Chapter 12 Reading Guide

1. List several functions of fluids.
2. A)Where is intracellular fluid (ICF) located? B)What is the largest component of extracellular fluid (ECF)?
3. Can you drink too much water? What are the symptoms?
4. List the symptoms of mild and extreme dehydration.
5. How is water lost from the body? How is it replenished?
6. A) What hormone causes water retention indirectly by causing kidneys to retain sodium? B) Where in the body does it come from?
7. What other effect does renin have on blood pressure? How are renin and angiotensin II related?
8. What are electrolytes?
9. If a cell were placed in pure water (no dissolved ions), would the cell shrink, swell, or experience no change in volume? Why?
10. What if a cell were placed in very salty water?
11. Which electrolytes are most easily lost via sweating?
12. Normally, what does your body do to deal with excess sodium intake?
13. Does high salt intake CAUSE hypertension in ALL people? Is there any drawback to limiting salt intake, as long as the daily sodium and chloride requirements are met?
14. Is sodium deficiency likely in the modern diet?
15. For most Americans, where (what type of foods) does most of our dietary sodium come from?
16. What is the name of a sodium deficiency, and what is one situation (besides deficient intake) that could bring it on?
17. Are chloride deficiencies or toxicities common?
18. Compare and contrast sodium and potassium: -what type of charge? –primary cation of the ECF or ICF? –which is better at attracting water? –which is found more in fresh foods? –which is found more in processed foods? –which is linked with increased blood pressure (when taken excessively)? –which is linked with decreased blood pressure (when taken adequately)?

19. What effect does potassium intake have on hypertension and risk of stroke?
20. What are some common causes and what are the symptoms of potassium deficiency?
21. What happens to excess potassium when ingested with food or supplements? Can too much K+ be life-threatening from food? From any source?
22. What are electrolytes? List the ones mentioned in this chapter.
23. Describe several functions of electrolyes.
24. What part of the brain controls thirst? What stimuli cause it to tell us we are thirsty? Besides inducing thirst, what other response will the body have (hint: hormones are released; what are they and what will they do)?
25. Why is it important that you drink throughout the day and not wait until you are thirsty?
26. Discuss the various modes of water intake and loss.
27. List 6 major minerals that are involved in fluid balance and neuromuscular function.
28. For each of the electrolytes covered in this chapter:
    a. Describe their functions
    b. Name, and describe symptoms of, deficiency disease
    c. Name, and describe symptoms of, toxicity disease
    d. Explain how common deficiency/toxicity is in the USA today, and what typically causes deficiency or toxicity
    e. List several good food sources
    f. Discuss any factors that might enhance or interfere with absorption

29. Discuss bottled water vs. tap water.
30. How are sodium and glucose absorption related?
31. What effect does a diet high in potassium have on blood pressure?
32. What effect does processing foods have on the sodium and potassium content of that food? Explain what processed foods are.
33. Is chlorine the same as chloride?
34. Discuss animal vs. plant bioavailability of phosphorus.

35. Go back to question 25 and expand upon your answer, now that you've gone through more of the chapter.
36. What are some lifestyle choices a person can make to keep his/her blood pressure normal?
37. Do sports drinks offer any measurable advantage for the average American (advantage over a well-rounded whole diet and plenty of water)? Explain. Here's an interesting comparison: check out table 9.7 and look at the sodium and potassium content for coffee and tea vs. the other drinks.

Supplemental Lectures

I. Blood and body fluids

a. Blood is composed of two parts:

i. Cellular- red and white blood cells plus platelets

ii. Plasma- water and dissolved solutes, mainly proteins and ions (minerals), but also things such as hormones and vitamins.

b. Extracellular Fluid (ECF) and Intracellular Fluid (ICF): ECF is found outside of cells; plasma and interstitial fluid (fluid in-between cells) are the 2 primary components of ECF. ICF is the fluid inside of cells. Cells work VERY hard to control the amounts and types of solutes in the ICF vs. the ECF. Cells can control the movement of solutes across their membranes (between the ECF and ICF), but they cannot control the movement of water. Water is attracted to certain solutes, especially Na+ and proteins. If cells can control the relative amounts of solutes in the ECF and ICF, they can keep the amount of water inside stable. If the ECF becomes too salty, water will move out of cells and they will shrink. If it becomes too dilute, water will move into cells and they will swell. Both situations are bad! The relative amounts of sodium and water in the ECF are very important for proper cell function. The next supplement will cover this in more detail.

II. Water and Electrolyte (minerals, ions) monitoring by the kidneys-

Blood plasma is filtered by the kidneys. Kidneys make sure that waste and excess solutes (for example, excess B-vitamins) are **excreted** in the **urine**. They also make sure that valuable solutes, for example glucose and proteins, are **retained** in the **blood**.

The amount of water let go (excreted) by the kidneys depends on two primary factors: a) body blood pressure, b) ion concentration (especially Na+) in the plasma.

Blood pressure needs to be maintained- it must be high enough to ensure that tissues get enough blood, but not too high. Excess pressure can damage vessels. If blood pressure is too high, kidneys will let more water be excreted into the urine. Reducing blood VOLUME reduces blood pressure. Kidneys will also excrete more Na+ when pressure is too high. Why? First, remember the relative amounts of Na+ and water (the concentration of Na+) is vital to proper cell function. Also, since water is attracted to Na+, if Na+ is excreted, water will be excreted more effectively.

Ion concentration needs to maintained within a certain range for proper nerve and muscle function, and generally to make sure cells don't swell or shrink. So, the kidneys also retain or excrete sodium and water based on plasma concentrations of Na+.

The kidneys, the brain and the heart all monitor either blood pressure or Na+ concentration or both. Each will release hormones that control water and Na+ retention by the kidneys. Those hormones are explained in the text.

Kidneys have limited ability to retain water specifically. When water really needs to be retained, the kidneys will

retain Na+ as well. Since water follows sodium, if more Na+ is retained in the blood, then more water will be retained.

III. **Mineral interactions-** excess intake of certain minerals can interfere with the absorption of other minerals. This is really only an issue when taking mineral supplements, not minerals from food. A general (but not absolute) rule is that similarly charged minerals interfere with each others' absorption. For example, if you take a Ca^{2+} supplement with a meal, the excess Ca^{2+} may interfere with the absorption of other 2+ minerals: iron (Fe^{2+}), magnesium (Mg^{2+}), zinc (Zn^{2+}). For this reason, some authorities recommend taking supplements between meals.

IV. **Processed Foods-** just to be clear, we are talking about stuff in cans, boxes and bags, particularly prepared meals, soups, etc. Processed foods often have lots of sodium added to them: to retain flavor, to add weight. I am actually uncertain how potassium is lost in the processing, um… process, but potassium content is reduced in processed foods (as a mineral, it would not be destroyed, but it is probably leached out during cooking, milling, etc). In any event, most Americans get most of their sodium from processed foods, and a diet that relies primarily on heavily processed foods is often low in potassium.