Chapter 12 Reading Guide

1. List several functions of water.
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. Does the AI for water include ALL sources of water, just pure water intake?
7. According to the DRI committee, do caffeinated beverages "count" as part of your water intake?
8. What are some advantages of hard water over soft water?
9. A) What hormone causes the direct retention of water by the kidneys? B) Where in the body does that hormone come from?
10. A) What hormone and enzyme cause water retention indirectly by causing kidneys to retain sodium? B) Where in the body does each come from?
11. Besides causing naodium/water retention, what other effect does rennin have on blood pressure?
12. What are electrolytes?
13. If a cell were placed in pure water (no dissolved ions), would the cell shrink, swell, or experience no change in volume? Why?
14. What if a cell were placed in very salty water?
15. When more sodium is retained by the kidneys, which electrolye is typically lost more?
16. Which electrolytes are most easily lost via sweating?
17. When a solution becomes more acid, the concentration of what electrolyte increased?
18. Very briefly describe the three mechanisms used to regulate blood pH.
19. Are minerals destroyed by light or heat?
20. What's the difference between "major" and "trace" minerals?
21. What are two substances found in plant foods that can decrease bioavailability of minerals? Provide examples of common foods that contain each.

22. Can single mineral supplements potentially decrease absorption of other minerals from food, if the supplement is taken with the meal? Explain.
23. Normally, what does your body do to deal with excess sodium intake?
24. 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?
25. Is sodium deficiency likely in the modern diet?
26. For most Americans, where does about 75% of our dietary sodium come from?
27. What is the name of a sodium deficiency, and what is one situation (besides deficient intake) that could bring it on?
28. Are chloride deficiencies or toxicities common?
29. 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)?
30. What effect does potassium intake have on hypertension and risk of stroke?
31. What are some common causes and what are the symptoms of potassium deficiency?
32. What happens to excess potassium when ingested with food or supplements? Can too much K+ be life-threatening from food? From any source?
33. What are some of the roles of calcium?
34. Why is it so important that blood concentrations of calcium are maintained, and why is that more immediately important than bone calcium?
35. Outline the effects calcium has, or is suspected to have, in preventing certain conditions and obesity. Is the obesity link absolutely confirmed?
36. If blood calcium is too high or too low, does this reflect a problem with diet? Why or why not?

37. Explain the responses of the body to falling blood calcium levels; name the hormones involved, where each comes from, and their effects (how each contributes to stabilizing blood calcium).
38. List several food sources besides dairy that provide decent amounts of bioavailable calcium.
39. Pho soup is prepared from a beef stock in which beef bones are soaked and slow cooked. Is Pho probably a good source of calcium?
40. For a young person (teenager let's say), what is the best way to protect against bone loss after age 35?
41. When will you know if you have inadequate calcium intake?
42. What are some symptoms of calcium toxicity?
43. What are some roles of phosphorus?
44. What are some roles of magnesium? What effect does adequate Mg^{2+} intake have on blood pressure?
45. Typically, why would Mg^{2+} deficiency occur? What are some symptoms?
46. Considering the vitamins and minerals covered so far, why is variety in the diet important?
47. Discuss briefly the factors that determine bone density and risk of osteoporosis (from Highlight 12).

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 Ca2+ supplement with a meal, the excess Ca2+ may interfere with the absorption of other 2+ minerals: iron (Fe2+), magnesium (Mg2+), zinc (Zn2+). For this reason, some authorities recommend taking supplements between meals.

*Go back to the Chapter 11 supplemental lectures for a refresher on blood vs. bone calcium.