The main mineral component of teeth is calcium hydroxyapatite $Ca_5(PO_4)_3OH$.

This is the same mineral, but as a crystal - not in a tooth. The color in this sample is due to small amounts of impurities.

$$Ca_5(PO_4)_3OH(s) \rightleftharpoons 5Ca^{2+}(aq) + 3PO_4^{3-}(aq) + OH^-(aq)$$

$$K_{sp} = 6.8 \times 10^{-37}$$

$$Ca_5(PO_4)_3F(s) \rightleftharpoons 5Ca^{2+}(aq) + 3PO_4^{3-}(aq) + F^-(aq)$$

$$K_{sp} = 3 \times 10^{-61}$$

H^+ reacts with multiple anions here – especially with the OH^-!

Discuss!

Does the solubility of teeth change in the presence of an acid?

How does the solubility of teeth treated with fluoride change in the presence of an acid?

Discuss!

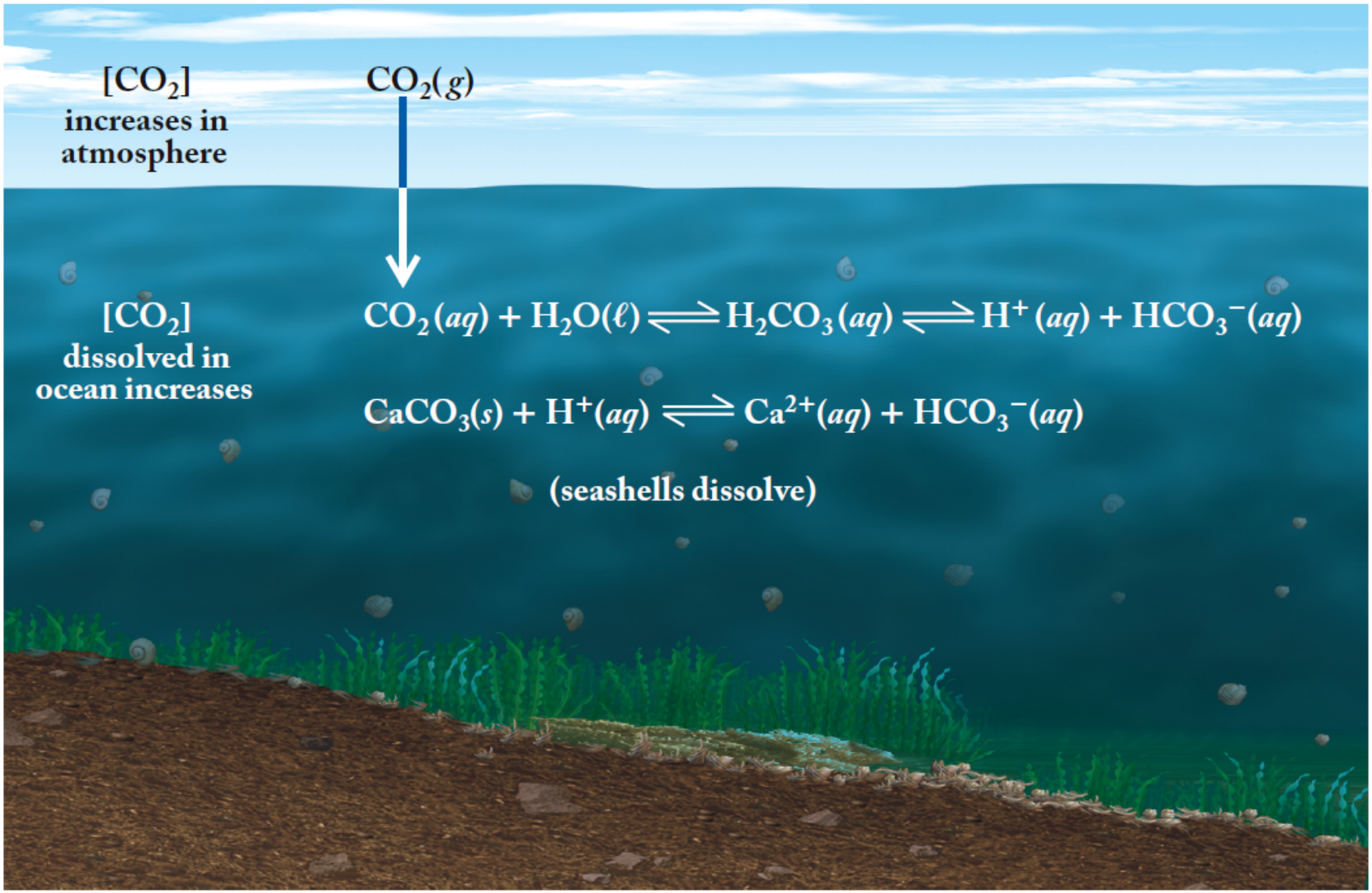
Does the solubility of teeth change in the presence of an acid?

Yes! H^+ reacts with OH^- to form H_2O, and Le Chatelier's Principle says if you remove a product, the system shifts to make more product. Product is ions.

How does the solubility of teeth treated with fluoride change in the presence of an acid?

H^+ reacts with F^- to form HF, and Le Chatelier's Principle says if you remove a product, the system shifts to make more product. Product is ions. K_{sp} is much smaller, and fluoride is a weaker base, so reacts less with acid.

Acidification of the Oceans



Discuss!

What does CO_2 form when it reacts with water?

Are global CO_2 levels changing?

What effect does this have on the pH of ocean water?

What effect does this have on the solubility of $CaCO_3$? Why?

Discuss!

What does CO_2 form when it reacts with water?

$CO_2 + H_2O \rightleftharpoons H_2CO_3$ (carbonic acid)

Are global CO_2 levels changing?

Yes – increasing, which allows more to dissolve

What effect does this have on the pH of ocean water?

This increases the acidity of the ocean, pH ↓

What effect does this have on the solubility of $CaCO_3$? Why? It dissolves more since carbonate is the anion of a weak acid (can be protonated, interacts according to K_{sp})