

Name: _____ Date: _____ Period: _____

How is pH Important to Living Organisms

HUMAN BLOOD pH:

Most living organisms can only survive within a narrow pH range. If the pH of their body or their environment fluctuates too much the organism can die. This is particularly true for human beings. For example, blood is normally slightly basic, with a pH range of 7.35 to 7.45. If our body's pH deviates slightly from this range, we will start to feel sick. If our blood pH falls below 6.8 or above 7.8, our body cells will stop functioning and death will occur.

If pH goes below 7.35, you have a condition called **acidosis**. Acidosis is caused by an overabundance of acid in the blood or a buildup of carbon dioxide in the blood. Carbon dioxide can build up in the blood when lung function is poor or breathing is slow. Symptoms of acidosis include drowsiness, nausea, vomiting, and fatigue. If left untreated, it can progress to coma and death.

When the pH goes above 7.45 you will have a condition called **alkalosis**. This can happen when there is an overabundance of bicarbonate in the blood or by a low level of carbon dioxide in the blood. When a person hyperventilates their breathing becomes more rapid and/or deeper. As a result, more carbon dioxide is expelled from the body. Alkalosis can also occur when the body loses too much acid such as when there are prolonged periods of vomiting. Symptoms include muscle weakness, muscle twitches and fatigue. It can ultimately progress to paralysis and death if not treated.

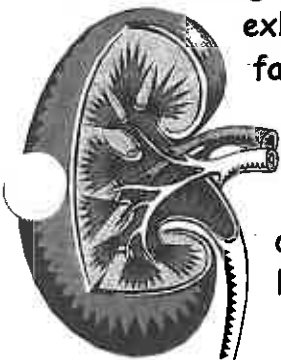
The body tries to maintain a stable, constant condition which is known as **homeostasis**. It has several systems in place to regulate its pH levels:

Lungs: One mechanism the body uses to control blood pH involves the release of carbon dioxide from the lungs. Carbon dioxide, which is mildly acidic, is a waste product created by cells as they use oxygen. As with all waste products, carbon dioxide gets excreted into the blood. The blood carries carbon dioxide to the lungs, where it is exhaled. As carbon dioxide accumulates in the blood, the pH of the blood lowers (acidity increases).

The brain regulates the amount of carbon dioxide that is exhaled by controlling the speed and depth of breathing. The amount of carbon dioxide exhaled, and consequently the pH of the blood, increases as breathing becomes faster and deeper. By adjusting the speed and depth of breathing, the brain and lungs are able to regulate the blood pH minute by minute.



Kidneys: The kidneys are also able to affect blood pH by excreting excess acids or bases in the urine. The kidneys make these adjustments more slowly than the lungs do, usually over several days.



As a means of preventing heartburn, restricting your diet is very important, since approximately 90-95% of sufferers can link their symptoms to specific foods. Sufferers should choose the kinds of foods risk of causing acid reflux, while some kinds of foods or drinks they are major heartburn triggers. Specifically, it has been shown that fatty foods and the symptoms of heartburn. Caffeinated beverages can cause tea, onions, peppermint, fruit or juice, pretzels, coffee, foods are to be avoided, chocolate, soda, or highly spiced especially shortly before bedtime (since acid has an easier time traveling back up the esophagus when you are lying down).



Should you have heartburn, it can be treated with medications that act to neutralize the acid in the stomach. For example, Tums, Alka-Seltzer, and baking soda are all basic solutions. When they are mixed with the acid in the stomach, some of the acid is neutralized. Less acid in the stomach means that stomach fluid has a higher pH. Then, when reflux occurs, the stomach contents washing up into the esophagus are less irritating because they contain much less acid.

PLANTS:

Human beings are not the only organisms that rely on fairly stable pH ranges. Plants also require narrow pH ranges for survival. Farmers must test the pH of their soil to be sure it is within the proper range for the crops they are trying to grow. For example, roses require a pH range of 5.8 to 6.2. Pine trees also require an acidic pH (4-6) whereas lettuce requires a basic pH of 8-9.

Did you know?

Farmers and gardeners used to taste their soil to determine its pH. If it had a sweet taste or smell, it was alkaline (basic). A sour taste meant it was acidic.

The pH of soil is very important because soil carries in it nutrients such as Nitrogen (N), Potassium (K), and Phosphorus (P) that plants need to grow, thrive, and fight off diseases. If the pH of the soil solution is increased above 5.5, Nitrogen (in the form of nitrate) is made available to plants. Phosphorus, on the other hand, is available to plants when soil pH is between 6.0 and 7.0.

Certain bacteria help plants obtain N by converting atmospheric Nitrogen into a form of N that plants can use. These bacteria live in root nodules of legumes (like alfalfa and soybeans) and function best when the pH of the plant they live in is growing in soil within an acceptable pH range. For instance, alfalfa grows best in soils having a pH of 6.2 - 7.8, while soybean grows best in soils with a pH between 6.0 and 7.0. Peanuts grow best in soils that have a pH of 5.3 to 6.6.

7. What is the pH level of stomach acid? What is the acid found in your stomach?
8. What is heartburn, what causes it, and how do antacids work to stop heartburn?
9. What kind of pH is necessary for plants to take up N and P? What happens if the soil is too acidic?
10. What is the danger associated with acidic soil and pesticide use?
11. What is added to soil to lower the pH? What is added to soil if the pH is too low?
12. What element must hydrangea plants have to produce a blue flower color? What kind of soil makes it possible for hydrangea plants to absorb this element?