

Acids & Bases

NChO 1999

1. Which oxide forms a basic solution when mixed with water?

- (A) K_2O (C) CO_2
(B) Al_2O_3 (D) SO_3

35. Which 0.1 M solution has the highest pH?

- (A) sodium carbonate
(B) sodium chloride
(C) ammonium carbonate
(D) ammonium chloride

36. Which is the strongest acid?

- (A) acetic acid - ($K_a = 1.8 \times 10^{-5}$)
(B) benzoic acid - ($K_a = 6.3 \times 10^{-5}$)
(C) formic acid - ($K_a = 1.8 \times 10^{-4}$)
(D) nitrous acid - ($K_a = 6.0 \times 10^{-4}$)

37. What is the order of concentration of the ions and molecules in a nitrous acid solution?

Nitrous acid, HNO_2 , is a weak acid.

- (A) $H_3O^+ = NO_2^- > HNO_2 > OH^-$
(B) $H_3O^+ = NO_2^- = HNO_2 = OH^-$
(C) $HNO_2 > H_3O^+ = NO_2^- > OH^-$
(D) $HNO_2 > NO_2^- > H_3O^+ > OH^-$

NChO 1998

33. A water solution of sodium carbonate, Na_2CO_3 , has a pH greater than 7 because

- (A) it contains more carbonate ions than water molecules.
(B) it contains more sodium ions than carbonate ions.
(C) sodium ions react with water.
(D) carbonate ions react with water.

34. Which species dissociates most completely in water solution?

- (A) NH_4^+ (C) HNO_3
(B) H_2CO_3 (D) HSO_4^-

37. According to Brønsted -Lowry Theory, which of these species cannot be amphoteric?

- (A) $NH_4^+(aq)$ (C) $NH_2^-(aq)$
(B) $NH_3(aq)$ (D) $NH_2^{2-}(aq)$

NChO 1997

34. Which acid reacts with NaOH to form sodium hypochlorite (the ingredient in household bleach)?

- (A) HOCl (C) $HOClO_2$
(B) $HOClO$ (D) $HOClO_3$

35. Which of these acids is the strongest in aqueous solution?

- (A) H_3PO_4 (C) $HClO_3$
(B) H_2SO_3 (D) HOCl

37. Normal rain water has a pH of 5.6. This is best explained by the presence of

- (A) nitrogen oxides.
(B) carbon dioxide.
(C) sulfur oxides.
(D) particulates.

38. In a 0.050 M solution of a weak monoprotic acid, $[H^+] = 1.8 \times 10^{-3}$. What is its K_a ?

- (A) 3.6×10^{-2} (C) 6.7×10^{-5}
(B) 9.0×10^{-5} (D) 1.6×10^{-7}

NChO 1996

34. According to the Brønsted-Lowry definition, a base is a substance that

- (A) increases the hydroxide ion concentration in water.
(B) can react with water to form OH^- ions.
(C) can donate an electron pair to form a covalent bond.
(D) can accept a proton from an acid.

5. What is the pH of a 0.02 M solution of KOH?

- (A) 12.3 (C) 2.0
(B) 12.0 (D) 1.7

36. Which couple is not a conjugate acid-base pair?
- (A) HCO_3^- and CO_3^{2-}
 (B) H_3O^+ and H_2O
 (C) H_2PO_4^- and PO_4^{3-}
 (D) NH_3 and NH_2^-

37. These acids are listed in order of decreasing acid strength in water.



According to the Brønsted-Lowry theory, which anion is the weakest base?

- (A) I^- (C) CH_3COO^-
 (B) NO_2^- (D) CN^-

38. What is the $[\text{H}^+]$ in a 0.40 M solution of HOCl?

Substance	Equilibrium Constant, K_a
HOCl	3.5×10^{-8}

- (A) 1.4×10^{-8} M (C) 1.9×10^{-4} M
 (B) 1.2×10^{-4} M (D) 3.7×10^{-4} M

39. Which of these salts will give a basic solution when added to water?

- (A) NH_4NO_3 (C) $\text{Ca}(\text{NO}_3)_2$
 (B) $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ (D) $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$

NChO 1995

2. When sodium oxide, Na_2O , is added to water, the major products expected are

- (A) Na^+ and OH^- ions
 (B) Na^+ ions and H_2O
 (C) Na^+ and O^{2-} ions
 (D) Na^+ and OH^- ions, and O_2 gas

36. At 0 °C the ion product constant of water, K_w , is 1.2×10^{-15} . The pH of pure water at this temperature is

- (A) 6.88 (C) 7.46
 (B) 7.00 (D) 7.56

37. What is the $[\text{H}^+]$ in a 0.010 M solution of HCN? The equilibrium constant, K_a , for HCN equals 6.2×10^{-10}
- (A) 3.6×10^{-3} M (C) 1.0×10^{-7} M
 (B) 2.5×10^{-6} M (D) 6.2×10^{-10} M

38. $\text{HCN}(\text{aq}) + \text{HCO}_3^-(\text{aq}) \rightleftharpoons \text{CN}^-(\text{aq}) + \text{H}_2\text{CO}_3(\text{aq})$

If the value of the equilibrium constant, K , is less than 1, what is the strongest base in this system?

- (A) HCN (C) CN^-
 (B) HCO_3^- (D) H_2CO_3

40. The conjugate acid of the bicarbonate ion, HCO_3^- , in H_2O is

- (A) H_3O^+ (C) OH^-
 (B) CO_3^{2-} (D) H_2CO_3

41. The sodium salt, NaA, of a weak acid is dissolved in water and no other substance is added. Which of the following statements is corrected?

- (A) $[\text{H}^+] = [\text{A}^-]$ (C) $[\text{A}^-] = [\text{OH}^-]$
 (B) $[\text{H}^+] = [\text{OH}^-]$ (D) $[\text{HA}] = [\text{OH}^-]$

42. Which of these ions is predicted to produce the most acidic solution when dissolved in H_2O ?

- (A) K^+ (C) Co^{2+}
 (B) Ba^{2+} (D) Fe^{3+}

43. When 0.10 M solutions of the solutes; HClO_4 , NH_4Br , KOH , KCN , are arranged in order in increasing $[\text{H}^+]$, the correct order is

- (A) $\text{KOH} < \text{KCN} < \text{NH}_4\text{Br} < \text{HClO}_4$
 (B) $\text{KCN} < \text{KOH} < \text{HClO}_4 < \text{NH}_4\text{Br}$
 (C) $\text{HClO}_4 < \text{NH}_4\text{Br} < \text{KCN} < \text{KOH}$
 (D) $\text{NH}_4\text{Br} < \text{HClO}_4 < \text{KOH} < \text{KCN}$