

The Chemistry of Life

There are about 6 elements that make up most of Living Things

Of the 92 naturally occurring elements, living things are composed of only about 26, and 6 of those 26 make up practically all of the weight of most living things. The other 20 elements essential for life are present in very small amounts, some in such tiny amounts that they are designated simply as "trace elements". The six most abundant elements are visualized on this diagram.

Color the heading Majority Elements in Living Things and titles H through B. It is recommended that you use the colors conventionally assigned in chemistry models, which are white or yellow for hydrogen, red for oxygen, black for carbon, and blue for nitrogen. There are no conventional colors for phosphorus and calcium, so pick any color you like. Then color as you read, coloring in sequence the boxes representing the majority elements in living things (H, O, C, N, P, Ca), the atoms rising and falling out of the boxes and forming compounds below the boxes, the water (A), and the food (B). Fill in the representative bands on the rabbit and the bush as you read about the percentage (by weight) of these living things formed by the six elements.

The element hydrogen is a gas, and it is the most abundant element in the universe. Most of the hydrogen on earth is combined with other elements. Hydrogen gas is so light that it easily escapes the earth's gravity at the upper edges of the atmosphere and is lost into outer space. Plants and animals are about 10 percent hydrogen by weight.

Oxygen is also a gas, but it is 16 times as heavy as hydrogen, so it remains in the atmosphere, although it also combines with many other elements. Water is a combination of two atoms of hydrogen and one atom of oxygen. Oxygen makes up about 63% of a typical animal and about 77 percent of a typical plant.

The element carbon is familiar to almost everyone in the form of charcoal, which is nearly pure carbon. Carbon can also form crystals such as graphite, which is used in pencil lead and in lubricants, or as diamond, which few people would guess is also pure carbon. In living organisms, carbon is combined with other elements to form carbohydrates, proteins, fats, and many other substances. Carbon comprises about 19% of the weight of a typical animal and about 12% of the weight of a typical plant. That particular combination of carbon, oxygen, and hydrogen shown here below the carbon box is the simple sugar glucose.

Nitrogen is a gas that makes up about 78% of the earth's atmosphere and is important to living things as a component of genes and proteins. Nitrogen constitutes about 4% of an animal and 1% of a plant.

Phosphorus is not found in nature as a pure element. It is so reactive that it will combine with almost anything it contacts, even the air. Yet a certain amount of it combined with other elements is necessary for life. Phosphorus comprises just under 1% of a plant or an animal.

Calcium is a grayish silver metal in pure form, but it too is rather reactive and is not found in pure form in nature. Very few plants have significant amounts of calcium, so is not shown on the plant diagram, but it makes up about 2% of the weight of a mammal, such as a rabbit, because it is one of the principal elements of the hard part of bone and is important in the contraction of muscle.

Analysis:

1. How many elements are involved in the chemical composition of living things?
2. What are the six most abundant elements in living things?
3. Why is hydrogen, the most abundant element in the universe, not found in earth's atmosphere?
4. What percent of the weight of a typical animal is oxygen?
5. What percent of the weight of a typical plant is oxygen?
6. Besides being part of the composition of bone, why else do mammals need calcium?

ELEMENTS IN LIVING THINGS.

MAJORITY ELEMENTS IN LIVING THINGS★

HYDROGEN_H
OXYGEN_O

CARBON_C
NITROGEN_N

PHOSPHORUS_P
CALCIUM_{Ca}

WATER_A
FOOD_B

