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Acid-Base Balance Review

Camille Freeman Breaks Down Acidosis & Alkalosis: Video
Khan Academy Introduction to Buffers: Video

1) Match the description with the correct term:
    a) Increase in serum bicarbonate ion levels: _____
    b) An increase in carbon dioxide levels: _____
    c) A decrease in serum bicarbonate: _____
    d) A decrease in carbon dioxide levels: _____

Terms: *respiratory acidosis, respiratory alkalosis, metabolic acidosis, metabolic alkalosis*

2) The correct pH of the blood is:
    a) 7.45-7.55
    b) 7.35-7.40
    c) 7.45-7.50
    d) 7.35-7.45
    e) 7.40-7.45
3) Symptoms of acidosis include:
    a) Delirium, coma, hyperkalemia, hypercalcemia
    b) Hyperirritability, disorientation, hypokalemia, hypocalcemia
4) Symptoms of alkalosis include:
    a) Delirium, coma, hyperkalemia, hypercalcemia
    b) Hyperirritability, disorientation, hypokalemia, hypocalcemia
5) In an experiment, acid was added to two solutions and then the pH was taken.
   Solution 1: distilled water only
   Solution 2: distilled water containing sodium bicarbonate

Solution 1 had a final pH of 4.5, while Solution 2 had a final pH of 6.8.
Which of the following statements explains the difference between the two solutions?

    a) Sodium bicarbonate increases the temperature of a solution, which helped raise the pH of Solution 2.
    b) Hormones released in Solution 2 allowed it to maintain a higher pH.
    c) The water in Solution 1 had a lower starting pH than the water in Solution 2.
    d) Sodium bicarbonate acted as a pH buffer in Solution 2.

6) What is the blood pH in acidosis? Above / below: _____
7) What is the blood pH in alkalosis? Above / below: _____
8) Reduced blood flow through the kidneys for a long time will have what effect on serum pH?
9) How would the lungs and kidneys respond to the ingestion of large quantities of antacids?
10) If a client has respiratory disorder causing acidosis, will the lungs compensate or will the kidneys compensate?

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11) Case: Blood pH is 7.34. Both the $PaCO_2$ (partial pressure of carbon dioxide) and the HCO_3 (bicarbonate) levels are elevated.
    a) Is this person in acidosis or alkalosis?
        i)
    b) What does elevated CO_2 mean?
        i)
    c) Is this metabolic or respiratory?
        i)
    d) Why is the bicarb elevated?
        i)
12) Case: A diabetic client is producing excess amounts of ketoacids.
    a) Describe the effects of this excess on serum bicarb levels and serum pH.
        i)
    b) Explain the possible compensations for this imbalance.
        i)
13) If both CO_2 levels and bicarb levels are elevated, is this compensated or uncompensated?
14) What is the ratio of bicarb to carbonic acid?
15) How “many” bicarbs does it take to buffer 5 carbonic acids? (___:5)
16) What is the role of carbonic acid?
17) What is the role of carbonic anhydrase?
18) What is the nutrient cofactor for carbonic anhydrase?
19) Carbonic anhydrase inhibitors are primarily used for the treatment of glaucoma, but also for gout, altitude sickness, and as diuretics. What is the effect if inhibiting the carbonic anhydrase enzyme?
20) Prolonged strenuous exercise leads to an increase in lactic acid. Why is it better to have a cool-down period with mild exercise rather than total rest immediately following strenuous exercise?

Note: H_2CO_3 = carbonic acid | HCO_3^- = bicarbonate

For each of the following, what kind of acid-base imbalance would we see? (**Metabolic vs. Respiratory** and **Acidosis vs. Alkalosis**?)

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Chronic bronchitis, pneumonia:	
Chronic diarrhea:	
Extreme weight loss / lipolysis: - think about ketones (compensation: increased renal excretion of acids and conservation of bicarbonate)	
Early stage vomiting/bulimia:	
Shock:	
Kidneys excreting excess H+:	
Narcotic or barbiturate overdose:	
Panic attack / hyperventilation:	
Diabetic ketoacidosis:	
Renal failure: (H+ ions aren't being properly excreted) - kidneys can reabsorb and release both the bicarbs and the H+ ions, but in thinking about H+ ions as being more dangerous/powerful than the buffer	
Chest injury with punctured lungs (sorry, Paula):	

Click here for the Renal Case Study for 9/23
Click here for Additional Renal Case Studies

Other Kidney Stuff to Know:
(These are the videos I watched. There are more, but I found these most useful and I watched them at 1.5 times the normal speed. If you understand the stuff below, you don't need them.)
Khan Academy Glomerular Filtration Video
Khan Academy Role of Nephron & Reabsorption Video
Khan Academy Recap/Review of Nephron Video
Khan Academy RAAS Video

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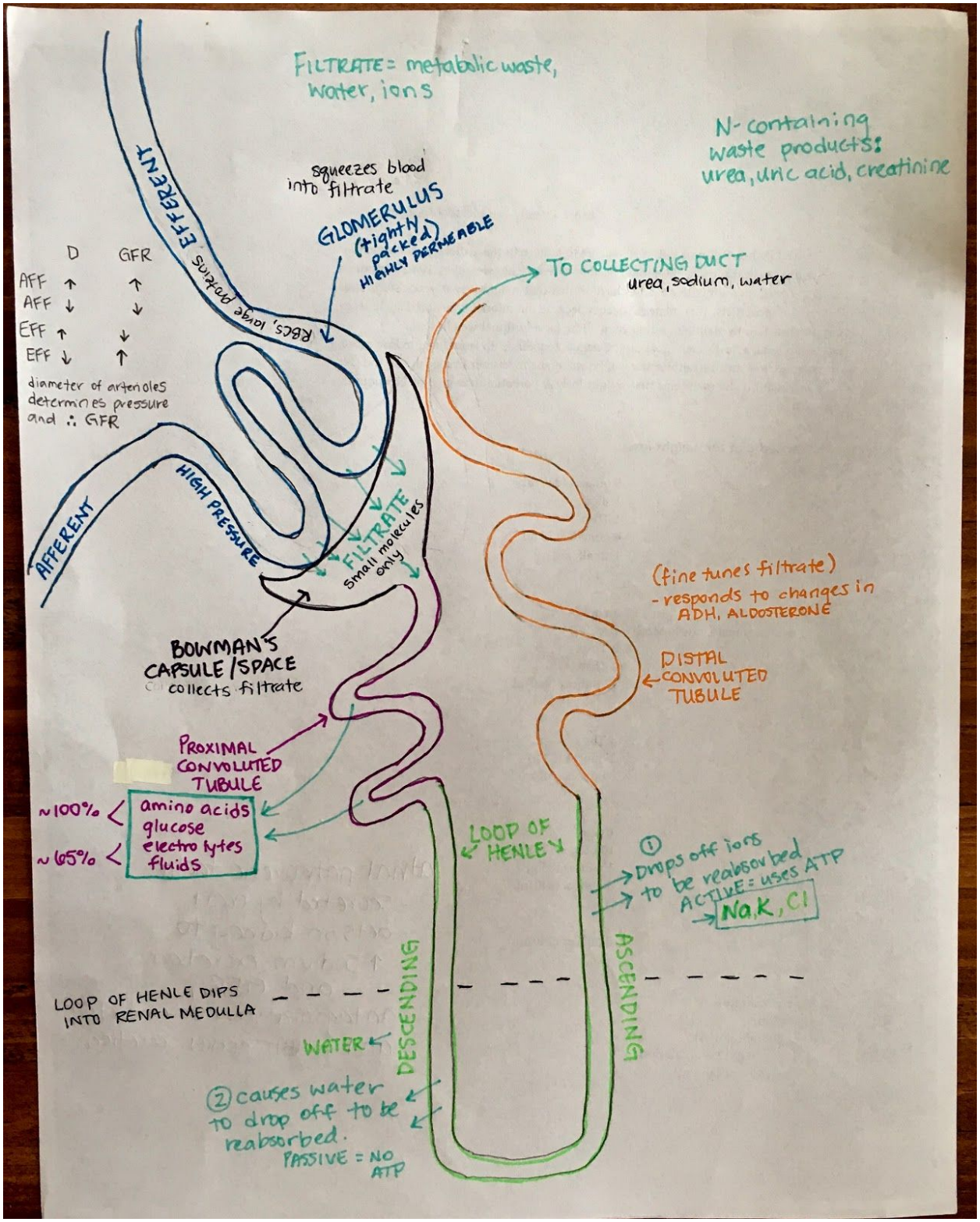
Understand the role of the glomerulus, the Bowman's capsule, the proximal convoluted tubule, the loop of henle, the distal convoluted tubule.



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RAAS:

The macula densa cells, located in the distal convoluted tubule of the nephron, test the filtrate that passes through. When they sense low salt and low blood pressure, they signal to the juxtaglomerular cells (JG cells) in the blood vessels of the kidneys to release RENIN.

RENIN is released and as it leaves, it runs into ANGIOTENSINOGEN (released by the liver), which is an inactive hormone. It is activated by RENIN and becomes ANGIOTENSIN I, which is converted by the endothelial cells throughout the body into ANGIOTENSIN II, a highly active hormone.

ANGIOTENSIN II has 4 effects to INCREASE BLOOD PRESSURE:

1) It signals to the skeletal muscles to vasoconstrict. (To increase BP)
2) It signals to the kidneys to reabsorb more water. (To increase BP)
3) It signals to the pituitary gland to secrete ADH (which tells your kidneys to reabsorb more water.)
4) It signals to the adrenal glands to secrete aldosterone. Aldosterone signals to the kidneys to reabsorb more salt. (This automatically causes more water to be reabsorbed because water always follows salt.)

Question: Are there inherent mechanisms to LOWER blood pressure?