

THE UNIVERSITY OF CHICAGO  
DEPARTMENT OF CHEMISTRY  
GENERAL CHEMISTRY  
EXAMINATION

NAME: \_\_\_\_\_  
SECTION: \_\_\_\_\_  
DATE: \_\_\_\_\_  
TIME: \_\_\_\_\_

INSTRUCTIONS: This examination is closed book and closed notes. You are allowed to use a non-programmable calculator.

SECTION I: Multiple Choice Questions (25 questions, 50 points)

1. Which of the following is a strong acid?

(A)  $\text{HCl}$  (B)  $\text{H}_2\text{SO}_4$  (C)  $\text{HNO}_3$  (D)  $\text{H}_2\text{CO}_3$

2. Which of the following is a weak base?

(A)  $\text{NH}_3$  (B)  $\text{CH}_3\text{COO}^-$  (C)  $\text{H}_2\text{PO}_4^-$  (D)  $\text{HPO}_4^{2-}$

3. Which of the following is a strong base?

(A)  $\text{NaOH}$  (B)  $\text{KOH}$  (C)  $\text{LiOH}$  (D)  $\text{RbOH}$



SECTION II: Free Response Questions (3 questions, 30 points)

1. (10 points) A 0.10 M solution of a weak acid,  $\text{HA}$ , has a pH of 3.0. Calculate the acid dissociation constant,  $K_a$ , for  $\text{HA}$ .

2. (10 points) A 0.10 M solution of a weak base,  $\text{B}$ , has a pH of 11.0. Calculate the base dissociation constant,  $K_b$ , for  $\text{B}$ .

3. (10 points) A 0.10 M solution of a salt,  $\text{NaA}$ , has a pH of 8.0. Calculate the acid dissociation constant,  $K_a$ , for  $\text{HA}$ .

4. (10 points) A 0.10 M solution of a salt,  $\text{NaB}$ , has a pH of 10.0. Calculate the base dissociation constant,  $K_b$ , for  $\text{B}$ .

5. (10 points) A 0.10 M solution of a salt,  $\text{NaHA}$ , has a pH of 4.0. Calculate the acid dissociation constant,  $K_a$ , for  $\text{HA}$ .