
CHAPTER 15

ACIDS AND BASES

Problem Categories

Biological: 15.100, 15.111, 15.141, 15.149, 15.153, 15.162, 15.164.

Conceptual: 15.32, 15.35, 15.36, 15.54, 15.72, 15.77, 15.78, 15.79, 15.80, 15.83, 15.84, 15.99, 15.102, 15.104, 15.117, 15.133, 15.134, 15.145, 15.158, 15.159.

Descriptive: 15.37, 15.38, 15.69, 15.70, 15.71, 15.87, 15.88, 15.89, 15.90, 15.94, 15.95, 15.106, 15.109, 15.112, 15.113, 15.118, 15.119, 15.124, 15.128, 15.135, 15.139, 15.142, 15.144, 15.153, 15.156, 15.159.

Environmental: 15.140.

Difficulty Level

Easy: 15.3, 15.4, 15.5, 15.6, 15.7, 15.8, 15.15, 15.16, 15.17, 15.18, 15.19, 15.20, 15.21, 15.22, 15.23, 15.24, 15.26, 15.31, 15.33, 15.34, 15.37, 15.54, 15.69, 15.70, 15.71, 15.80, 15.94, 15.96, 15.102, 15.103, 15.104, 15.106, 15.109, 15.113, 15.116, 15.135, 15.139.

Medium: 15.25, 15.32, 15.35, 15.36, 15.38, 15.43, 15.44, 15.45, 15.46, 15.47, 15.48, 15.49, 15.50, 15.53, 15.55, 15.56, 15.57, 15.58, 15.65, 15.66, 15.72, 15.77, 15.78, 15.79, 15.81, 15.82, 15.83, 15.84, 15.87, 15.88, 15.89, 15.90, 15.93, 15.95, 15.97, 15.98, 15.99, 15.100, 15.101, 15.105, 15.110, 15.111, 15.112, 15.114, 15.115, 15.117, 15.118, 15.121, 15.123, 15.124, 15.126, 15.128, 15.131, 15.133, 15.134, 15.136, 15.142, 15.144, 15.145, 15.147, 15.148, 15.152, 15.153, 15.155, 15.158, 15.159, 15.160.

Difficult: 15.63, 15.64, 15.107, 15.108, 15.119, 15.120, 15.122, 15.125, 15.127, 15.129, 15.130, 15.132, 15.137, 15.138, 15.140, 15.141, 15.143, 15.146, 15.149, 15.150, 15.151, 15.154, 15.156, 15.157.

15.3 Table 15.2 of the text contains a list of important Brønsted acids and bases. (a) both (why?), (b) base, (c) acid, (d) base, (e) acid, (f) base, (g) base, (h) base, (i) acid, (j) acid.

15.4 Recall that the conjugate base of a Brønsted acid is the species that remains when *one* proton has been removed from the acid.

(a) nitrite ion: NO_2^-

(b) hydrogen sulfate ion (also called bisulfate ion): HSO_4^-

(c) hydrogen sulfide ion (also called bisulfide ion): HS^-

(d) cyanide ion: CN^-

(e) formate ion: HCOO^-

15.5 In general the components of the conjugate acid–base pair are on opposite sides of the reaction arrow. The base always has one fewer proton than the acid.

(a) The conjugate acid–base pairs are (1) HCN (acid) and CN^- (base) and (2) CH_3COO^- (base) and CH_3COOH (acid).

(b) (1) HCO_3^- (acid) and CO_3^{2-} (base) and (2) HCO_3^- (base) and H_2CO_3 (acid).

(c) (1) H_2PO_4^- (acid) and HPO_4^{2-} (base) and (2) NH_3 (base) and NH_4^+ (acid).

(d) (1) HClO (acid) and ClO^- (base) and (2) CH_3NH_2 (base) and CH_3NH_3^+ (acid).

(e) (1) H_2O (acid) and OH^- (base) and (2) CO_3^{2-} (base) and HCO_3^- (acid).

15.6 The conjugate acid of any base is just the base with a proton added.

(a) H_2S (b) H_2CO_3 (c) HCO_3^- (d) H_3PO_4 (e) H_2PO_4^-

(f) HPO_4^{2-} (g) H_2SO_4 (h) HSO_4^- (i) HSO_3^-

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