

Acid/Base Homeostasis

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1. Acid/Base Homeostasis

- Chemical buffers, the respiratory system, and the urinary system work together to ensure that the pH of body fluids remain within a specific narrow limit.

2. Goals

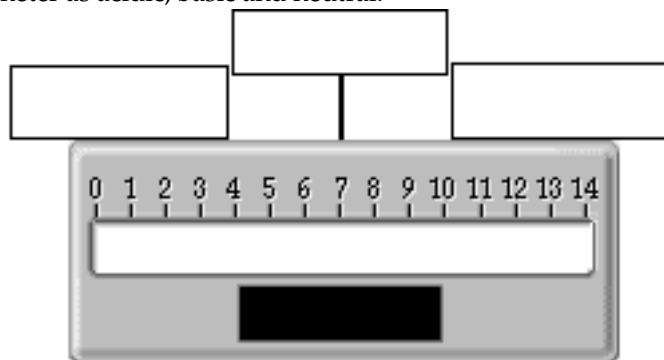
- To compare the pH differences of the various fluid compartments and exocrine secretions
- To describe the three homeostatic mechanisms the body uses to regulate pH
- To describe the causes and results of the four major acid/base disturbances
- To understand the compensation mechanisms involved in acid/base homeostasis

3. Maintaining a Balance of Acids and Bases

- Maintaining a balance of acids and bases is an important process in the body.
- We measure the acidity or basicity of a solution in units of pH, which is a measurement of the concentration of free hydrogen ion in solution.
- Acids and bases in our bodies come from the food we eat.
- Other acids come from metabolism. Lactic acid generated during exercise is an example.
- In order to maintain acid/base homeostasis, our bodies constantly need to adjust the pH of body fluids.

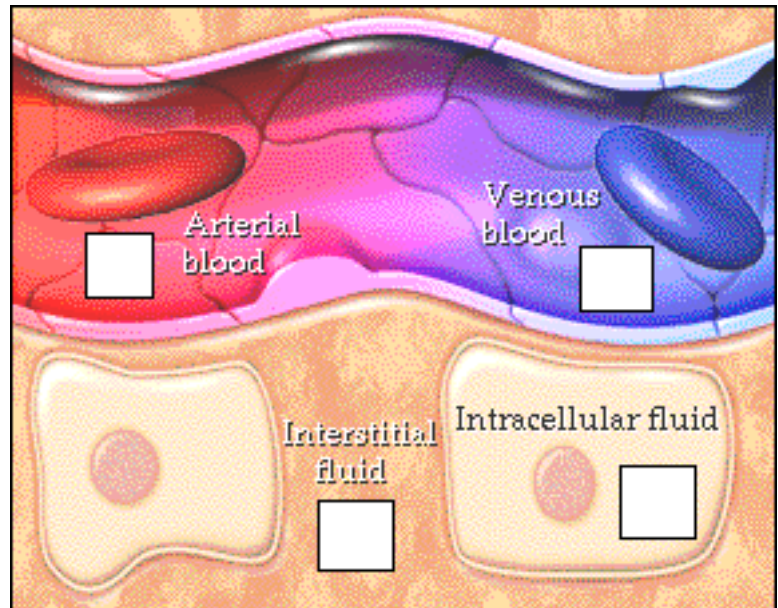
4. Concept of pH

- Which pH is the most acidic, pH 4 or 8? _____
- The lower the pH, the more acidic the solution is.
- When H^+ increases, acidity increases, and pH decreases.
- When H^+ decreases, acidity decreases, and pH increases.
- Which pH has the greater concentration of H^+ in it, pH 7 or 8? _____
- When a solution has more H^+ it is more acidic, and it has a lower pH.
- When we increase or decrease the pH by one pH unit, we are changing the concentration of H^+ by a factor of 10. So there is 10 times less H^+ in a pH 8 solution compared to a pH 7 solution.
- Label the parts of this pH meter as acidic, basic and neutral:



5. pH of Body Fluids

- Let's take the pH of some fluids in the body.
- The pH of arterial blood fluctuates within a normal range of 7.35-7.45.
- The pH of venous blood is slightly lower than that of arterial blood, about 7.35, caused by the presence of more carbonic acid.
- In addition the pH of interstitial fluid is about the same as for venous blood, 7.35.
- In the cell, pH will register about 7.0. Organelles within the cell also have different pH's.
- Which is the most acidic fluid compartment.

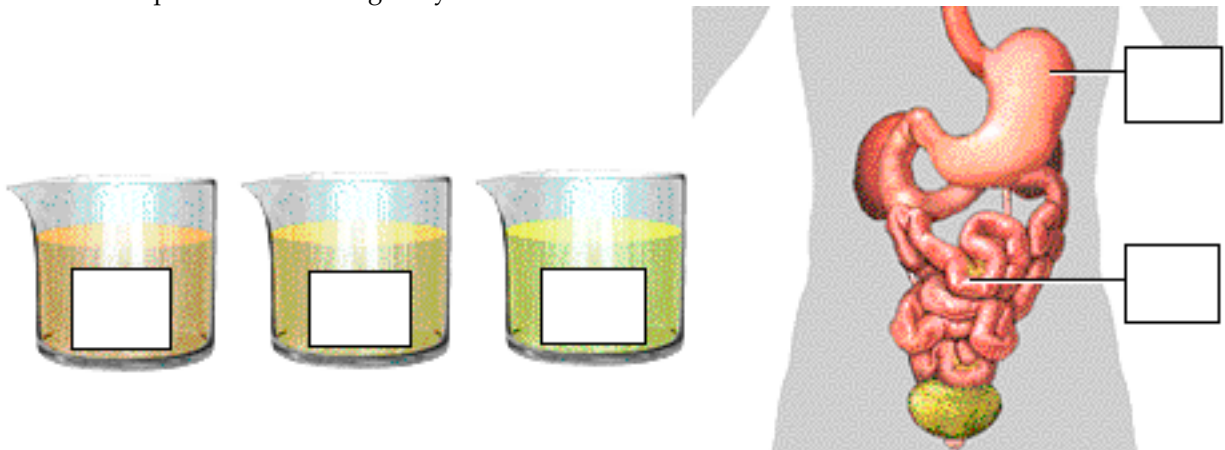


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- The lower the pH, the more acid is present.

- We have just checked the pH of the intracellular and extracellular fluids which are carefully regulated with respect to pH. Now let's check the pH of some exocrine secretions whose pH vary widely.

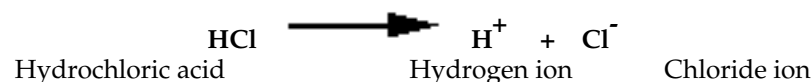
6. pH of Exocrine Secretions

- The pH of the gastric juice typically varies from 1.2 to 3.0. However the pH typically increases after eating a large meal as a result of the buffering effect of the food.
- The pH of the small intestine is slightly basic because of the presence of bicarbonate ions.
- In each container is a urine sample from the same individual at different times. The pH of urine will vary between 4.5 and 8.0 based on diet and metabolic state.
- Later we will see how the kidney helps to maintain the pH of body fluids by releasing acids and bases into the urine.
- Indicate the pH of the following body fluids:



7. Strong Acid: Hydrochloric Acid

- When the body is in acid/base homeostasis, the pH of the arterial blood is 7.35-7.45 and the proportion of acid and base is correct for normal body function.
- Let's look at the difference between strong and weak acids. Acids are substances that release hydrogen ion and are therefore hydrogen ion donors. Strong acids, such as hydrochloric acid, release all their hydrogen ion in water.



Continue to Acid/Base Homeostasis – Part II
(Separate Document)