

***Campbell's Biology, 9e (Reece et al.)***  
**Chapter 41 Animal Nutrition**

Chapter 41 relates the energetic and nutritional needs of animals with the evolutionary adaptations that optimize nutrient ingestion, digestion, absorption, and distribution of nutrients. The locations and specializations of organs and tissues along the gastrointestinal tract are detailed, as are the regulatory mechanisms that coordinate functions.

**Multiple-Choice Questions**

- 1) In a well-fed human eating a Western diet, the richest source of stored chemical energy in the body is
- A) fat in adipose tissue.
  - B) glucose in the blood.
  - C) protein in muscle cells.
  - D) glycogen in muscle cells.
  - E) calcium phosphate in bone.

Answer: A

Topic: Concept 41.1

Skill: Knowledge/Comprehension

- 2) Animals that migrate great distances would obtain the greatest energetic benefit of storing chemical energy as
- A) proteins.
  - B) minerals.
  - C) carbohydrates.
  - D) amino acids.
  - E) fats.

Answer: E

Topic: Concept 41.1

Skill: Application/Analysis

- 3) Certain nutrients are considered "essential" in the diets of some animals because
- A) only those animals use those nutrients.
  - B) the nutrients are subunits of important polymers.
  - C) these animals are not able to synthesize these nutrients.
  - D) the nutrients are necessary coenzymes.
  - E) only certain foods contain them.

Answer: C

Topic: Concept 41.1

Skill: Knowledge/Comprehension

- 4) To maintain adequate nutrition, animals require dietary access to certain amino acids. An amino acid that is referred to as "nonessential" would be best described as one that
- A) can be made by the animal's body from other substances.
  - B) is not used by the animal in biosynthesis.
  - C) must be ingested in the diet.
  - D) is not readily absorbed by the gastrointestinal tract.
  - E) is not found in many proteins.

Answer: A

Topic: Concept 41.1

Skill: Knowledge/Comprehension

- 5) Which pair correctly associates a physiological process with the appropriate vitamin?
- A) blood clotting and vitamin C
  - B) normal vision and vitamin A
  - C) synthesis of cell membranes and vitamin D
  - D) protection of skin from cancer and vitamin E
  - E) production of white blood cells and vitamin K

Answer: B

Topic: Concept 41.1

Skill: Knowledge/Comprehension

- 6) The fat-soluble vitamins include
- A) vitamin A.
  - B) vitamin B<sub>12</sub>.
  - C) vitamin C.
  - D) iodine.
  - E) calcium.

Answer: A

Topic: Concept 41.1

Skill: Knowledge/Comprehension

- 7) Which pair correctly associates a biochemical process with the appropriate mineral associated with its use in animals?
- A) maintenance of bone and calcium
  - B) cofactor in enzymes that make ATP and magnesium
  - C) thyroid hormone synthesis and iron
  - D) nucleic acid synthesis and sulfur
  - E) glucose homeostasis and iodine

Answer: A

Topic: Concept 41.1

Skill: Knowledge/Comprehension

8) A general rule relating the capacity of a specific animal's digestive system to provide adequate access to substrates for biosynthesis of cellular components, as well as fuel molecules needed for ATP production, is that the animal should have access to

- A) a high-protein, low-carbohydrate diet.
- B) a diet low in lipids and high in protein.
- C) a low-calorie diet with a large intake of fluids, especially water.
- D) a diet that matches the "food pyramid" for the species.
- E) a diet that maximizes vitamins and minerals.

Answer: D

Topic: Concept 41.1

Skill: Synthesis/Evaluation

Use the following table showing the contents of a multivitamin supplement and its percentage of recommended daily values (DV) to answer the following questions.

<b>Dietary Supplement</b>	<b>% DV</b>
Vitamin A	70
Vitamin C	100
Vitamin D	100
Vitamin E	150
Vitamin K	13
Vitamin B <sub>1</sub>	100
Vitamin B <sub>2</sub>	100
Folic acid	100
Vitamin B <sub>12</sub>	417
Calcium	20
Phosphorus	5
Iodine	100
Magnesium	25
Zinc	100
Copper	100
Chromium	125
Molybdenum	100
Iron	0

9) The most likely reason that some of the vitamins and minerals in this supplement are found at less than 100% is

- A) that it would be chemically impossible to add more.
- B) these vitamins and minerals are too large in size to reach 100%.
- C) it is too easy to overdose on minerals such as phosphorus and calcium.
- D) it is dangerous to overdose on fat-soluble vitamins such as A and K.
- E) these supplements are meant for those who have been deprived of healthy foods.

Answer: D

Topic: Concept 41.1

Skill: Application/Analysis

10) A mineral that is especially important for preventing anemia is

- A) zinc.
- B) iron.
- C) iodine.
- D) molybdenum.
- E) folic acid.

Answer: B

Topic: Concept 41.1

Skill: Application/Analysis

11) Folic acid supplements have become especially important for pregnant women because

- A) folic acid supplies vitamins that only pregnant women can use.
- B) the folic acid is stored in adipose tissue by pregnant women so supplements are needed to make more available in the circulation.
- C) the fetus makes high levels of folic acid.
- D) folic acid deprivation is associated with neural tube abnormalities in a fetus.
- E) folic acid deprivation is a cause of heart abnormalities in a newborn.

Answer: D

Topic: Concept 41.1

Skill: Knowledge/Comprehension

12) Excessive iron absorption and accumulation to toxic levels is associated with

- A) excessive blood volume.
- B) a liver abnormality that results in a decreased number of red blood cells.
- C) various forms of inherited or acquired anemia.
- D) the genetic disorder known as hemochromatosis.
- E) menstruation and menopause.

Answer: D

Topic: Concept 41.1

Skill: Knowledge/Comprehension

13) Fat digestion yields fatty acids and glycerol, whereas protein digestion yields amino acids; both digestive processes

- A) are catalyzed by the same enzyme.
- B) are excludible intracellular processes in most organisms.
- C) add a water molecule to break bonds (hydrolysis).
- D) require the presence of hydrochloric acid to lower the pH.
- E) require ATP as an energy source.

Answer: C

Topic: Concept 41.2

Skill: Application/Analysis

14) Ingested dietary substances must cross cell membranes to be used by the body, a process known as

- A) ingestion.
- B) digestion.
- C) hydrolysis.
- D) absorption.
- E) elimination.

Answer: D

Topic: Concept 41.2

Skill: Knowledge/Comprehension

15) In marine sponges, intracellular digestion of peptides is usually immediately preceded by

- A) hydrolysis.
- B) endocytosis.
- C) absorption.
- D) elimination.
- E) secretion.

Answer: B

Topic: Concept 41.2

Skill: Knowledge/Comprehension

16) The large surface area in the gut directly facilitates

- A) secretion.
- B) absorption.
- C) elimination.
- D) filtration
- E) temperature regulation.

Answer: B

Topic: Concept 41.2

Skill: Knowledge/Comprehension

17) An advantage of a complete digestive system over a gastrovascular cavity is that the complete system

- A) excludes the need for extracellular digestion.
- B) allows specialized functions in specialized regions.
- C) allows digestive enzymes to be more specific.
- D) allows extensive branching.
- E) facilitates intracellular digestion.

Answer: B

Topic: Concept 41.2

Skill: Knowledge/Comprehension

18) Earthworms, grasshoppers, and birds all have a

- A) gastric cecae.
- B) larynx.
- C) crop.
- D) pharynx.
- E) epiglottis.

Answer: C

Topic: Concept 41.2

Skill: Application/Analysis

19) Because the foods eaten by animals are often composed largely of macromolecules, this requires the animals to have mechanisms for

- A) elimination.
- B) dehydration synthesis.
- C) enzymatic hydrolysis.
- D) regurgitation.
- E) demineralization.

Answer: C

Topic: Concept 41.2

Skill: Application/Analysis

20) In the digestive system, peristalsis is

- A) a process of fat emulsification in the small intestine.
- B) voluntary control of the rectal sphincters regulating defecation.
- C) the transport of nutrients to the liver through the hepatic portal vessel.
- D) a common cause of loss of appetite, fatigue, and dehydration.
- E) smooth muscle contractions that move food along the esophagus.

Answer: E

Topic: Concept 41.3

Skill: Knowledge/Comprehension

21) After ingestion by humans, the first category of macromolecules to be chemically digested by enzymes in the mouth is

- A) proteins.
- B) carbohydrates.
- C) cholesterol and other lipids.
- D) nucleic acids.
- E) minerals.

Answer: B

Topic: Concept 41.3

Skill: Knowledge/Comprehension

22) Salivary amylase digests

- A) protein.
- B) starches.
- C) monosaccharides.
- D) glucose.
- E) maltose.

Answer: B

Topic: Concept 41.3

Skill: Knowledge/Comprehension

- 23) Among mammals, it is generally true that
- A) all types of foods begin their enzymatic digestion in the mouth.
  - B) after leaving the oral cavity, the bolus enters the larynx.
  - C) the epiglottis prevents swallowed food from entering the trachea.
  - D) the esophagus is a key source of digestive enzymes.
  - E) the trachea leads to the esophagus and then to the stomach.

Answer: C

Topic: Concept 41.3

Skill: Knowledge/Comprehension

- 24) Digestive secretions with a pH of 2 are characteristic of the
- A) small intestine.
  - B) stomach.
  - C) pancreas.
  - D) liver.
  - E) mouth.

Answer: B

Topic: Concept 41.3

Skill: Knowledge/Comprehension

- 25) Pepsin is a digestive enzyme that
- A) is manufactured by the pancreas.
  - B) helps stabilize fat-water emulsions.
  - C) splits maltose into monosaccharides.
  - D) begins the hydrolysis of proteins in the stomach.
  - E) is denatured and rendered inactive in solutions with low pH.

Answer: D

Topic: Concept 41.3

Skill: Knowledge/Comprehension

- 26) Upon activation by stomach acidity, the secretions of the parietal cells
- A) initiate the digestion of protein in the stomach.
  - B) initiate the mechanical digestion of lipids in the stomach.
  - C) initiate the chemical digestion of lipids in the stomach.
  - D) include pepsinogen.
  - E) delay digestion until the food arrives in the small intestine.

Answer: A

Topic: Concept 41.3

Skill: Application/Analysis

- 27) The bile salts
- A) are enzymes.
  - B) are manufactured by the pancreas.
  - C) emulsify fats in the duodenum.
  - D) increase the efficiency of pepsin action.
  - E) are normally an ingredient of gastric juice.

Answer: C

Topic: Concept 41.3

Skill: Knowledge/Comprehension

28) Complex nutrients are digested and then absorbed into the lymph or bloodstream as

- A) disaccharides.
- B) polymers.
- C) monomers.
- D) enzymes.
- E) peptides.

Answer: C

Topic: Concept 41.3

Skill: Knowledge/Comprehension

29) An enzyme with high activity in an acidic environment is

- A) amylase.
- B) pepsin.
- C) gastrin.
- D) trypsin.
- E) sucrose.

Answer: B

Topic: Concept 41.3

Skill: Knowledge/Comprehension

30) The absorption of fats differs from that of carbohydrates in that the

- A) processing of fats does not require any digestive enzymes, whereas the processing of carbohydrates does.
- B) fat absorption occurs in the stomach, whereas carbohydrates are absorbed from the small intestine.
- C) carbohydrates need to be emulsified before they can be digested, whereas fats do not.
- D) most absorbed fat first enters the lymphatic system, whereas carbohydrates directly enter the blood.
- E) fats, but not carbohydrates, are digested by bacteria before absorption.

Answer: D

Topic: Concept 41.3

Skill: Knowledge/Comprehension

31) A nutritional monomer that can be transported in the blood after a typical meal is

- A) sucrose.
- B) maltose.
- C) fatty acid.
- D) dipeptide.
- E) trinucleotide.

Answer: C

Topic: Concept 41.3

Skill: Knowledge/Comprehension



32) For a nondiabetic person, the glucose concentration in this part of the vasculature varies more than in any other part.

- A) abdominal artery
- B) coronary arteries
- C) pulmonary veins
- D) hepatic portal vessel
- E) jugular vein

Answer: D

Topic: Concept 41.3

Skill: Application/Analysis

33) Glandular secretions that are released initially as inactive precursors of digestive enzymes are the

- A) protein-digesting enzymes.
- B) fat-solubilizing bile salts.
- C) acid-neutralizing bicarbonate.
- D) carbohydrate-digesting enzymes.
- E) hormones such as gastrin.

Answer: A

Topic: Concept 41.3

Skill: Knowledge/Comprehension

34) Because adult lampreys attach onto the surface of large fish for long periods of time to feed on body fluids, they can accomplish nutritional balance without need for a

- A) liver.
- B) pancreas.
- C) intestine.
- D) stomach.
- E) gallbladder.

Answer: D

Topic: Concept 41.3

Skill: Application/Analysis

35) Constipation can result from the consumption of a substance that

- A) contains plenty of fiber.
- B) promotes water reabsorption in the large intestine.
- C) speeds up movement of material in the large intestine.
- D) decreases water reabsorption in the small intestine.
- E) stimulates peristalsis.

Answer: B

Topic: Concept 41.3

Skill: Application/Analysis

- 36) Historically inaccurate diagnosis of acid reflux disorders and gastric ulcers has been improved by
- A) pH monitoring.
  - B) X-ray technology.
  - C) the diagnosis and treatment of *H. pylori* infection.
  - D) colonoscopy.
  - E) sonography.

Answer: C

Topic: Concept 41.3

Skill: Synthesis/Evaluation

- 37) A hiatal hernia that disrupts the functional relationship between the smooth muscle in the esophagus and that in the stomach would be most likely to increase the frequency of

- A) gastric reflux.
- B) premature entry of food into the duodenum.
- C) excess secretion of pepsinogen.
- D) increased stomach pH.
- E) retention of food in the stomach.

Answer: A

Topic: Concept 41.3

Skill: Application/Analysis

- 38) A significant contribution of intestinal bacteria to human nutrition is the benefit of bacterial

- A) production of vitamins A and C.
- B) generation of gases needed for elimination.
- C) absorption of organic materials.
- D) production of vitamin K.
- E) recovery of water from fecal matter.

Answer: D

Topic: Concept 41.3

Skill: Knowledge/Comprehension

- 39) The cells that secrete acidic fluid in the stomach are

- A) the chief cells of the stomach.
- B) the parietal cells of the stomach.
- C) not needed for the transformation of pepsinogen to pepsin.
- D) in the lumen of the stomach.
- E) adding secretions along the esophagus.

Answer: D

Topic: Concept 41.3

Skill: Knowledge/Comprehension

40) Stomach cells are moderately well adapted to the acidity and protein-digesting activities in the stomach by having

- A) a sufficient colony of *H. pylori*.
- B) a thick, mucous secretion and active mitosis of epithelial cells.
- C) a high level of secretion by chief cells.
- D) a high level of secretion from parietal cells.
- E) secretions enter the stomach from the pancreas.

Answer: B

Topic: Concept 41.3

Skill: Application/Analysis

41) The molar teeth of herbivorous mammals are especially effective at

- A) cutting.
- B) ripping.
- C) grinding.
- D) splitting.
- E) piercing.

Answer: C

Topic: Concept 41.4

Skill: Knowledge/Comprehension

42) A group of animals among which a relatively long cecum is likely to be found is the

- A) carnivores.
- B) herbivores.
- C) autotrophs.
- D) heterotrophs.
- E) omnivores.

Answer: B

Topic: Concept 41.4

Skill: Knowledge/Comprehension

43) The adaptations suited to a carnivorous diet include

- A) broad, flat molars.
- B) a rumen.
- C) ingestion of feces.
- D) bile salts.
- E) amylase.

Answer: D

Topic: Concept 41.4

Skill: Knowledge/Comprehension

44) Cattle are able to survive on a diet consisting almost entirely of plant material because

- A) they are autotrophic.
- B) cattle, like rabbits, re-ingest their feces.
- C) they manufacture all 15 amino acids out of sugars in the liver.
- D) cattle saliva has enzymes capable of digesting cellulose.
- E) they have cellulose-digesting, symbiotic microorganisms in chambers of their stomachs.

Answer: E

Topic: Concept 41.4

Skill: Application/Analysis

45) Analysis of jawbones from the skeletal remains of a vertebrate animal reveal its dietary patterns owing to

- A) the position of muscle attachment sites.
- B) the prevalence of specific kinds of teeth.
- C) the size of the mouth opening.
- D) the evidence of food molecules still present.
- E) whether the mouth is the most anterior structure.

Answer: B

Topic: Concept 41.4

Skill: Application/Analysis

46) An enlarged cecum is typical of

- A) rabbits, horses, and herbivorous bears.
- B) carnivorous animals.
- C) tubeworms that digest via symbionts.
- D) humans and other primates.
- E) tapeworms and other intestinal parasites.

Answer: A

Topic: Concept 41.4

Skill: Synthesis/Evaluation

47) Coprophagy, the nutrition-boosting ingestion of fecal material, is important for the nutritional balance of

- A) ruminants such as cows.
- B) insects and arthropods.
- C) rabbits and their relatives.
- D) squirrels and some rodents.
- E) very large animals, such as elephants.

Answer: C

Topic: Concept 41.4

Skill: Knowledge/Comprehension

48) PKU (phenylketonuria) is a hereditary condition in which infants and young children who ingest the amino acid phenylalanine risk serious neurological damage. However, the risk of damage can be substantially reduced by the severe restriction of phenylalanine in the diet. Which of the following is the nutritional concept that forms the basis for this preventive treatment?

- A) enzymatic hydrolysis
- B) essential nutrients
- C) symbiosis
- D) dehydration synthesis
- E) structural anatomy of the brain

Answer: B

Topic: Concept 41.5

Skill: Synthesis/Evaluation

- 49) When the digestion and absorption of organic molecules results in more energy-rich molecules than are immediately required by an animal, the excess is
- A) eliminated in the feces.
  - B) stored as starch in the liver.
  - C) stored as glycogen in the liver and muscles.
  - D) oxidized and converted to ATP.
  - E) hydrolyzed and converted to ADP.

Answer: C

Topic: Concept 41.5

Skill: Knowledge/Comprehension

- 50) Hypoglycemia, or low levels of glucose in the blood of a healthy human, is "corrected" by a(n)
- A) increase in the secretion of insulin.
  - B) increase in the secretion of glucagon.
  - C) increase in the secretion of both insulin and glucagon.
  - D) decrease in the secretion of both insulin and glucagon.
  - E) increase in the secretion of thyroid hormones.

Answer: B

Topic: Concept 41.5

Skill: Application/Analysis

- 51) A fasting animal whose energy needs exceed those provided in its diet draws on its stored resources in which order?
- A) fat, then glycogen, then protein
  - B) glycogen, then protein, then fat
  - C) liver glycogen, then muscle glycogen, then fat
  - D) muscle glycogen, then fat, then liver glycogen
  - E) fat, then protein, then glycogen

Answer: C

Topic: Concept 41.5

Skill: Knowledge/Comprehension

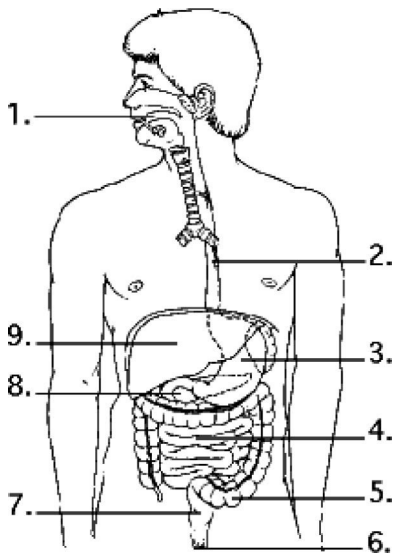
- 52) Obesity in humans is most clearly linked to
- A) type 1 diabetes and prostate cancer.
  - B) type 1 diabetes and breast cancer.
  - C) type 2 diabetes and muscle hypertrophy.
  - D) type 2 diabetes and cardiovascular disease.
  - E) type 2 diabetes and decreased appetite.

Answer: D

Topic: Concept 41.5

Skill: Application/Analysis

## Art Questions



53) Examine the digestive system structures in the figure above. The agents that help emulsify fats are produced in

- A) 1
- B) 2
- C) 3
- D) 8
- E) 9

Answer: E

Topic: Concept 41.3

Skill: Knowledge/Comprehension

54) Examine the digestive system structures in the figure above. The highest rate of nutrient absorption occurs at location(s)

- A) 3 only.
- B) 4 only.
- C) 1 and 4.
- D) 3 and 4.
- E) 1, 3, and 4.

Answer: B

Topic: Concept 41.3

Skill: Knowledge/Comprehension

55) Examine the digestive system structures in the figure above. Most of the digestion of fats occurs in section(s)

- A) 3 only.
- B) 4 only.
- C) 1 and 4.
- D) 3 and 4.
- E) 1, 3, and 4.

Answer: B

Topic: Concept 41.3

Skill: Knowledge/Comprehension

56) Examine the digestive system structures in the figure above. Bacteria that produce vitamins as products are residents of location

- A) 3.
- B) 4.
- C) 5.
- D) 7.
- E) 8.

Answer: C

Topic: Concept 41.3

Skill: Knowledge/Comprehension

### Scenario Questions

Use the following information to answer the questions below.

Mouse mutations can affect an animal's appetite and eating habits. The *ob* gene codes for a satiety factor, the hormone leptin. The *db* gene product, the leptin receptor, is required to respond to the satiety factor.

57) Leptin is a product of adipose cells. Therefore, a very obese mouse would be expected to have

- A) increased gene expression of *ob* and decreased expression of *db*.
- B) increased gene expression of *db* and decreased expression of *ob*.
- C) decreased transcription of both *ob* and *db*.
- D) mutation of *ob* or *db*.

Answer: D

Topic: Concept 41.5

Skill: Synthesis/Evaluation

58) Many obese humans produce normal or increased levels of leptin without satiety, so the search for healthy regulation of food intake should focus on

- A) providing supplementary leptin.
- B) inactivation of leptin.
- C) overexpression of the leptin receptor gene.
- D) eliminating carbohydrates from the diet.
- E) inhibition of leptin receptors.

Answer: D

Topic: Concept 41.5

Skill: Synthesis/Evaluation

## End-of-Chapter Questions

The following questions are from the end-of-chapter “Test Your Understanding” section in Chapter 41 of the textbook.

59) Which of the following animals is *incorrectly* paired with its feeding mechanism?

- A) lion—substrate feeder
- B) baleen whale—suspension feeder
- C) aphid—fluid feeder
- D) clam—suspension feeder
- E) snake—bulk feeder

Answer: A

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

60) The mammalian trachea and esophagus both connect to the

- A) large intestine.
- B) stomach.
- C) pharynx.
- D) rectum.
- E) epiglottis.

Answer: C

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

61) Which of the following organs is *incorrectly* paired with its function?

- A) stomach—protein digestion
- B) oral cavity—starch digestion
- C) large intestine—bile production
- D) small intestine—nutrient absorption
- E) pancreas—enzyme production

Answer: C

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension

62) Which of the following is *not* a major activity of the stomach?

- A) mechanical digestion
- B) HCl secretion
- C) mucus secretion
- D) nutrient absorption
- E) enzyme secretion

Answer: D

Topic: End-of-Chapter Questions

Skill: Knowledge/Comprehension



63) After surgical removal of an infected gallbladder, a person must be especially careful to restrict dietary intake of

- A) starch.
- B) protein.
- C) sugar.
- D) fat.
- E) water.

Answer: D

Topic: End-of-Chapter Questions

Skill: Application/Analysis

64) If you were to jog 1 km a few hours after lunch, which stored fuel would you probably tap?

- A) muscle proteins
- B) muscle and liver glycogen
- C) fat stored in the liver
- D) fat stored in adipose tissue
- E) blood proteins

Answer: B

Topic: End-of-Chapter Questions

Skill: Application/Analysis