AP Chemistry Acid–Base Practice

Choose one answer per question. Circle A, B, C, or D.

1. In the model equation $HA + B \rightleftharpoons A^- + HB^+$, which species acts as the base in the forward direction?
   A. B
   B. HA
   C. HB^+
   D. A^-

2. A model ion Q^- acts as a base and gains one proton. What is its conjugate acid?
   A. HQ^-
   B. Q^{2-}
   C. HQ
   D. HQ^+

3. One model solution has pH 4.00 and a second has pH 6.00. How does the first solution’s hydronium concentration compare with the second’s?
   A. It is twice as large.
   B. It is 100 times as large.
   C. It is 10 times as large.
   D. It is 100 times smaller.

4. Two fictional monoprotic acid solutions start with the same dissolved acid concentration. A larger fraction of acid particles ionizes in X than in Y. Which acid is stronger in this comparison?
   A. The strength depends only on the size of the sample.
   B. The acid in Y
   C. Both strengths must be equal.
   D. The acid in X

5. In a water model, the temperature changes the value of the ion-product constant for water. Which criterion still identifies a neutral solution?
   A. The pH is exactly 7.00 at any temperature.
   B. Hydronium and hydroxide concentrations are equal.
   C. The hydroxide concentration is exactly zero.
   D. The pH and the ion-product constant are numerically equal.

6. A simulated aqueous solution at 25 °C has pOH 5.20. Using pH + pOH = 14.00, what is its pH?

A. 8.80
B. 5.20
C. 9.20
D. 19.20

7. The simulated hydronium concentration is 2.0×10^{-5} mol/L. Using the usual concentration approximation, what is the pH to two decimal places?

A. 2.00
B. 5.30
C. 5.00
D. 4.70

8. Model acid HX has Ka = 1.0×10^{-4}, and HY has Ka = 1.0×10^{-6} under the same conditions. Which conjugate base is stronger?

A. Both are equally strong.
B. X^-
C. Y^-
D. The formulas do not identify either conjugate base.

9. A fictional salt releases an inert spectator cation and A^-, the conjugate base of a weak acid HA. Which statement fits the model aqueous solution?

A. A^- can accept a proton from water, increasing hydroxide.
B. A^- donates a proton to water, increasing hydronium.
C. The spectator cation releases an equal amount of hydronium.
D. The salt makes a neutral solution simply because it contains equal numbers of ions.

10. Two same-volume model buffers use the same acid and conjugate base in a one-to-one ratio. Buffer A has four times the concentration of each component. Which buffer generally tolerates a larger addition of acid before its pH shifts by the same amount?

A. The ratio determines capacity and concentration determines pH.
B. Buffer B
C. Both tolerate the same addition because the ratio is equal.
D. Buffer A

11. An idealized monoprotic weak-acid titration reaches equivalence after 24.0 mL of model base has been added. Why can the curve at 12.0 mL estimate the acid’s pKa?

A. The pH has to equal 7.00 in every buffer.
B. All of HA has been converted to A^-.
C. Half of HA has been converted to A^-, so their concentrations are equal.
D. The hydroxide concentration is equal to the initial acid concentration.

12. A fictional diprotic model acid H_2D starts with 0.018 mol. Each unit of a model base removes one proton. How many moles of base does the model require to reach the second equivalence point?

A. 0.018 mol
B. 0.036 mol
C. 0.009 mol
D. 0.054 mol

13. A fictional buffer contains 0.009 mol A^- and 0.006 mol HA. A modeled proton input converts 0.003 mol A^- to HA with negligible volume change. What happens to the pH relative to pKa?

A. It finishes exactly at pKa.
B. It moves from below pKa to above pKa.
C. It stays above pKa the whole time.
D. It moves from above pKa to below pKa.

14. At 25 °C, two idealized titrations use the same strong base. One starts with a strong monoprotic acid; the other starts with a weak monoprotic acid. Which solution has the higher pH at its own equivalence point?

A. The weak-acid solution, because its conjugate base reacts with water.
B. The strong-acid solution, because its anion attracts more protons.
C. They must have the same pH because the starting acids have one removable proton.
D. The weak-acid solution, because extra titrant has already been added.

15. A model starts with 0.210 mol/L HA and no added A^-. At equilibrium, 0.010 mol/L HA has ionized and water’s own ionization is negligible. What is the concentration-based Ka?

A. 5.0×10^{-2}
B. 4.8×10^{-4}
C. 5.0×10^{-4}
D. 2.0×10^{-3}