# AP Chem - Unit 10 Review



1. If the acid dissociation constant, $K_a$, for an acid HA is $8 \times 10^{-4}$ at 25 °C, what percent of the acid is dissociated in a 0.50-molar solution of HA at 25 °C?

   A) 0.2%
   B) 1%
   C) 2%
   D) 4%

2. Each of the following can act as both a Brönsted acid and a Brönsted base EXCEPT

   A) $HCO_3^-$
   B) $H_2PO_4^-$
   C) $NH_4^+$
   D) $H_2O$

3. When phenolphthalein is used as the indicator in a titration of an HCl solution with a solution of NaOH, the indicator undergoes a color change from clear to red at the end point of the titration. This color change occurs abruptly because

   A) phenolphthalein is involved in the rate-determining step of the reaction between $H_3O^+$ and $OH^-$

   B) the solution being titrated undergoes a large pH change near the end point of the titration

   C) phenolphthalein undergoes an irreversible reaction in basic solution

   D) $OH^-$ acts as a catalyst for the decomposition of phenolphthalein

4. Equal volumes of 0.10-molar $H_3PO_4$ and 0.20-molar KOH are mixed. After equilibrium is established, the type of ion in solution in largest concentration, other than the $K^+$ ion, is

   A) $H_2PO_4^-$

   B) $HPO_4^{2-}$

   C) $PO_4^{3-}$

   D) $OH^-$

**5.** What volume of 0.150-molar HCl is required to neutralize 25.0 milliliters of 0.120-molar $Ba(OH)_2$?

A) 20.0 mL

B) 30.0 mL

C) 40.0 mL

D) 80.0 mL

**6.** A 1-molar solution of which of the following salts has the highest pH?

A) $Na_2SO_4$

B) $Na_2CO_3$

C) $NH_4Cl$

D) $NaHSO_4$

$$HC_2H_3O_2(aq) + CN^-(aq) \leftrightarrows HCN(aq) + C_2H_3O_2^-(aq)$$

**7.** The reaction represented above has an equilibrium constant equal to $3.7 \times 10^{-4}$. Which of the following can be concluded from this information?

A) $CN^-(aq)$ is a stronger base than $C_2H_3O_2^-(aq)$.
B) $HCN(aq)$ is a stronger acid than $HC_2H_3O_2(aq)$.
C) The conjugate base of $CN^-(aq)$ is $C_2H_3O_2^-(aq)$.
D) The pH of a solution containing equimolar amounts of $CN^-(aq)$ and $HC_2H_3O_2(aq)$ is 7.0.

**8** How can 100. mL of sodium hydroxide solution with a pH of 13.00 be converted to a sodium hydroxide solution with a pH of 12.00?

A) By diluting the solution with distilled water to a total volume of 200 mL
B) By diluting the solution with distilled water to a total volume of 1.00 L
C) By adding 100. mL of 0.10 *M* HCl
D) By adding 100. mL of 0.10 *M* NaOH

9. Ascorbic acid, $H_2C_6H_6O_6(s)$, is a diprotic acid with $K_1 = 7.9 \times 10^{-5}$ and $K_2 = 1.6 \times 10^{-12}$. In a 0.005 $M$ aqueous solution of ascorbic acid, which of the following species is present in the lowest concentration?

A) $H_3O^+(aq)$
B) $H_2C_6H_6O_6(aq)$
C) $HC_6H_6O_6^-(aq)$
D) $C_6H_6O_6^{2-}(aq)$

10. Which of the following is the conjugate acid of $NH_2^-$?

A) $NH^{2-}$
B) $NH_3$
C) $H^+$
D) $NH_4^+$

11. The pH of a solution prepared by the addition of 10. mL of 0.002 $M$ KOH($aq$) to 10. mL of distilled water is closest to

A) 12
B) 11
C) 10
D) 4

| Chemical Formula | Dissociation Constant |
|---|---|
| $CH_3COOH$ | $K = 1.8 \times 10^{-5}$ |
| $NH_3$ | $K = 1.8 \times 10^{-5}$ |
| $H_2CO_3$ | $K_1 = 4 \times 10^{-7}$ |
| $HCO_3^-$ | $K_2 = 4 \times 10^{-11}$ |

12. A buffer solution is prepared by mixing equal volumes of 0.50 $M$ weak acid with 1.0 $M$ of its conjugate base. Based on the data given in the table above, which of the following pairs of chemical solutions should be used to prepare the buffer solution so that the pH will be between 4 and 7?

A) $CH_3COOH$ and $NH_3$
B) $CH_3COOH$ and $CH_3COONa$
C) $H_2CO_3$ and $NH_3$
D) $H_2CO_3$ and $Na_2CO_3$

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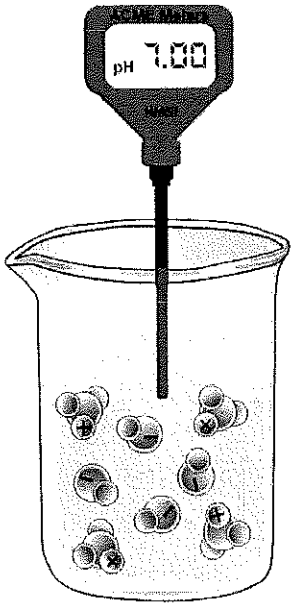
$$H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$$

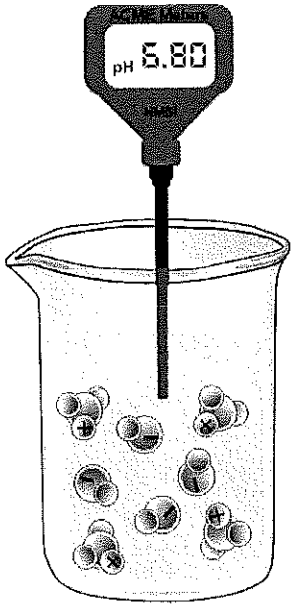
The autoionization of water, as represented by the equation above, is known to be endothermic and may also be represented as follows:

Which of the following correctly describes what occurs as the temperature of water is raised? Water molecules have been omitted for clarity.

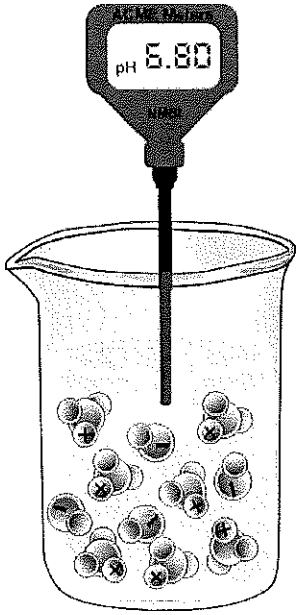
A)



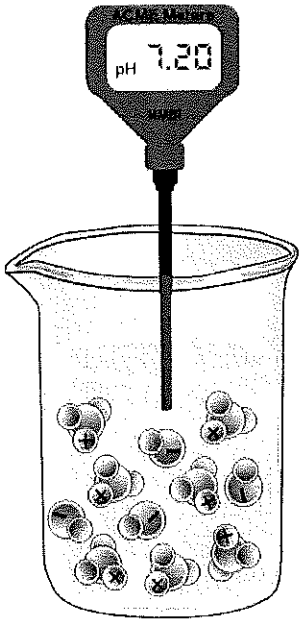

C)




B)




D)



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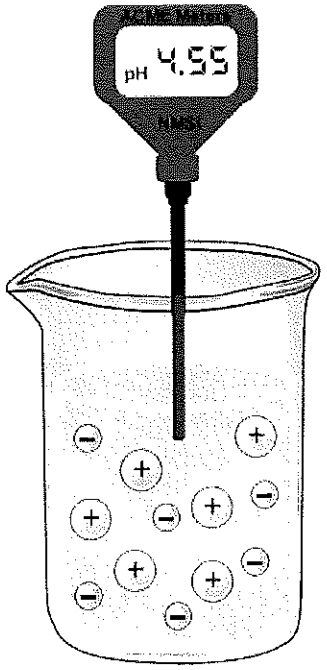
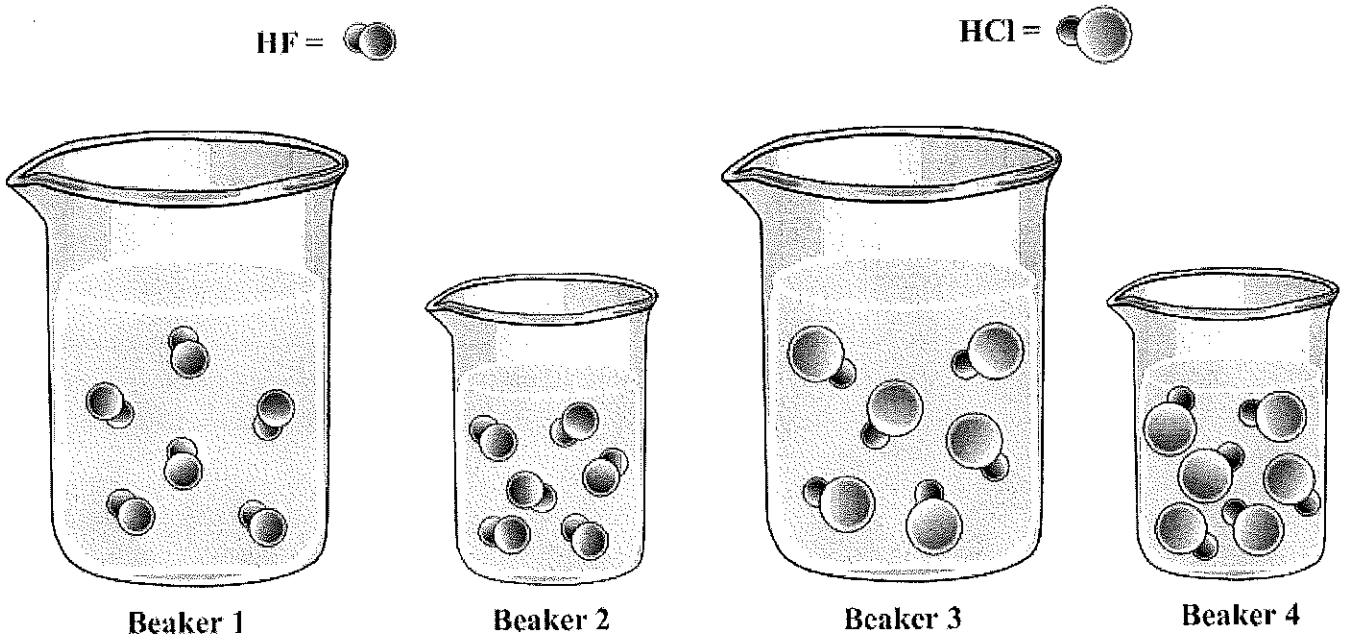



Which of the following salts is most likely to form an aqueous solution having the pH shown in the figure above?

A) $NH_4Cl$
B) NaBr
C) $LiNO_3$
D) RbCN

15 Equal moles of the indicated acids are dissolved in the amounts of water shown in the beakers below. In which solution will the percent ionization of the acid be the lowest?




A) Beaker 1
B) Beaker 2
C) Beaker 3
D) Beaker 4