

SCH4U Acid Base Practice - Answers

- If a pH meter was placed in a 2.5 mol/L solution of sodium hydroxide the reading would be which of the following?

a. 0.40	d. -0.40
b. 13.60	e. 0.0
c. 15.40	

- When equal quantities of nitric acid and methylamine are combined the solution is/has a

a. neutral	d. pH = 7
b. basic	e. both a and d
c. acidic	

- If sodium acetate was dissolved in distilled water, which of the following could be added to make a functional buffer?

a. potassium acetate	d. citric acid
b. acetic acid	e. potassium citrate
c. ammonia	

- K_w is which of the following?

 - the equilibrium constant for water which is 1.0×10^{-14} at 25°C
 - $K_a \times K_b$ for conjugate acid - base partners
 - $[\text{OH}^-][\text{H}_3\text{O}^+]$ for any solution
 - both a and b
 - all of the above**

- When 45 mL of 0.65 mol/L acetic acid is added to 65 mL of 0.45 mol/L sodium hydroxide the resulting mixture is/has a(n)

a. neutral	d. pH < 7
b. basic	e. both c and d
c. acidic	

- A small amount of NaOH(aq) is added to this buffer system

$$\text{HCHO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^{1+} + \text{CHO}_2^{1-}$$

Which one of the following statements are true?

 - the pH drops only a little since the equilibrium shifts right
 - the pH rises only a little since the equilibrium shifts left
 - the pH drops only a little since the equilibrium shifts left
 - the pH rises only a little since the equilibrium shifts right**
 - the pH does not change since the buffer uses up all the HCl(aq)

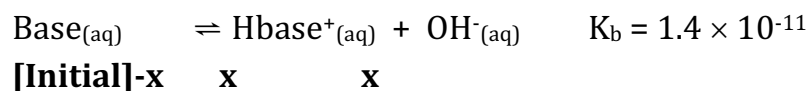
7. For carbonic acid (H_2CO_3) the $K_{a1} =$
- $[\text{CO}_3^{2-}][\text{H}_3\text{O}^{1+}]^2 / [\text{H}_2\text{CO}_3]$
 - $[\text{HCO}_3^{1-}][\text{H}_3\text{O}^{1+}] / [\text{H}_2\text{CO}_3]$
 - $[\text{CO}_3^{1-}][\text{H}_3\text{O}^{1+}]^2 / [\text{H}_2\text{CO}_3]$
 - $[\text{HCO}_3^{1-}][\text{H}_3\text{O}^{1+}] / [\text{H}_2\text{CO}_3]$
 - $[\text{H}_2\text{CO}_3] / [\text{CO}_3^{1-}][\text{H}^{1+}]^2$
8. If the K_a of a weak acid is 3.4×10^{-7} , the K_a of its conjugate base partner must be which of the following?
- 2.9×10^{-8}
 - 6.46
 - 7.54
 - 3.1×10^{-7}
 - 3.4×10^{-7}
9. If the pH of a basic solution at 25°C is 12.56, what is the pOH; and the $[\text{H}^{1+}]$, $[\text{OH}^{1-}]$ in mol/L?

$$\begin{aligned} \text{pOH} &= 14 - 12.56 = 1.44 \\ [\text{H}^+] &= 10^{-12.56} = 2.8 \times 10^{-13} \text{ M} \\ [\text{OH}^-] &= 10^{-1.44} = 0.036 \text{ M} \end{aligned}$$

10. If the pH of a solution at 25°C is 5.76, what is the pOH; and the $[\text{H}_3\text{O}^+]$, $[\text{OH}^-]$ in mol/L? (3 marks)

$$\begin{aligned} \text{pOH} &= 8.24 \\ [\text{H}_3\text{O}^+] &= 1.7 \times 10^{-6} \text{ mol/L} \\ [\text{OH}^-] &= 5.8 \times 10^{-9} \text{ mol/L} \end{aligned}$$

11. What is the initial concentration of a weak base with $K_b = 1.4 \times 10^{-11}$ and pH = 8.75?



$$\begin{aligned} \text{pOH} &= 5.25 \\ [\text{OH}^-] &= 10^{-5.25} = 5.6 \times 10^{-6} = x \\ K_b &= [\text{Hbase}^+][\text{OH}^-] / [\text{base}] \\ 1.4 \times 10^{-11} &= x^2 / [\text{Initial}] - x \\ 1.4 \times 10^{-11} [\text{Initial} - 7.8 \times 10^{-17}] &= (5.6 \times 10^{-6})^2 \\ \text{Initial concentration} &= 2.2 \text{ M} \end{aligned}$$

12. What is the initial concentration of a weak monoprotic acid with $K_a = 2.7 \times 10^{-7}$ and $\text{pH} = 5.35$?



$$\text{pH} = 5.35$$

$$[\text{H}_3\text{O}^+] = 10^{-5.35} = 4.5 \times 10^{-6} = x$$

$$K_a = \frac{[\text{A}^-][\text{H}^+]}{[\text{HA}]}$$

$$2.7 \times 10^{-7} = \frac{x^2}{[\text{Initial}] - x}$$

$$2.7 \times 10^{-7} [\text{Initial}] - 1.2 \times 10^{-12} = (4.5 \times 10^{-6})^2$$

$$\text{Initial Concentration} = 7.9 \times 10^{-5} \text{ M}$$