1. What is the pH of the solution that results from adding 50.0 mL of 4.0 M HCl to 50.0 mL of 2.0 M NaOH.

   A) 0.00   B) 1.00   C) 2.00   D) 7.00   E) 14.00

2. Which 1.0 M solution has the lowest pH?

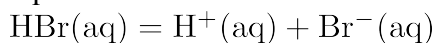| Acid	K_a
HF	3.5×10^{-4}
HCN	1.0×10^{-10}
HCOOH	1.8×10^{-4}
CH₃COOH	1.8×10^{-5}

   A) HF
   B) HCN
   C) HCOOH
   D) CH₃COOH
   E) It cannot be determined from the information given

3. Which 1.0 M acid solution has the largest $[H_3O^+]$?

Acid	K_a
H₃BO₃	7.3×10^{-10}
H₂CO₃	4.3×10^{-7}
HNO₂	4.6×10^{-4}
H₂SO₃	1.5×10^{-2}

   A) H₃BO₃
   B) H₂CO₃
   C) HNO₂
   D) H₂SO₃
   E) It cannot be determined from the information given

4. The equation for the ionization of HBr is:
   $$HBr(aq) = H^+(aq) + Br^-(aq)$$
   The equation for the ionization constant, K_a, is

   A) $K_a = [HBr]$
   B) $K_a = [H^+][Br]$
   C) $K_a = \dfrac{[HBr]}{[H^+][Br^-]}$
   D) $K_a = \dfrac{[H^+][Br^-]}{[HBr]}$
   E) $K_a = \dfrac{[HBr][Br^-]}{[H^+]}$

5. What is the pH of a 0.100 M CH₃COOH ($K_a = 1.8 \times 10^{-5}$ at 298 K) solution?

   A) 1.00   B) 2.87   C) 3.13   D) 7.00   E) 13.0

6. What is the hydrogen ion concentration, $[H^+]$, of a 0.010 M HOCl ($K_a = 4.0 \times 10^{-8}$ at 298 K) solution?

   A) 4.0×10^{-10} M   B) 4.0×10^{-18}M
   C) 2.0×10^{-5} M   D) 2.0×10^{-4} M
   E) 1.0×10^{-2} M

7. In a 0.10 M solution of hydrofluoric acid, HF, the $[H^+]$ is 8.2×10^{-3} M. What is the ionization constant?

   A) $K_a = 8.2 \times 10^{-6}$ B) $K_a = 6.7 \times 10^{-5}$
   C) $K_a = 1.6 \times 10^{-5}$ D) $K_a = 6.7 \times 10^{-4}$
   E) $K_a = 7.5 \times 10^{-4}$

8. Which aqueous solution contains the lowest concentration of hydrogen ions, H^+?

	Conc.	Acid	K_a
I	0.10 M	HBr	Large
II	1.0 M	HCN	1.0×10^{-10}
III	0.1 M	H₂SO₄	Large
IV	1.0 M	CH₃COOH	1.8×10^{-5}

   A) I   B) II
   C) III   D) IV
   E) both I and III

9. What is the $[H_3O^+]$ in a solution with a pOH of 4.60?

   A) 4.0×10^{-10} M   B) 2.5×10^{-5} M
   C) 3.3×10^{-3} M   D) 6.6×10^{-1} M
   E) 9.7×10^{-1} M

10. Which equation correctly relates pH and $[H_3O^+]$?

   A) $pH = \log [H_3O^+]$
   B) $pH = 14 - [H_3O^+]$
   C) $pH = -\log [H_3O^+]$
   D) $pH = pK_w - [H_3O^+]$
   E) $pH = [H_3O^+] - 14$