepared by dissolving 0.10 mol of HCl and 0.10 mol of NaCl in 250 mL of water. Is this solution a buffer? Explain.

