BIOL 103 Homework (Ch. 7)
Answer Key

1. Describe two differences between fat-soluble and water-soluble vitamins.
   Fat-soluble vitamins first travel in the lymphatic system (inside chylomicrons) before entering the bloodstream.
   Water-soluble vitamins are absorbed directly into the bloodstream.
   Most fat-soluble vitamins are not readily excreted and are stored in the liver and adipose tissue.
   Most water-soluble vitamins are readily excreted and stored in limited quantities.

2. What are the main roles of vitamin A in the body? What is an early sign of vitamin A deficiency?
   Vitamin A is necessary for vision, cell differentiation, immune function, reproduction, and bone health. An early sign of vitamin A deficiency is night blindness.

3. What is vitamin D’s nickname? Why? Why is vitamin D also considered a hormone?
   Vitamin D is called the "sunshine vitamin" because UV sunlight hitting the skin makes vitamin D from cholesterol. Like all hormones, vitamin D is made in one part of the body and acts elsewhere in the body.

4. What is vitamin E’s primary function? What are the best sources of vitamin E?
   Vitamin E acts as an antioxidant. Nuts, seeds, and vegetable oils are good sources of vitamin E.

5. What is the best-known function of vitamin K?
   Blood clotting

6. Which two fat-soluble vitamins potentially are the most toxic? Which two are the least toxic?
   Vitamins A and D have the greatest potential to be toxic. Least toxic are vitamins E and K.

7. List the nine water-soluble vitamins and one main function for each.
   Thiamin functions in energy metabolism as the coenzyme thiamin pyrophosphate (TPP).
   TPP helps in the breakdown of glucose, synthesis of RNA and DNA, and synthesis of neurotransmitters.
   Riboflavin functions in energy metabolism as coenzymes that participate in reactions that break down glucose, fatty acids, and amino acids for energy.
   Niacin coenzymes function in 200 metabolic pathways including pathways in energy metabolism and fatty acid synthesis.
   Vitamin B₆ functions in amino acid metabolism and in the synthesis of hemoglobin and neurotransmitters.
   Folate is essential to the synthesis of DNA, and good folate status prevents some birth defects. Folate also helps lower homocysteine levels.
Vitamin B₁₂ activates folate and maintains the myelin sheath that protects nerve fibers and supports red blood cell synthesis.
Pantothenic acid functions in energy metabolism as part of coenzyme A.
Biotin acts as a coenzyme critical to energy and amino acid metabolism, as well as in fatty acid synthesis.
Vitamin C is important in collagen synthesis, assists with absorption of iron, and is an antioxidant.

8. **Name the diseases and/or characteristic symptoms of deficiencies of each water-soluble vitamin.**
Thiamin – beriberi
Riboflavin – ariboflavinosis
Niacin – pellagra
Vitamin B₆ – no disease name; a deficiency causes microcytic hypochromic anemia
Folate – no disease name; a deficiency causes megaloblastic anemia; low status during pregnancy increases risk for neural tube defects
Vitamin B₁₂ – deficiency can result from pernicious anemia and cause megaloblastic anemia and permanent nerve damage
Pantothenic acid – no disease name; deficiency is extremely unlikely
Biotin – no disease name, a deficiency causes hair loss, poor growth, and neurological symptoms
Vitamin C – scurvy

9. **List the water-soluble vitamins demonstrated to be toxic in large doses. What signs indicate toxic levels of each vitamin?**
The only water-soluble vitamins with demonstrated toxicity are niacin, vitamin B₆, and vitamin C. Excessive amounts of niacin can cause "niacin flush," nausea, headache, and blurred vision. Over time, liver damage can result. Excessive amounts of vitamin B₆ can cause irreversible nerve damage, and excessive doses of vitamin C can cause abdominal cramps and diarrhea.