Chapter 13 − Problems 2, 6, 10, 16, 30

Michael Brodskiy

Instructor: Mr. Morgan

February 18, 2020

2. (a) $CN^-(aq)$ is the base, and the $HCN(aq)$ is the conjugate acid pair. H_2O is the acid, and $OH^-(aq)$ is the conjugate base pair.

   (b) $HCO_3^-(aq)$ is the base, and the $H_2CO_3(aq)$ is the conjugate acid pair. $H_3O^+(aq)$ is the acid, and H_2O is the conjugate base pair

   (c) $HC_2H_3O_2(aq)$ is the acid, and $C_2H_3O_2^-(aq)$ is the conjugate base pair. $HS^-(aq)$ is the base, and $H_2S(aq)$ is the conjugate acid pair.

6. (a) $HAsO_4^{2-}$

   (b) $Fe(H_2O)_4(OH)_2$

   (c) ClO_3^-

   (d) NH_3

   (e) $C_2H_3O_2^-$

10. (a) $Zn(H_2O)_3OH^+ + H_2O \rightleftharpoons Zn(H_2O)_2(OH)_2 + H_3O^+$

    (b) $HSO_4^- + H_2O \rightleftharpoons SO_4^{2-} + H_3O^+$

    (c) $HNO_2 + H_2O \rightleftharpoons NO_2^- + H_3O^+$

    (d) $Fe(H_2O)_6^{2+} + H_2O \rightleftharpoons Fe(H_2O)_5(OH)^+ + H_3O^+$

    (e) $HC_2H_3O_2 + H_2O \rightleftharpoons C_2H_3O_2^- + H_3O^+$

    (f) $H_2PO_4^- + H_2O \rightleftharpoons HPO_4^{2-} + H_3O^+$

16. (a)

$$-0.76 = -\log_{10}\left([H^+]\right)$$
$$[H^+] = 10^{.76}$$
$$= 5.754[M_{H^+}]$$
$$14 + 0.76 = -\log_{10}\left([OH^-]\right)$$
$$[OH^-] = 10^{-14.76}$$
$$= 1.74 \cdot 10^{-15}[M_{OH^-}]$$

(b)

$$9.11 = -\log_{10}\left([\mathrm{H^+}]\right)$$
$$[\mathrm{H^+}] = 10^{-9.11}$$
$$= 7.8 \cdot 10^{-10}[\mathrm{M_{H^+}}]$$
$$14 - 9.11 = -\log_{10}\left([\mathrm{OH^-}]\right)$$
$$[\mathrm{OH^-}] = 10^{-4.89}$$
$$= 1.3 \cdot 10^{-5}[\mathrm{M_{OH^-}}]$$

(c)

$$3.81 = -\log_{10}\left([\mathrm{H^+}]\right)$$
$$[\mathrm{H^+}] = 10^{-3.81}$$
$$= 1.55 \cdot 10^{-4}[\mathrm{M_{H^+}}]$$
$$14 - 3.81 = -\log_{10}\left([\mathrm{OH^-}]\right)$$
$$[\mathrm{OH^-}] = 10^{-10.19}$$
$$= 6.46 \cdot 10^{-11}[\mathrm{M_{OH^-}}]$$

(d)

$$12.08 = -\log_{10}\left([\mathrm{H^+}]\right)$$
$$[\mathrm{H^+}] = 10^{-12.08}$$
$$= 8.3 \cdot 10^{-13}[\mathrm{M_{H^+}}]$$
$$14 - 12.08 = -\log_{10}\left([\mathrm{OH^-}]\right)$$
$$[\mathrm{OH^-}] = 10^{-1.92}$$
$$= 1.2 \cdot 10^{-2}[\mathrm{M_{OH^-}}]$$

30.

$$[\mathrm{H^+}]_{\mathrm{HNO_3}} = 10^{-1.39}$$
$$= 4.1 \cdot 10^{-2}\,[\mathrm{M_{H^+}}]$$
$$.145 \cdot .575 = 8.34 \cdot 10^{-2}\,[\mathrm{mol}]$$
$$.493 \cdot .041 = 2 \cdot 10^{-2}\,[\mathrm{mol}]$$
$$\frac{10.34 \cdot 10^{-2}}{.638} = .162[\mathrm{M}]$$
$$-\log_{10}\left(.162\right) = .79$$