

# Chemistry 1010

The Chemistry of Food:

Vitamins and Minerals

**Now that we've discussed the macronutrients, it's time to talk about the micronutrients.**

## **Vitamins**

**Vitamins are complex organic compounds needed in small amounts in the diet.**

**Rather than providing energy or building material for the body, they participate in essential chemical reactions.**

**Vitamins can be divided into water-soluble and fat-soluble compounds.**

### **Fat soluble vitamins**

**stored in fat tissues in the body**

**you can build up a reserve for later use**

**they can also be toxic if you take too much**

### **Water soluble vitamins**

**dissolve in body fluids**

**not stored, you need them in your diet every day**

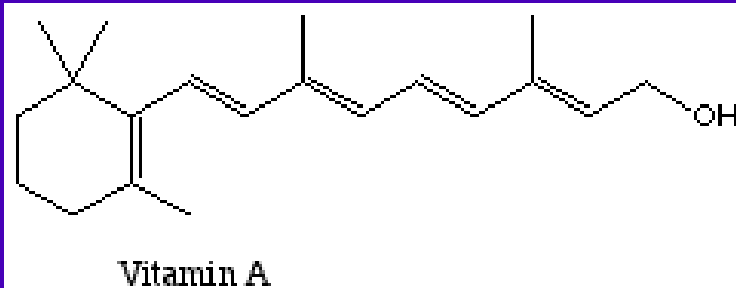
**extra doses are just excreted in urine**

**cooking vegetables in water removes these**

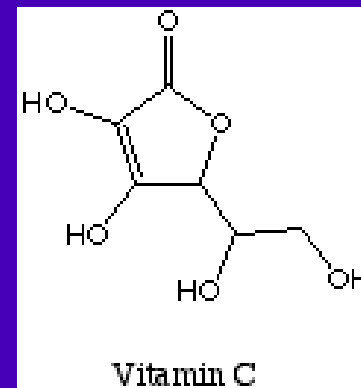
# What makes a vitamin fat-soluble or water-soluble?

**fat-soluble vitamins have mostly carbon and hydrogen**

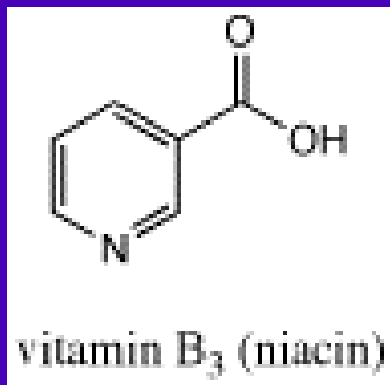
**water-soluble vitamins have many functional groups containing oxygen and nitrogen.**



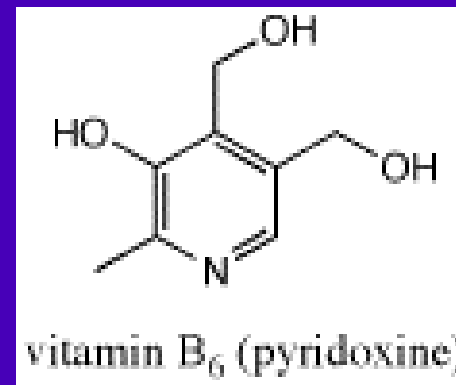
**fat-soluble**



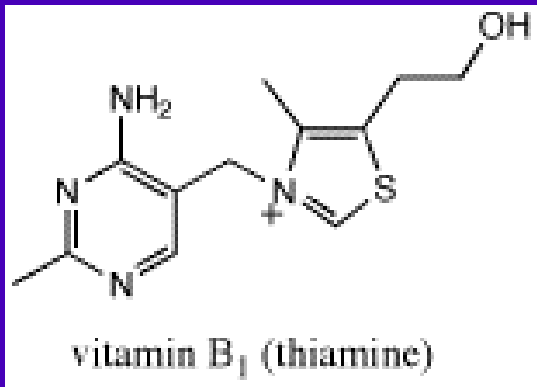
**water-soluble**



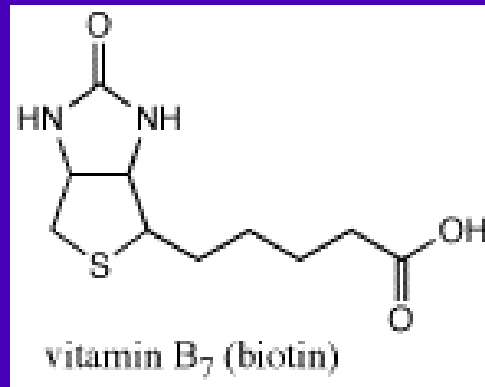
**water-soluble**



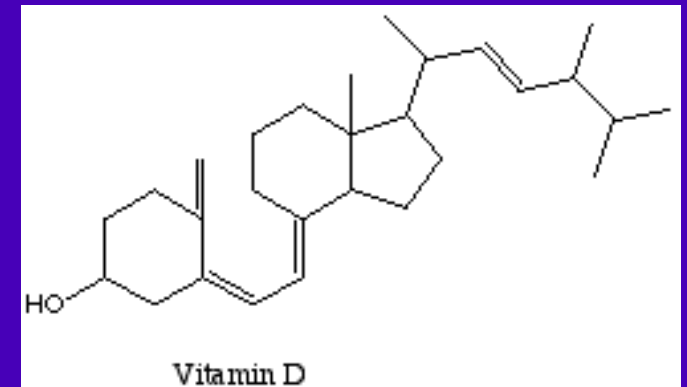
**water-soluble**



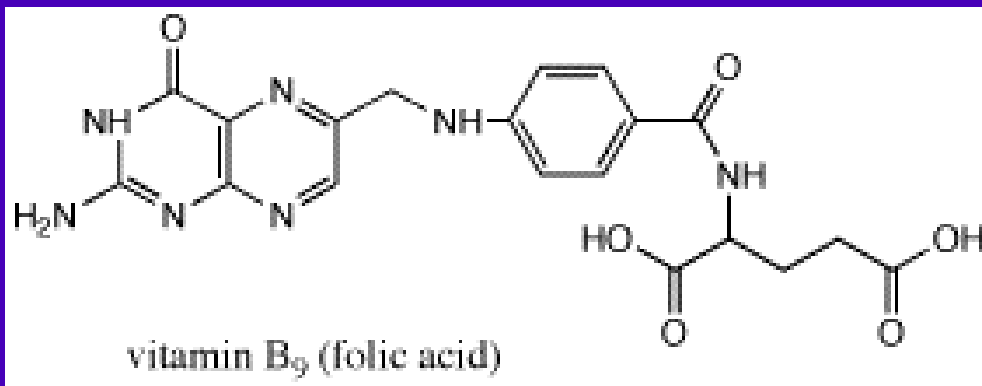
**water-soluble**



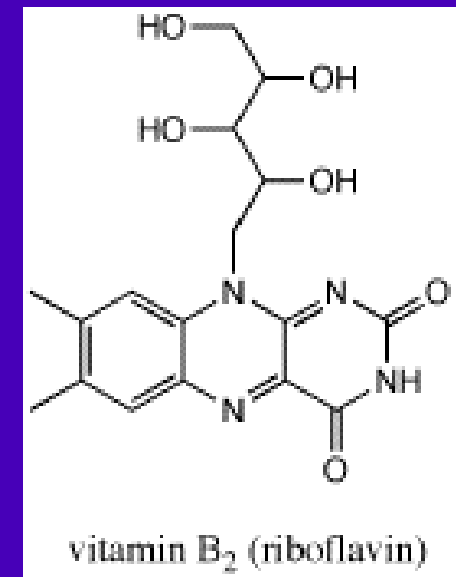
**water-soluble**



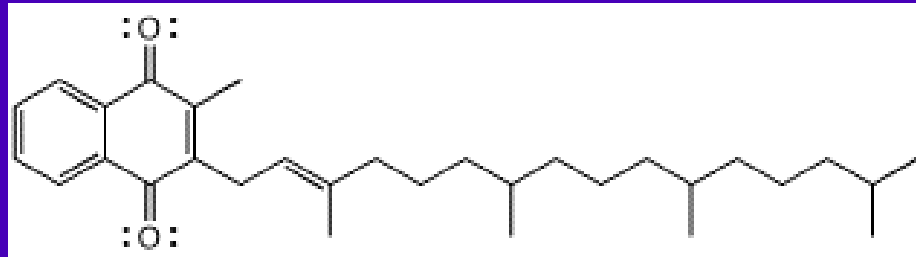
**fat-soluble**



**water-soluble**

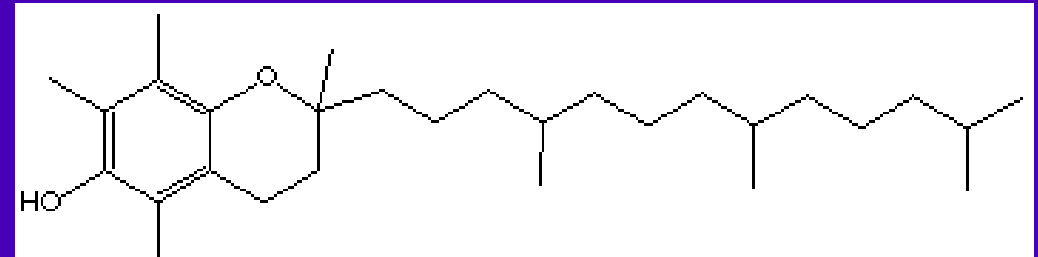


**water-soluble**



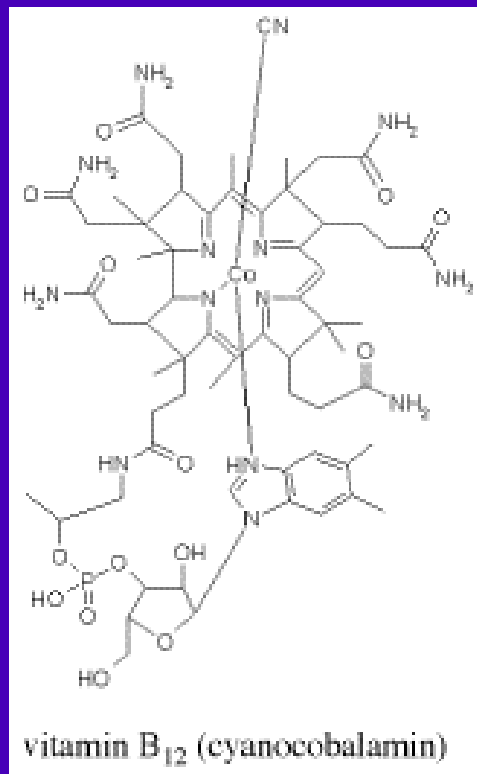
vitamin K

**fat-soluble**



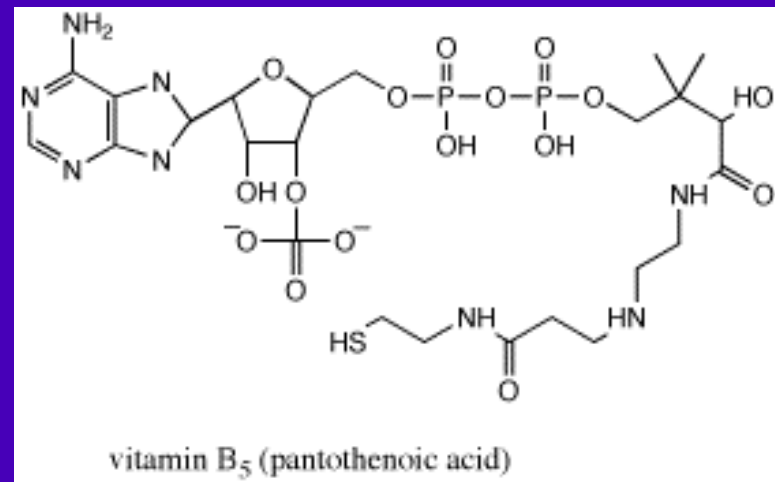
Vitamin E

**fat-soluble**



vitamin B<sub>12</sub> (cyanocobalamin)

**water-soluble**

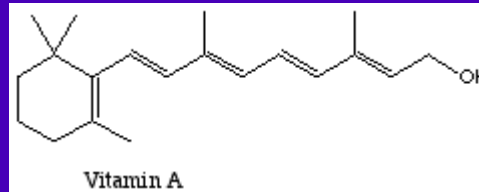


vitamin B<sub>5</sub> (pantothenic acid)

**water-soluble**

Let's look more closely at three of these vitamins:

vitamin A (retinol)



**Vitamin A is important for maintaining the health of eyes, skin, and mucus membranes, and for vision in dim light**

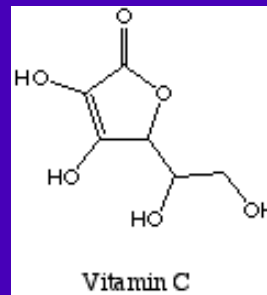
**Deficiency in vitamin A causes impaired dark adaptation and night blindness, and slow growth in children**

**Vitamin A is found in carrots, apricots, cantaloupe, and green leafy vegetables**



**The molecule actually present in foods is not vitamin A, but a precursor,  $\beta$ -carotene, that the body converts to it. Your body only makes as much as you need, so you can't usually reach toxic amounts from food.**

## Vitamin C (ascorbic acid)



**Vitamin C is necessary for forming collagen, a connective tissue.**

**Vitamin C deficiency causes scurvy, a disease with symptoms of swollen, bleeding gums, loose teeth, stiff, sore joints, and slow wound healing.**

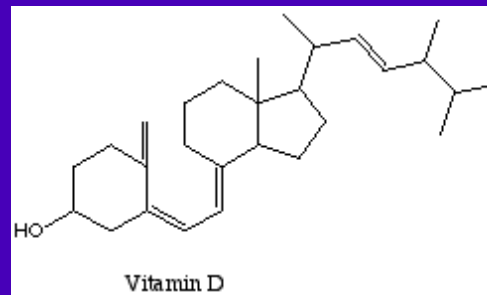
**Vitamin C is found in oranges, grapefruit, lemons, limes, and green peppers**



**Scurvy was a problem for sailors and pioneers, who rarely had fresh fruit to eat. British sailors called “limeys” because they ate limes to prevent scurvy.**



# Vitamin D (cholecalciferol)



**Vitamin D is important for the absorption of calcium and phosphorus in the intestines.**

**Lack of vitamin D causes rickets in children, osteomalacia in adults (soft, bowed bones)**



**Vitamin D is found mostly in fortified milk, but it can also be formed when sunlight strikes the skin.**



**In cold climates, cultures where all skin is covered, and when too much sunscreen is worn, vitamin D deficiency can occur.**



## Minerals

The other category of micronutrients is minerals.

Minerals are elements other than C, H, O and N which are needed for good health.

Minerals are divided into major minerals and minor minerals.

major minerals: **needed in amounts greater than 100 mg per day**

sulfur – **found in two amino acids, helps form their shape**

calcium, phosphorus – **found in bones and teeth**  
**important in nerve transmission**

magnesium – **nerve transmission**

sodium, potassium, chlorine – **electrolyte balance**

**minor minerals: needed in amounts less than 100 mg per day**

**iron – needed for hemoglobin to carry oxygen**

**iodine – to make thyroid hormone**

**cobalt – needed for vitamin B12 to work**

**others: fluoride, zinc, copper, selenium, manganese,  
molybdenum, chromium**

**Some minerals are needed in such small amounts, they weren't discovered until hospital patients were kept alive entirely by IV for long periods of time.**



# Where do vitamins and minerals come from?

**vitamins are  
manufactured  
by plants**

**minerals come  
from the soil  
plants are grown in**



**animal meat, milk,  
and eggs contain  
vitamins and minerals  
the animal got from  
eating plants**

**animals also manufacture  
a few vitamins**





## Nutrition Labels

**Good nutrition is extremely important for good health.**

**Four of the top ten causes of death are related to what we eat:**

**heart disease, stroke, cancer, diabetes**

**300,000 deaths per year attributable to diet**

**Federal law requires nutrition labels, designed to help the public make informed decisions about what to include in their diet.**

# What information can you get from the Nutrition Facts label?

<b>Nutrition Facts</b>	
Serving Size 1 cup (228g)	
Servings Per Container 2	
Amount Per Serving	
<b>Calories</b> 260	Calories from Fat 120
<hr/>	
% Daily Value*	
<b>Total Fat</b> 13g	<b>20%</b>
Saturated Fat 5g	<b>25%</b>
<i>Trans</i> Fat 2g	
<b>Cholesterol</b> 30mg	<b>10%</b>
<b>Sodium</b> 660mg	<b>28%</b>
<b>Total Carbohydrate</b> 31g	<b>10%</b>
Dietary Fiber 0g	<b>0%</b>
Sugars 5g	
<b>Protein</b> 5g	
<hr/>	
Vitamin A 4%	• Vitamin C 2%
Calcium 15%	• Iron 4%
* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:	
	Calories: 2,000    2,500
Total Fat	Less than 65g    80g
Sat Fat	Less than 20g    25g
Cholesterol	Less than 300mg    300mg
Sodium	Less than 2,400mg    2,400mg
Total Carbohydrate	300g    375g
Dietary Fiber	25g    30g
Calories per gram:	
Fat 9	• Carbohydrate 4    • Protein 4

- serving size
- servings per container
- total calories
- calories from fat
- total fat
- saturated fat
- trans fat
- unsaturated fat (subtract!)
- cholesterol
- sodium
- total carbohydrate
- dietary fiber
- sugars
- protein
- vitamins A and C
- calcium and iron