Nutrition and Metabolism

1. Define essential nutrient.
   An essential nutrient is one that human cells cannot synthesize, such as certain amino acids.

2. List some common sources of carbohydrates.
   Carbohydrates can come from grains, vegetables, meats, cane sugar, beet sugar, molasses, honey, and fruits.

3. Summarize the importance of cellulose in the diet.
   Cellulose provides bulk (fiber or roughage) that the muscular wall of the digestive system can push against thereby facilitating the movement of the food.

4. Explain what happens to excess glucose in the body.
   Glucose is stored as glycogen in the liver and muscles. It is also stored as adipose tissue.

5. Explain why a temporary drop in the glucose concentration may impair nervous system functioning.
   The neurons depend upon a continuous supply of glucose for survival. Any decrease in the normal amount required will have an effect on the person’s neurological state.

6. List some factors that affect an individual’s need for carbohydrates.
   The physical activity of a person increases the need for carbohydrates. A person’s basal metabolic rate is one of the determining factors of the amount of carbohydrates needed.

7. Define triglyceride.
   A triglyceride is the most common dietary fat.

8. List some common sources of lipids.
   Lipids are found in both plant and animal based food. Meat, eggs, milk, lard, seeds, nuts, plant oils, liver, egg yolks, cheese, and some meats are sources of lipids.

   Beta-oxidation decomposes fatty acids. Beta-oxidation activates fatty acids and breaks them down into segments of two carbon atoms each.

10. Explain how fats may provide energy.
    Fatty acid segments are converted into acetyl coenzyme A, which can then be oxidized in the citric acid cycle.
    Before fats can be used as an energy source, they must be broken down into glycerol and fatty acids.

11. Describe the liver’s role in fat metabolism.
    The liver converts fatty acids from one form to another. It also controls the total amount of circulating lipids and cholesterol that is released into the blood.

12. Discuss the functions of cholesterol.
    Cholesterol is used to produce bile salts. It also provides structural material for cell and organelle membranes. It furnishes starting materials for adrenal cortex hormone production and synthesis of certain sex hormones.

13. Define deamination, and explain its importance.
    Deamination is a process that occurs in the liver that removes the nitrogen-containing portions (–NH₂ groups) from the amino acids. These –NH₂ groups subsequently react to form a waste called urea. The liver therefore produces urea from amino groups formed by deamination of amino acids. The blood carries urea to the kidneys, where it is excreted in urine.

14. List some common sources of protein.
    Meats, fish, poultry, cheeses, nuts, milk, eggs, cereals, and legumes are sources of protein.

15. Distinguish between essential and nonessential amino acids.
Essential amino acids are those that must be obtained in the diet as the body either can not manufacture them in sufficient quantities or are unable to produce them at all. A nonessential amino acid is one that the body can produce in sufficient quantities.

16. Explain why all of the essential amino acids must be present before growth can occur. If one of the amino acids is missing, then protein synthesis cannot take place. Protein synthesis is the backbone for growth.

17. Distinguish between complete and incomplete proteins. Complete proteins contain adequate amounts of the essential amino acids to maintain human body tissues and promote normal growth and development. Incomplete proteins are unable, by themselves, to maintain human tissues or to support normal growth and development.

18. Review the major functions of amino acids.
   a. Amino acids make up proteins, which are the building blocks of the body.
   b. Amino acids are also potential sources of energy.

19. Define nitrogen balance. Nitrogen balance is a condition in which the amount of nitrogen taken in is equal to the amount excreted.

20. Explain why a protein deficiency may be accompanied by edema. Protein deficiency may decrease the level of plasma proteins, which decreases the osmotic pressure of the blood. As a result, fluids collect in the tissues, producing a condition called nutritional edema.

21. Define calorie. A Calorie is the amount of heat needed to raise the temperature of a gram of water by one degree Celsius. The calorie used to measure food is 1,000 times greater.

22. Explain how the caloric values of foods are determined. Food samples are placed into a bomb calorimeter. The chamber is filled with oxygen gas and submerged in water. The food is ignited and allowed to oxidize completely. Heat released from the food raises the temperature in the surrounding water, and the change in temperature is measured. Since the volume of water is known, the amount of heat released from the food can be calculated.

23. Define basal metabolic rate. The basal metabolic rate (BMR) is a measurement of the rate at which the body expends energy under basal conditions. These basal conditions are when a person is awake and at rest, after an overnight fast, and in a comfortable controlled environment.

24. List some factors that affect the BMR.
   a. Sex
   b. Body size
   c. Body temperature
   d. Level of endocrine gland activity

25. Define energy balance. Energy balance exists when the caloric intake equals the caloric output.

26. Explain what is meant by desirable weight. Desirable weight is a weight that is based on the height-weight guidelines that are based upon people that live the longest. It is difficult to define at best.

27. Distinguish between overweight and obesity. Overweight can be defined as exceeding desirable weight by 10% to 20%. Obesity is properly defined as an excess of adipose tissue. It is also when an individual exceeds 20% of the desirable weight.

28. Discuss the general characteristics of fat-soluble vitamins.
Fat-soluble vitamins dissolve in fats and are affected by the same factors that influence lipid absorption. They are stored in moderate quantities in various tissues. These vitamins are fairly resistant to the effects of heat so cooking or food processing does not destroy them.

29. List the fat-soluble vitamins, and describe the major functions of each vitamin.
   a. Vitamin A—Necessary for synthesis of visual pigments, mucoproteins and mucopolysaccharides as well as for normal development of bones and teeth and the maintenance of epithelial cells.
   b. Vitamin D—Promotes the absorption of calcium and phosphorus as well as promotes the development of teeth and bones.
   c. Vitamin E—Prevents oxidation of vitamin A and polyunsaturated fatty acids and may help maintain stability of cell membranes.
   d. Vitamin K—Needed for synthesis of prothrombin, which functions in blood clotting.

30. List some good sources for each of the fat-soluble vitamins.
   a. Vitamin A—Liver, fish, whole milk, butter, eggs, leafy green vegetables, yellow and orange vegetables, and fruit.
   b. Vitamin D—Milk, egg yolk, fish liver oils, and fortified foods.
   c. Vitamin E—Oils from cereal seeds, salad oils, margarine, shortenings, fruits, nuts, and vegetables.
   d. Vitamin K—Leafy green vegetables, egg yolk, pork, liver, soy oil, tomatoes, and cauliflower.

31. Explain what is meant by the vitamin B complex.
   Vitamin B complex is several compounds that are essential for normal cellular metabolism that often occur together in foods.

32. List the water-soluble vitamins, and describe the major functions of each vitamin.
   a. Thiamine (Vitamin B₁)—part of the coenzyme needed for oxidation of carbohydrates and in a coenzyme needed in synthesis of ribose.
   b. Riboflavin (Vitamin B₂)—part of enzymes and coenzymes such as FAD, needed for oxidation of glucose and fatty acids as well as needed for cellular growth.
   c. Niacin (Nicotinic Acid)—part of coenzymes NAD and NADP needed for oxidation of glucose and synthesis of proteins, fats, and nucleic acids.
   d. Vitamin B₆—coenzyme needed for synthesis of proteins and various amino acids as well as for conversion of tryptophan to niacin, for antibody production and for synthesis of nucleic acids.
   e. Pantothenic Acid—part of coenzyme A needed for oxidation of carbohydrates and fats.
   f. Cyanocobalamin (Vitamin B₁₂)—part of coenzyme needed for synthesis of nucleic acids and for the metabolism of carbohydrates; plays a role in myelin synthesis.
   g. Folacin (Folic Acid)—coenzyme needed for metabolism of certain amino acids and for synthesis of DNA as well as production of normal red blood cells.
   h. Biotin—coenzyme needed for metabolism of amino acids and fatty acids and for synthesis of nucleic acids.
   i. Ascorbic Acid (Vitamin C)—needed for collagen production, conversion of folacin to folic acid, and metabolism of certain amino acids as well as promoting absorption of iron and synthesis of hormones from cholesterol.

33. List some good sources for each of the water-soluble vitamins.
   a. Thiamine (Vitamin B₁)—lean meats, liver, eggs, whole-grain cereals, leafy green vegetables, and legumes.
   b. Riboflavin (Vitamin B₂)—meats, dairy products, leafy green vegetables, and legumes.
   c. Niacin (Nicotinic Acid)—liver, lean meats, peanuts, and legumes.
   d. Vitamin B₆—liver, meats, bananas, avocados, beans, peanuts, whole-grain cereals, and egg yolk.
   e. Pantothenic Acid—meats, whole-grain cereals, legumes, milk, fruits, and vegetables.
f. **Cyanocobalamin** *(Vitamin B12)*—liver, meats, milk, cheese, and eggs.
g. **Folacin** *(Folic Acid)*—liver, leafy green vegetables, whole-grain cereals, and legumes.
h. **Biotin**—liver, egg yolk, nuts, legumes, and mushrooms.
i. **Ascorbic Acid** *(Vitamin C)*—citrus fruits, tomatoes, potatoes, and leafy green vegetables.

34. **Discuss the general characteristics of the mineral nutrients.**
**Minerals** can be incorporated into organic molecules such as the iron in hemoglobin. They also can be in inorganic molecules such as the calcium phosphate of bones. Other minerals are free ions such as sodium in the blood. They are present in all body cells where they comprise parts of the structural material. They are also portions of enzyme molecules, contribute to the osmotic pressure of body fluids, and play vital roles in the conduction of nerve impulses, the contraction of muscle fibers, the coagulation of blood, and the maintenance of pH.

35. **List the major minerals, and describe the major functions of each mineral.**
   a. **Calcium** *(Ca)*—is important for bone and teeth structure; is essential for nerve impulse conduction, muscle fiber contraction, and blood coagulation; increases the permeability of cell membranes; and activates certain enzymes.
   b. **Phosphorus** *(P)*—is important for bone and teeth structure; is a component in nearly all metabolic reactions; is a constituent of nucleic acids, many proteins, some enzymes, and some vitamins; and occurs in cell membranes, ATP, and phosphates of the body fluids.
   c. **Potassium** *(K)*—helps to maintain intercellular osmotic pressure and regulate pH; promotes metabolism; is needed for nerve impulse conduction and muscle fiber contraction.
   d. **Sulfur** *(S)*—is an essential part of various amino acids, thiamine, insulin, biotin, and mucopolysaccharides.
   e. **Sodium** *(Na)*—helps to maintain osmotic pressure of extracellular fluids and regulate water movement; needed for conduction of nerve impulses and contractions of muscle fibers; aids in regulation of pH and in transport of substances across cell membranes.
   f. **Chlorine** *(Cl)*—helps maintain osmotic pressure of extracellular fluids, regulates pH, and maintains electrolyte balance; is essential in the formation of hydrochloric acid; aids transport of carbon dioxide by red blood cells.
   g. **Magnesium** *(Mg)*—needed in metabolic reactions that occur in mitochondria and are associated with the production of ATP; plays a role in the breakdown of ATP to ADP.

36. **List some good sources for each of the major minerals.**
   a. **Calcium** *(Ca)*—milk, milk products, and leafy green vegetables
   b. **Phosphorus** *(P)*—meats, cheese, nuts, whole-grain cereals, milk, and legumes
   c. **Potassium** *(K)*—avocados, dried apricots, meats, nuts, potatoes, and bananas
   d. **Sulfur** *(S)*—meats, milk, eggs, and legumes
   e. **Sodium** *(Na)*—table salt, cured ham, sauerkraut, cheese, and graham crackers
   f. **Chlorine** *(Cl)*—same as for sodium
   g. **Magnesium** *(Mg)*—milk, dairy products, legumes, nuts, and leafy green vegetables

37. **Distinguish between a major mineral and a trace element.**
**Major minerals**, such as calcium and phosphorus, account for nearly 75% of the mineral elements in the body. The other major minerals account for 0.05% or more of the body minerals. A **trace element** is an essential mineral that is found in minute amounts, each taking up less than 0.005% of the adult body weight.

38. **List the trace elements, and describe the major functions of each trace element.**
   a. **Iron** *(Fe)*—is part of the hemoglobin molecule, catalyzes formation of Vitamin A; is incorporated into a number of enzymes.
   b. **Manganese** *(Mn)*—occurs in enzymes needed for synthesis of fatty acids, and cholesterol, formation of urea, and normal functions of the nervous system.
39. List some good sources of each of the trace elements.
   a. Iron (Fe)—liver, lean meats, dried apricots, raisins, enriched whole-grain cereals, legumes, and molasses.
   b. Manganese (Mn)—nuts, legumes, whole-grain cereals, leafy green vegetables and fruits.
   c. Copper (Cu)—liver, oysters, crab meat, nuts, whole-grain cereals, and legumes.
   d. Iodine (I)—iodized table salt.
   e. Cobalt (Co)—liver, lean meats, and milk.
   f. Zinc (Zn)—meats, cereals, legumes, nuts, and vegetables.
   g. Fluorine (F)—fluoridated water.
   h. Selenium (Se)—lean meats, fish, and cereals.
   i. Chromium (Cr)—liver, lean meats, and wine.

40. Define adequate diet.
    An adequate diet provides sufficient energy (calories), essential fatty acids, essential amino acids, vitamins, and minerals to support optimal growth and to maintain and repair body tissues.

41. Explain various methods to eat an adequate diet.
    Read and understand food labels.
    Disregard claims such as “light” and “low fat” and skip right to the calories of different ingredients.
    Follow the U.S. Dept. of Agriculture food pyramid as a guideline to healthy eating.

42. Define malnutrition.
    Malnutrition is poor nutrition that results from a lack of essential nutrients or a failure to utilize them.

43. Distinguish between primary and secondary malnutrition.
    Malnutrition that is caused by diet alone is called primary malnutrition. Secondary malnutrition occurs when an individual’s characteristics make a normally adequate diet insufficient. This can be a secondary condition to a devastating illness such as cancer.

44. Discuss bodily changes during starvation.
    After one day without eating, the body’s reserves of sugar and starch are gone. The body then extracts energy from fat and then from muscle protein. Hunger ceases as the body uses energy from fat reserves. Metabolism gradually slows to conserve energy, blood pressure drops, the pulse slows, and chills set in. Skin becomes dry and hair falls out. The immune system’s antibody proteins are dismantled for their amino acids causing a decline in protection against infection. Mouth sores and anemia develop, the heart beats irregularly, and bone begins to degenerate. After several weeks, coordination is lost. Near the end, the starving individual is blind, deaf, and emaciated.

45. Distinguish among marasmus, kwashiorkor, anorexia nervosa, and bulimia.
    Marasmus is caused by a lack of nutrients and causes the person to resemble a living skeleton. Kwashiorkor is a form of protein starvation that generally appears in a child that has just been weaned from protein-rich breast milk to protein-poor gruel. These are the
children with the protruding bellies. **Anorexia nervosa** is a condition where the person suffers from a self-imposed starvation. **Bulimia** is a condition where a person eats everything they want, often in large quantities, and then purge themselves with self-induced vomiting or laxative abuse.

### 46. Describe some medical conditions that affect the ability to obtain adequate nutrition as a person ages.

Medical conditions that affect the ability to obtain adequate nutrition include depression, tooth decay and periodontal disease, diabetes mellitus, lactose intolerance, and alcoholism. These conditions may lead to deficiencies that are not immediately obvious. Vitamin A deficiency, for example, may take months or years to become noticeable because the liver stores this fat-soluble vitamin. Calcium depletion may not produce symptoms, even as the mineral is taken from bones. The earliest symptom of malnutrition, fatigue, may easily be attributed to other conditions or ignored.