

# Ionization Equations and Constants

Use with Chapter 18,  
Section 18.2

| Ionization Constants for Weak Acids |  |                       |
|-------------------------------------|--|-----------------------|
| Acid                                | Ionization equation  | $K_a$ (298 K)         |
| Hydrosulfuric                       | $\text{H}_2\text{S} \rightleftharpoons \text{H}^+ + \text{HS}^-$                 | $8.9 \times 10^{-8}$  |
|                                     | $\text{HS}^- \rightleftharpoons \text{H}^+ + \text{S}^{2-}$                      | $1 \times 10^{-19}$   |
| Phosphoric                          | $\text{H}_3\text{PO}_4 \rightleftharpoons \text{H}^+ + \text{H}_2\text{PO}_4^-$  | $7.5 \times 10^{-3}$  |
|                                     | $\text{H}_2\text{PO}_4^- \rightleftharpoons \text{H}^+ + \text{HPO}_4^{2-}$      | $6.2 \times 10^{-8}$  |
|                                     | $\text{HPO}_4^{2-} \rightleftharpoons \text{H}^+ + \text{PO}_4^{3-}$             | $2.2 \times 10^{-13}$ |
| Hydrofluoric                        | $\text{HF} \rightleftharpoons \text{H}^+ + \text{F}^-$                           | $6.3 \times 10^{-4}$  |
| Methanoic                           | $\text{HCOOH} \rightleftharpoons \text{H}^+ + \text{HCOO}^-$                     | $1.8 \times 10^{-4}$  |
| Ethanoic<br>(Acetic)                | $\text{CH}_3\text{COOH} \rightleftharpoons \text{H}^+ + \text{CH}_3\text{COO}^-$ | $1.8 \times 10^{-5}$  |
| Carbonic                            | $\text{H}_2\text{CO}_3 \rightleftharpoons \text{H}^+ + \text{HCO}_3^-$           | $4.5 \times 10^{-7}$  |
|                                     | $\text{HCO}_3^- \rightleftharpoons \text{H}^+ + \text{CO}_3^{2-}$                | $4.7 \times 10^{-11}$ |
| Hypochlorous                        | $\text{HClO} \rightleftharpoons \text{H}^+ + \text{ClO}^-$                       | $4.0 \times 10^{-8}$  |

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1. Why do some acids have more than one ionization equation?

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2. How do you know that the acids listed in the table are listed from strongest to weakest?

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3. Which is stronger, the conjugate base of carbonic acid or the conjugate base of phosphoric acid? Explain.

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4. Write all the ionization equations for phosphorous acid ( $\text{H}_3\text{PO}_3$ ), a weak acid.

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5. Write the ionization constant expression for these acids.

a. hypochlorous acid \_\_\_\_\_

b. methanoic acid \_\_\_\_\_

6. Why can you assume that the concentrations of the ions in the ionization constant expression for a weak acid are equal?

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