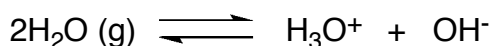


Acids and Bases Problem Set

- Which of the following could not act as a Lewis base?
 - NH_3
 - H^-
 - CaO
 - none of the above
- Which below is the weakest acid?
 - carbonic acid, H_2CO_3 ($K_a = 4.5 \times 10^{-7}$)
 - acetic acid, $\text{CH}_3\text{CO}_2\text{H}$ ($K_a = 1.8 \times 10^{-5}$)
 - phenol, $\text{C}_6\text{H}_5\text{OH}$ ($K_a = 1.3 \times 10^{-10}$)
 - boric acid, H_3BO_3 ($K_a = 5.8 \times 10^{-10}$)
- 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 for each. 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 does this directly imply about the autoprotolysis of water?



- Autoprotolysis of water is a second order reaction.
 - Autoprotolysis of water is an endothermic process.
 - Autoprotolysis of water is spontaneous.
 - All of the above.
- What is $\text{p}K_a$ for hypochlorous acid, HClO ($K_a = 3.2 \times 10^{-8}$)?
 - 7.5
 - 2.4
 - 2.4
 - 8.5
 - What is the approximate pH of the solution that results when 27 g of hydrocyanic acid, HCN , ($K_a = 4.9 \times 10^{-10}$) is dissolved in 5 liters of water?
 - 6.0
 - 3.5
 - 5.0
 - 4.5
 - When 1.0 g of an unknown monoprotic strong acid are dissolved in 1 liter of water, the pH of the resulting solution is 2.0. What is the molecular weight of the acid?
 - 10 g
 - 100 g
 - 20 g
 - cannot be determined from given information

7. What is the hydrogen ion concentration of a solution with a pOH of 4?
- 1.0×10^{-4} mol liter⁻¹
 - 4.0×10^1 mol liter⁻¹
 - 1.0×10^1 mol liter⁻¹
 - 1.0×10^{-10} mol liter⁻¹
8. 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? (AW Na = 23g; AW Cl = 35.5 g)
- 1.0 mol liter⁻¹
 - 5.0 mol liter⁻¹
 - 2.0 mol liter⁻¹
 - 0.5 mol liter⁻¹
9. If 2.0 liters of 1 N hydrochloric acid (a strong acid) is added to 0.5 liters of 4 N ammonium hydroxide (a weak base), the resulting solution will be:
- acidic
 - neutral
 - basic
 - cannot be determined from given information
10. Below are some common indicators listed with the pH associated with their color changes. Which of the following would be useful for determining the equivalence point (to within 1 %) in a titration of 1 N strong acid with a strong base?
- thymol blue (pH 8-9)
 - litmus (pH 6-8)
 - methyl red (pH 4-6)
 - all of the above

11. Using the Henderson-Hasselbalch equation:

$$\text{pH} = \text{p}K_a + \log \frac{[\text{base}]}{[\text{acid}]}$$

Determine the approximate pH of a of a 1 liter solution containing 10 moles of H₂CO₃ ($K_a = 4.5 \times 10^{-7}$) and one mole of NaHCO₃.

- 5.3
- 6.8
- 6.0
- 7.3

11. Which below is the titration curve for the addition of strong base to weak acid?

