

Hydrogen ion concentration - pH scale and Buffer solution

1. (a) pH of blood does not change because it is a buffer solution.

2. (c) 0.001 M of $NaOH$ means $[OH^-] = .001$

$$= 10^{-3}M \Rightarrow pOH = 3$$

$$pH + pOH = 14 \Rightarrow pH = 14 - 3 = 11$$

3. (d) $[H_3O^+]$ means $[H^+] = 6.2 \times 10^{-9} \text{ mol/l}$

$$pH = -\log(6.2 \times 10^{-9}) = 8.21$$

4. (b) $CH_3NH_2 + HCl \longrightarrow CH_3NH_3^+ Cl^-$

$$0.1 \quad 0.08 \quad 0$$

$$0.02 \quad 0 \quad 0.08$$

(Basic buffer solution)

$$pOH = pK_b + \log \frac{0.08}{0.02}$$

$$= pK_b + 0.602$$

$$= 3.30 + 0.602 = 3.902$$

$$\therefore pH = 10.09$$

$$[H^+] = 7.99 \times 10^{-11} \approx 8 \times 10^{-11} M$$

5. (b) $pH + pOH = pK_w$

6. (d) $pH = -\log[H^+]$

$$5.4 = -\log[H^+]; [H^+] = 3.98 \times 10^{-6}.$$



7. (a) $KCN + H_2O \rightleftharpoons KOH + HCN$. KOH is a strong base and HCN is a weak acid.

8. (c) $[H^+] = 10^{-3} M$, $pH = -\log[10^{-3}]$, $pH = 3$

9. (b) $[H^+] = [OH^-]$

$$K_w = [H^+][OH^-] = 10^{-14}$$

$$\therefore [H^+] = 10^{-7}, pH = -\log[H^+] = 7.$$

10. (d) $pH = 5$ means $[H^+] = 10^{-5}$

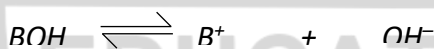
$$pOH = 14 - pH = 14 - 5 = 9$$

$$[OH^-] = 10^{-pOH} = 10^{-9}$$

11. (a) $pH = -\log [H^+]$; $[H^+] = 0.01 N$

$$pH = -\log [10^{-2}]; pH = 2$$

12. (d)



Initial $C \quad 0 \quad 0$

At eq. $C - C\alpha \quad C\alpha \quad C\alpha$

$$K_b = \frac{C^2\alpha^2}{C(1-\alpha)} = C\alpha^2 \text{ assuming } \alpha \ll 1; 1 - \alpha \approx 1$$

$$10^{-12} = 10^{-2} \times \alpha^2; \alpha^2 = 10^{-10}; \alpha = 10^{-5}$$

$$[OH^-] = C\alpha = .01 \times 10^{-5} = 10^{-7}$$

13. (c) $pH = 4$ means; $[H^+] = 10^{-4} mol$

14. (a) Buffer solution is a mixture of weak acid and its conjugate base.

15. (b) Adding Na_2CO_3 to water makes the solution basic and hence a pH increases from 7.





16. (d) NaClO_4 is a salt of strong acid HClO_4 . So it is a strong acid salt.

17. (b) NaOH is a base, so that its $\text{pH} > 7$

18. (c) It is a strong base.

1 M NaOH has maximum $[\text{OH}^-]$ and minimum $[\text{H}^+]$ and maximum pH .

19. (c) When $\text{pH} = 7$ means neutral, $\text{pH} < 7$ means acidic, $\text{pH} > 7$ means basic.

20. (d) As the solution is acidic, $\text{pH} < 7$. This is because $[\text{H}^+]$ from H_2O [10^{-7}M] cannot be neglected in comparison to 10^{-10}M

