

Acids & Bases Practice Items

1. Which of the following could not act as a Lewis base?

- A. NH_3
- B. H^-
- C. CaO
- D. CH_4

2. Which below is the weakest acid?

- A. carbonic acid, H_2CO_3 ($K_a = 4.5 \times 10^{-7}$)
- B. acetic acid, $\text{CH}_3\text{CO}_2\text{H}$ ($K_a = 1.8 \times 10^{-5}$)
- C. phenol, $\text{C}_6\text{H}_5\text{OH}$ ($K_a = 1.3 \times 10^{-10}$)
- D. boric acid, H_3BO_3 ($K_a = 5.8 \times 10^{-10}$)

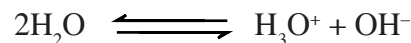
3. Which of the following is the best explanation for why perchloric acid, HClO_4 , is more acidic than hypochlorous acid, HOCl ?

- A. Chlorine is less highly oxidized in HClO_4 than in HOCl .
- B. ClO_4^- is stabilized by charge delocalization.
- C. Perchlorate is a strong nucleophile.
- D. Hypochlorite is a weaker base than perchlorate.

4. What is $\text{p}K_a$ of hypochlorous acid, HClO ? ($K_a = 3.2 \times 10^{-8}$)

- A. -2.4
- B. 2.4
- C. 7.5
- D. 8.5

5. At 25°C the autoprotolysis of pure water, shown below, attains equilibrium hydronium and hydroxide ion concentrations of about 1×10^{-7} moles per liter, respectively. The equilibrium concentrations vary somewhat with temperature, however. At 0°C , the concentrations are about 8×10^{-8} moles per liter, and at 100°C the concentrations are about 7×10^{-7} moles per liter. What can we conclude about the autoprotolysis of water?



- A. Autoprotolysis of water is a second order reaction.
- B. Autoprotolysis of water is an endothermic process.
- C. Autoprotolysis of water is spontaneous.
- D. Water is a strong electrolyte.

6. What is the approximate pH of the solution that results when 55 g of hydrocyanic acid, HCN , ($K_a = 4.9 \times 10^{-10}$) is dissolved in 20 liters of water?

- A. 0.7
- B. 3.5
- C. 5.3
- D. 6.5

7. When water is added to 1.0 g of an unknown diprotic strong acid to form 2 liter of solution, the pH of the resulting solution is 1.0. What is the molecular weight of the acid?

- A. 10 g mol^{-1}
- B. 20 g mol^{-1}
- C. 100 g mol^{-1}
- D. 200 g mol^{-1}

8. What is the hydrogen ion concentration of a solution with a pOH of 3.5?
- A. $3.2 \times 10^{-11} \text{ M}$
 - B. $5.0 \times 10^{-10} \text{ M}$
 - C. $1.5 \times 10^{-10} \text{ M}$
 - D. $3.2 \times 10^{-4} \text{ M}$
9. In the laboratory, it was found that 50 ml of a solution containing an unknown amount of NaOH was neutralized by 200 ml solution containing an unknown amount HCl. The solution was then evaporated. The mass of NaCl recovered after evaporation was 5.9 g. What was the normality of the alkaline solution prior to mixture?
- A. 0.5 N
 - B. 1.0 N
 - C. 2.0 N
 - D. 5.0 N
10. If 0.5 liters of 4 N ammonium hydroxide is added dropwise to 2.0 liters of 1 N hydrochloric acid, the resulting solution will be
- A. weakly acidic
 - B. strongly basic
 - C. neutral
 - D. weakly basic
11. Of the choices of common indicators listed along with the pH associated with their color changes, which would be most useful for determining the equivalence point in a titration of 1 N HNO_3 with 5 N NaOH?
- A. methyl red ($\text{p}K_a$ 4.95)
 - B. p-Nitrophenol ($\text{p}K_a$ 7.2)
 - C. thymol blue ($\text{p}K_a$ 8.9)
 - D. allizarin yellow ($\text{p}K_a$ 11.2)
12. Determine the pH of a 1 liter solution containing 1 mole of H_2CO_3 ($K_a = 4.5 \times 10^{-7}$) and 0.1 mol of NaHCO_3 .
- A. 3.5
 - B. 5.4
 - C. 6.8
 - D. 7.3
13. Which results from combining excess concentrated HCl with concentrated K_2CO_3 ?
- A. formation of a colored complex
 - B. precipitation
 - C. liberation of gas
 - D. a solution of weak base
14. All of the following substances increase the concentration of hydronium ion in aqueous solution except
- A. carbon dioxide
 - B. sulfur dioxide
 - C. phosphorus pentoxide
 - D. calcium oxide
15. Which of the following is the weakest acid?
- A. HF
 - B. HCl
 - C. HBr
 - D. HI

