- Teeth are made from hydroxyapatite, $\text{Ca}_5(\text{PO}_4)_3\text{OH}$. Why does an acidic medium promote tooth decay and how can the decay be stopped using fluoridation of drinking water? Use chemical equations where appropriate.
Solution A consists of a 0.15 M aqueous solution of nitrous acid (HNO₂) at 25 °C. Calculate the pH of Solution A. The pKₐ of HNO₂ is 3.15.

ANSWER:

At 25 °C, 1.00 L of Solution B consists of 13.8 g of sodium nitrite (NaNO₂) dissolved in water. Calculate the pH of Solution B.

ANSWER:

Solution B (1.00 L) is poured into Solution A (1.00 L) and allowed to equilibrate at 25 °C. Calculate the pH of the final solution.

ANSWER:

If you wanted to adjust the pH of the mixture of Solution A and Solution B to be exactly equal to 3.00, which component in the mixture would you need to increase in concentration?
In the presence of excess hydroxide ion, \( \text{Mg}^{2+} \) can be precipitated as \( \text{Mg(OH)}_2(s) \). What amount (in mol) of solid sodium hydroxide must be added to a 0.10 M solution of \( \text{Mg(NO}_3)_2 \) to just cause precipitation of \( \text{Mg(OH)}_2(s) \)? The solubility product constant of \( \text{Mg(OH)}_2 \) is \( 7.1 \times 10^{-12} \text{ M}^3 \).

**ANSWER:**

In a separate experiment, the \( \text{Mg(OH)}_2 \) is precipitated by adding 0.10 mol of \( \text{Mg(NO}_3)_2 \) to 1.0 L of a 0.10 M \( \text{NH}_3 \) solution. What amount (in mol) of \( \text{NH}_4\text{Cl} \) must be added to this solution to just dissolve the precipitate? The \( \text{pK}_a \) of \( \text{NH}_4\text{Cl} \) is 9.24.

**ANSWER:**
- Shown here is the classical form of the amino acid leucine.

\[
\begin{array}{c}
\text{A} \\
\text{B}
\end{array}
\]

List the types of intermolecular interactions in which the sites A and B could be involved.

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Leucine has an unusually high melting point for a small molecule. Suggest a reason for this.
Ice is less dense than liquid water. The triple point of water is 0.001 °C, 0.006 atm and its critical point is 374 °C, 218 atm. Sketch the phase diagram for water showing all the main features.