ANSWERS TO CHAPTER 17

CONTENT LEARNING ACTIVITY

Nutrition
1. Nutrients; 2. Essential nutrients; 3. Balanced diet; 4. Kilocalorie

Carbohydrates
1. Glucose; 2. Sucrose; 3. Starch; 4. Glycogen; 5. Cellulose; 6. Disaccharide; 7. Complex carbohydrate

Lipids
1. Triacylglycerol; 2. Saturated fat; 3. Unsaturated fat; 4. Adipose; 5. Fatty acids; 6. Cholesterol; 7. Phospholipid

Proteins
1. Essential; 2. Nonessential; 3. Complete; 4. Collagen; 5. Enzyme; 6. Buffer; 7. Antibody

Sources and Recommended Requirements
A. 1. Carbohydrate; 2. Fat (all); 3. Fat (saturated); 4. Cholesterol; 5. Essential fatty acid; 6. Protein
B. 1. Carbohydrate; 2. Saturated fat; 3. Monounsaturated fat; 4. Polyunsaturated fat; 5. Protein (complete); 6. Protein (incomplete)

Vitamins
A. 1. Essential vitamins; 2. Provitamins; 3. Coenzyme; 4. Fat-soluble vitamins; 5. Fat-soluble vitamins; 6. Water-soluble vitamins; 7. Antioxidant; 8. Free radical
B. 1. Vitamin C; 2. Vitamin A; 3. Vitamin K; 4. Vitamin B_{12}; 5. Vitamin D

Minerals
1. Calcium; 2. Sodium; 3. Chlorine; 4. Phosphorus; 5. Iron; 6. Iodine; 7. Potassium

Metabolism
A. 1. Anabolism; 2. Catabolism; 3. Catabolism; 4. ATP; 5. ATP
B. 1. Biochemical pathway; 2. DNA; 3. Chemical signal; 4. End product

Carbohydrate Metabolism
A. 1. Glucose; 2. Glycogen; 3. NADH
B. 1. Glycolysis; 2. Anaerobic respiration; 3. Oxygen debt; 4. Aerobic respiration; 5. Acetyl CoA; 6. Citric acid cycle; 7. Electron-transport chain
C. 1. Glycolysis; 2. ADP; 3. Anaerobic respiration; 4. Lactic acid; 5. Acetyl CoA; 6. Aerobic respiration; 7. Citric acid cycle; 8. NADH; 9. H_2O; 10. ATP

Lipid and Protein Metabolism
1. Triacylglycerol; 2. Fatty acids; 3. Acetyl CoA; 4. Ketone bodies; 5. Amino acids; 6. Ammonia; 7. Urea

Metabolic States
1. Absorptive state; 2. Absorptive state; 3. Absorptive state; 4. Postabsorptive state; 5. Postabsorptive state; 6. Postabsorptive state; 7. Postabsorptive state

Metabolic Rate
1. Basal metabolic rate; 2. Assimilation; 3. Kilocaloric intake; 4. Skeletal muscle contractions

Body Temperature
1. Homeotherm; 2. Free energy; 3. Heat; 4. Convection; 5. Conduction; 6. Radiation; 7. Vasodilation; 8. Hypothalamus

QUICK RECALL

1. Carbohydrates, lipids, proteins, vitamins, minerals, and water
2. Main energy source of body, minor energy storage (e.g., glycogen), and structural (e.g., DNA, RNA, ATP)
3. Energy source, major energy storage molecules (e.g., adipose tissue), and structural components of plasma membranes
4. Structural (e.g., collagen), regulatory (e.g., enzymes, hormones, buffers), transport (e.g., hemoglobin, carrier molecules), protection (e.g., antibodies), and energy source
5. Phase 1: glucose to pyruvic acid (glycolysis), Phase 2: pyruvic acid to lactic acid; anaerobic respiration produces 2 ATP molecules
6. Phase 1: glucose to pyruvic acid (glycolysis), Phase 2: pyruvic acid to acetyl CoA, Phase 3: citric acid cycle and electron transport chain produce carbon dioxide and water; aerobic respiration produces 38 ATP molecules
7. Basal metabolism, muscle contraction, and assimilation of food
8. Radiation, convection, conduction, and evaporation

WORD PARTS

1. glycogen; glycolysis
2. glycolysis
3. metabolism
4. lipid; lipase
5. vitamin; provitamin
6. homeotherm

MASTERY LEARNING ACTIVITY

1. C. Complex carbohydrates are large polysaccharides and include starch (energy storage in plants), glycogen (energy storage in animals), and cellulose (roughage in human diet). Sucrose (table sugar) and lactose (milk sugar) are disaccharides.

2. A. The typical American diet (by percent kilocalories) is 50% to 60% carbohydrates, 35% to 45% fats, and 10% to 15% protein. Cellulose is not digestible by humans.

3. E. Olive and peanut oils are good sources of monounsaturated fats. Polyunsaturated fats are in fish, safflower, sunflower, and corn oils. Saturated fats are in the fats of meats, diary products, eggs, nuts, coconut oil, and palm oil. Egg yolks are high in cholesterol.

4. B. A complete protein food contains the eight essential amino acids, from which the nonessential amino acids can be synthesized. Complete protein foods include red meat, fish, poultry, milk, cheese, and eggs; incomplete protein foods include beans, peas, leafy green vegetables, and grains.

5. D. Vitamins function as coenzymes, parts of coenzymes, or parts of enzymes. Most vitamins cannot be synthesized by the body, and they are not broken down before use. Vitamins A, D, E, and K are fat-soluble vitamins.

6. D. Minerals are inorganic nutrients that are necessary for normal metabolic functions. They are components of enzymes and function as buffers or osmotic regulators. Minerals compose about 4% to 5% of body weight.

7. A. Anaerobic respiration does not require oxygen and produces fewer ATP molecules than aerobic respiration.

8. A. Glycolysis takes place in both anaerobic and aerobic respiration. The other reactions listed take place in aerobic respiration.

9. B. The formation of water by the electron transport chain using inspired oxygen is the last step in aerobic respiration.

10. D. Remember that glucose (and other organic food molecules) are made up of carbon atoms bonded together. Each carbon bond is broken and the carbon atom combines with oxygen (derived from water) to form carbon dioxide. These reactions take place after glycolysis and in the citric acid cycle.

11. C. Fatty acids are derived from lipids in adipose tissue and released into the blood. Other cells take up the fatty acids and break them down into acetyl CoA that can enter the citric acid cycle to produce ATP. Ketones are formed from acetyl CoA, and glycogen breaks down into glucose.

12. D. The breakdown of amino acids results in the formation of ammonia, which is toxic to cells. The liver converts the ammonia to urea, which is eliminated by the kidneys.

13. D. The free energy in food can be released and used to drive anabolic reactions. Most of the free energy in food, however, is released as heat. Kilocalories express the free energy in food in terms of heat.

14. A. Basal metabolism accounts for 60% of energy expenditure, muscular activity 30%, and assimilation of food 10%.

15. B. The evaporation of water from the surface of the skin eliminates heat.

☆ FINAL CHALLENGES ☆

1. First, exercise increases energy (kilocalorie) usage. Second, following exercise the basal metabolic rate is elevated because of elevated body temperature and repayment of the oxygen debt. Third, exercise increases the proportion of muscle tissue to adipose tissue in the body. Because muscle tissue is metabolically more active than adipose tissue, basal metabolic rate increases. Fourth, during exercise epinephrine levels increase, resulting in increased blood sugar levels (see chapter 10), which can depress the hunger center in the brain and reduce food consumption following exercise.

2. All else being equal the typical male loses weight more rapidly because males have a higher basal metabolic rate than females.

3. Drinking cool water could help in two ways. Because the water is cool, raising the water to body temperature requires the expenditure of energy. Also, stretch of the stomach decreases appetite (see chapter 16).

4. During fever production the body produces heat by shivering. The body also conserves heat by constriction of blood vessels in the skin (producing pale skin) and by reduction in sweat loss (producing dry skin). When the fever breaks, i.e., "the crisis is over," heat is lost from the body to lower body temperature to normal. This is accomplished by dilation of blood vessels in the skin (producing flushed skin) and increased sweat loss (producing wet skin).