

Chapter 3 – Digestion, absorption and transport

MULTIPLE CHOICE

1. The process by which food is broken down into absorbable components is called:
 - a. digestion
 - b. absorption
 - c. excretion
 - d. mastication
 - e. adsorption

ANS: A

DIF: Bloom's: Remember

REF: Digestion

OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

2. What is umami?
 - a. The flavour associated with monosodium glutamate
 - b. The opening between the duodenum and jejunum
 - c. The intestinal enzyme that hydrolyses fish proteins
 - d. An intestinal enzyme that hydrolyses dietary nucleic acids
 - e. A flavour that combines sweet and sour

ANS: A

DIF: Bloom's: Remember

REF: Digestion

OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

3. Taste buds:
 - a. react only with particles in solution
 - b. are located throughout the oral cavity
 - c. produce amylase but not pepsin or lipase
 - d. can individually sense only one of the basic taste sensations at a time
 - e. are located only on the tip of the tongue

ANS: A

DIF: Bloom's: Remember

REF: Digestion

OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

4. Where is the epiglottis located?
 - a. Pharynx
 - b. Bile duct
 - c. Pancreatic duct
 - d. Lower oesophagus
 - e. At the outlet of the stomach

ANS: A

DIF: Bloom's: Remember

REF: Digestion

OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

5. What part of the GI tract prevents a person from choking while swallowing?
 - a. Mouth
 - b. Epiglottis
 - c. Pyloric sphincter
 - d. Upper oesophageal sphincter
 - e. Chyme

ANS: B DIF: Bloom's: Understand REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

6. What structure functions to prevent entrance of food into the trachea?
- Tongue
 - Epiglottis
 - Cardiac sphincter
 - Trachea sphincter
 - Upper oesophageal sphincter

ANS: B DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

7. Which action is characteristic of the appendix?
- It ferments fibre.
 - It stores lymph cells.
 - It slows down peristalsis.
 - It stores preformed stools.
 - It assists in the formation of T-cells.

ANS: B DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

8. What is a bolus?
- An enzyme that hydrolyses starch
 - A portion of food swallowed at one time
 - A device used to analyse the contents of the stomach
 - A sphincter muscle separating the stomach from the small intestine
 - A food item that has passed through the small intestine into the colon

ANS: B DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

9. One function of the pyloric sphincter is to:
- secrete acid into the stomach
 - secrete hormones into the stomach
 - prevent the contents of the small intestine from backing up into the stomach
 - prevent the contents of the small intestine from emptying too quickly into the colon
 - initiate peristalsis

ANS: C DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

10. Chyme can best be described as:
- the semisolid mass of undigested food that passes through the ileocecal valve
 - a semi-liquid mass of partially digested food released by the stomach into the small intestine
 - the mixture of pancreatic juices containing enzymes for digestion of the macronutrients
 - a thick, viscous material synthesised by mucosal cells for protection against digestive juices
 - chewed food combined with saliva that has passed from the oesophagus into the stomach

ANS: B DIF: Bloom's: Understand REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

11. The primary function of the rectum is to:
- control the functioning of the colon
 - absorb minerals from waste materials
 - store waste materials prior to evacuation
 - absorb excess water from waste materials
 - store digestive hormones until they are needed

ANS: C DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

12. What is the name given to partially digested food in the stomach?
- Chyme
 - Liquid food
 - Gastric mucous
 - Semi-liquid mass
 - Bolus

ANS: A DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

13. What structure separates the colon from the small intestine?
- Pylorus
 - Ileocecal valve
 - Gastric retainer
 - Rectal sphincter
 - Lower sphincter

ANS: B DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

14. Which of the following is a feature of peristalsis?
- It occurs when longitudinal muscles oppose the action of transverse muscles.
 - Its rate is consistent throughout the GI tract.
 - It occurs at powerful levels in the small intestine, but not at all in the colon.
 - It is caused by alternate tightening and relaxing of circular and longitudinal muscles.
 - It may occur unpredictably, but typically occurs in response to a full stomach.

ANS: D DIF: Bloom's: Understand REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

15. What structure controls the release of material from the stomach to the small intestine?
- Ileocecal valve
 - Pyloric sphincter
 - Diaphragmatic valve
 - Oesophageal sphincter
 - Hepatic portal valve

ANS: B DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

16. One function of sphincter muscles is to:
- control peristalsis
 - grind large food particles
 - secrete digestive juices into the GI tract
 - control the passage of food through the GI tract
 - trigger hormone release

ANS: D DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

17. Which structure prevents reflux of stomach contents?
- Pepsinogen
 - Gastric mucosa
 - Upper oesophageal sphincter
 - Lower oesophageal sphincter
 - Duodenum

ANS: D DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

18. What is the function of mucous in the stomach?
- It emulsifies fats.
 - It neutralises stomach acid.
 - It activates pepsinogen to pepsin.
 - It protects stomach cells from gastric juices.
 - It absorbs essential nutrients.

ANS: D DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

19. What is a function of hydrochloric acid in the stomach?
- It absorbs water.
 - It inhibits peristalsis.
 - It neutralises the food mass.
 - It creates an optimum acidity.
 - It prevents relaxation of the lower oesophageal sphincter.

ANS: D DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

20. What best describes the normal pH of the stomach?
- Very acidic
 - Slightly acidic
 - Neutral
 - Slightly alkaline
 - Very alkaline

ANS: A DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

21. Which substance protects the stomach lining from damage due to digestive juices?
- Water
 - Mucus
 - Pepsinogen
 - Dietary fats
 - Gastrin

ANS: B DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

22. Which part of the GI tract contains highly acidic digestive juices?
- Colon
 - Ileum
 - Stomach
 - Duodenum
 - Rectum

ANS: C DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

23. One important function of mucous is to:
- help solubilise bile
 - stabilise pancreatic enzymes
 - enhance absorption of vitamin B₁₂
 - protect the stomach walls from digestion
 - facilitate peristalsis

ANS: D DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

24. The process by which bile acts on fat so that enzymes can attack the fat is known as:
- condensation
 - emulsification
 - enzymification
 - phosphorylation
 - inhibition

ANS: B DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

25. The purpose of bicarbonate in the digestive process is to:
- raise the pH of chyme
 - lower the pH of chyme
 - hydrolyse large peptides
 - increase peristalsis
 - reduce the risk of vomiting

ANS: A DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

26. After the pancreatic juices have mixed with chyme in the small intestine, which of the following describes the pH of the resulting mixture?
- Very acidic
 - Moderately acidic
 - Approximately neutral
 - Moderately alkaline
 - Very alkaline

ANS: C DIF: Bloom's: Understand REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

27. One function of the gall bladder is to:
- store bile
 - produce bile
 - reabsorb water and salts
 - perform enzymatic digestion
 - remove toxins from the blood

ANS: A DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

28. Which class of nutrients requires the least amount of digestion?
- Lipids
 - Proteins
 - Vitamins
 - Simple carbohydrates
 - Complex carbohydrates

ANS: C DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

29. What is the function of bile?
- It emulsifies fats.
 - It initiates digestion of protein.
 - It enhances absorption of complex carbohydrates.
 - It protects the stomach and small intestine from the action of hydrochloric acid.
 - It stimulates the absorption of vitamins and minerals.

ANS: A DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

30. What is an important function of the intestinal villi crypts?
- Synthesis of chylomicrons
 - Secretion of juices into the small intestine
 - Synthesis of fragments of fat for use by the colon
 - Transport of fat-soluble nutrients into the circulation
 - Storage of bile

ANS: B DIF: Bloom's: Remember REF: Absorption
OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.

31. What is the name of the projections on the inner surface of the small intestine?
- Villi
 - Cilia
 - Mesenteric vessels
 - Vascular projectiles
 - Mitochondria

ANS: A DIF: Bloom's: Remember REF: Absorption
OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.

32. What is a function of the intestinal microvilli?
- Secretion of bile salts
 - Secretion of digestive acid
 - Transport of nutrient molecules
 - Transport of pancreatic enzymes
 - Stimulation of peristalsis

ANS: C DIF: Bloom's: Remember REF: Absorption
OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.

33. What is the primary site for absorption of nutrients?
- Crypt
 - Villus
 - Microvilli
 - Macrovilli
 - Goblet cells

ANS: C DIF: Bloom's: Remember REF: Absorption
OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.

34. On which concept was the myth of 'food combining' based?
- 'Eat several snacks per day so the system is not overwhelmed.'
 - 'Combine different food types to enhance the absorption process.'
 - 'Avoid eating certain food combinations – e.g. meat and fruit at the same meal – to prevent competition.'
 - 'Take enzyme pills or powder periodically so the system can rest and rejuvenate.'
 - 'Eat only one type of food at each meal in order to avoid overstimulation of acid.'

ANS: C DIF: Bloom's: Understand REF: Absorption
OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.

35. When nutrients are transported from intestinal epithelial cells to the vascular system, which organ is first to receive them?
- Liver
 - Heart
 - Lungs
 - Kidneys
 - Gall bladder

ANS: A DIF: Bloom's: Understand REF: Absorption
OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.

36. Which vessel carries blood from the liver to the heart?

- a. Aorta
- b. Hepatic vein
- c. Thoracic duct
- d. Hepatic portal vein
- e. Hepatic artery

ANS: B

DIF: Bloom's: Remember

REF: The circulatory system

OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.

37. The hepatic portal vein empties into the:

- a. liver
- b. heart
- c. pancreas
- d. hepatic vein
- e. spleen

ANS: A

DIF: Bloom's: Remember

REF: The circulatory system

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38. Exchange of oxygen, nutrients and waste materials takes place across the walls of small vessels called:

- a. ducts
- b. venules
- c. arterioles
- d. capillaries
- e. lymphatics

ANS: D

DIF: Bloom's: Remember

REF: The circulatory system

OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.

39. What is the most metabolically active organ?

- a. Liver
- b. Spleen
- c. Stomach
- d. Pancreas
- e. Brain

ANS: A

DIF: Bloom's: Remember

REF: The circulatory system

OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.

40. Which vehicle conducts lymph into the vascular system?

- a. Villi
- b. Mesentery
- c. Subclavian vein
- d. Common bile duct
- e. Thoracic duct

ANS: C

DIF: Bloom's: Remember

REF: The circulatory system

OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.

41. What is the first major organ to receive nutrients that are absorbed into the lymph?

- a. Liver
- b. Heart
- c. Spleen
- d. Pancreas
- e. Gall bladder

ANS: B

DIF: Bloom's: Remember

REF: The circulatory system

OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.

42. Where does the lymph ultimately collect?

- a. Liver
- b. Thoracic duct
- c. Heart
- d. Subclavian vein
- e. Bloodstream

ANS: B

DIF: Bloom's: Remember

REF: The circulatory system

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43. Certain types of fibre and complex proteins that are degraded by GI bacteria are called:

- a. prebiotics
- b. probiotics
- c. postbiotics
- d. symbiotics
- e. abiotics

ANS: A
the GI tract

DIF: Bloom's: Remember

REF: The health and regulation of

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

44. Microorganisms in food that are viable when consumed and beneficial to health are known as:

- a. probiotics
- b. prebiotics
- c. postbiotics
- d. symbiotics
- e. abiotics

ANS: A
the GI tract

DIF: Bloom's: Remember

REF: The health and regulation of

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

45. When consumed on a regular basis, which food promotes healthful changes in the microflora of the GI tract?

- a. Fish
- b. Yoghurt
- c. Poultry
- d. Iron-rich foods
- e. Natural sugars

ANS: B
the GI tract

DIF: Bloom's: Understand

REF: The health and regulation of

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

46. The gastrointestinal microbiome is comprised primarily of:

- a. villi
- b. bacteria
- c. mucosa
- d. probiotics
- e. viruses

ANS: B

DIF: Bloom's: Remember

REF: The health and regulation of

the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

47. What is the *primary* role of the normal, thriving intestinal bacterial population?

- a. It helps to degrade meat and dairy proteins.
- b. It helps to prevent infectious bacteria from attacking the system.
- c. It synthesises vitamin D, which can be absorbed into the body.
- d. It synthesises several amino acids, which can be absorbed into the body.
- e. It aids in the absorption of essential nutrients.

ANS: B

DIF: Bloom's: Understand

REF: The health and regulation of

the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

48. Which substance is known to be produced by small intestinal bacteria?

- a. Mucous
- b. Chyme
- c. Glucose
- d. Vitamins
- e. Protein

ANS: D

DIF: Bloom's: Remember

REF: The health and regulation of

the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

49. What two systems coordinate all digestive and absorptive processes?

- a. Enzyme and thoracic
- b. Portal and lymphatic
- c. Nervous and endocrine
- d. Transport and circulatory
- e. Circulatory and nervous

ANS: C

DIF: Bloom's: Remember

REF: The health and regulation of

the GI tract

OBJ: Describe how bacteria, hormones, and nerves influence the health and activities of the GI tract.

50. What is the normal pH of the stomach?

- a. 0.25–0.75
- b. 1.5–1.7
- c. 2.0–2.5
- d. 7.5–8.0
- e. 8.5–9.0

ANS: B

DIF: Bloom's: Remember

REF: The health and regulation of

the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

51. Which substance regulates the pH of the stomach?

- a. Gastrin
- b. Insulin
- c. Secretin
- d. Cholecystokinin
- e. Glucagon

ANS: A

DIF: Bloom's: Remember

REF: The health and regulation of

the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

52. Which substance functions to control the release of hydrochloric acid to prevent excessive acidity?

- a. Insulin
- b. Gastrin
- c. Secretin
- d. Cholecystokinin
- e. Glucagon

ANS: B

DIF: Bloom's: Understand

REF: The health and regulation of

the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

53. Which substance stimulates the pancreas to release bicarbonate-rich juice?

- a. Gastrin
- b. Secretin
- c. Glucagon
- d. Gastric-inhibitory peptide
- e. CCK

ANS: B

DIF: Bloom's: Remember

REF: The health and regulation of

the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

54. Which characteristic describes pancreatic digestive enzyme function?

- a. The major hormone controlling the release of pancreatic enzymes is gastrin.
- b. The release of pancreatic enzymes is controlled primarily by the pancreatic sphincter.
- c. The pancreas can increase the activity of fat-degrading enzymes in response to more fat in the diet.
- d. In general, the amounts of digestive enzymes secreted by the pancreas remain constant over a wide range of nutrient intakes.
- e. Pancreatic enzymes can digest protein and fat, but not carbohydrate.

ANS: C

DIF: Bloom's: Remember

REF: The health and regulation of

the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

55. The presence of fat in the intestines stimulates cells of the intestinal wall to release:

- a. lipase
- b. gastrin
- c. secretin
- d. cholecystokinin
- e. glucagon

ANS: D

DIF: Bloom's: Remember

REF: The health and regulation of

the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

56. Which substance controls the release of bile into the small intestine?
- Gastrin
 - Secretin
 - Prozymogen
 - Cholecystokinin
 - Insulin

ANS: D
the GI tract

DIF: Bloom's: Remember

REF: The health and regulation of

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

57. Which action is associated with the presence of fat in the GI tract?
- Inhibition of mucosal enzyme activities
 - Slowing of the process of digestion and absorption
 - Inhibition of thiamin, riboflavin and niacin absorption
 - Stimulation and hastening of digestion and absorption
 - Markedly increased transit time

ANS: B
the GI tract

DIF: Bloom's: Remember

REF: The health and regulation of

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

58. What is intestinal ischemia?
- Reduced blood flow to the intestines
 - Chronic episodes of reverse peristalsis
 - Construction of intestinal lymph supply
 - Inflammation of two or more sphincter muscles
 - Severe and repeated episodes of intestinal blockage

ANS: A
the GI tract

DIF: Bloom's: Remember

REF: The health and regulation of

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

59. Which of the following results from reverse peristalsis?
- Gas
 - Choking
 - Vomiting
 - Diarrhoea
 - Constipation

ANS: C

DIF: Bloom's: Understand

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

60. A person with chronic diarrhoea is at risk for:
- dehydration
 - paradoxical constipation
 - peptic ulcers
 - Heimlich's disease
 - GERD

ANS: A

DIF: Bloom's: Understand

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

61. Inflammation of the large intestine is known as:

- a. colitis
- b. indigestion
- c. haemorrhoiditis
- d. acid dysregulation
- e. diverticulitis

ANS: A

DIF: Bloom's: Remember

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

62. Which statement does *not* describe a characteristic of irritable bowel syndrome?

- a. Abdominal discomfort is usually frequent and can be severe.
- b. Effective treatment can include peppermint oil.
- c. Diarrhoea is a common symptom.
- d. A combination of stress plus certain foods may trigger an attack.
- e. It is an autoimmune disease.

ANS: E

DIF: Bloom's: Remember

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

63. When ingested in large quantities, the sugar alternative sorbitol and the fat alternative olestra are known to induce:

- a. diarrhoea
- b. vomiting
- c. pancreatitis
- d. coeliac disease
- e. insulin intolerance

ANS: A

DIF: Bloom's: Remember

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

64. Which of the following statements best describes constipation?

- a. Most common GI disorder
- b. An autoimmune disorder
- c. A symptom, not a disease
- d. Diagnosed when a person has bowel movements three times per week
- e. Inflammation of the intestinal tract

ANS: C

DIF: Bloom's: Understand

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

65. A person on a low-fibre diet is at increased risk for experiencing elevated rectal vein pressure, leading to formation of:

- a. reflux
- b. hiccups
- c. haemorrhoids
- d. peptic ulcers
- e. vomiting

ANS: C

DIF: Bloom's: Understand

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

66. What is the primary cause of belching?

- a. Swallowing air

- b. Viral infections
- c. Eating spicy foods
- d. Drinking alcoholic beverages
- e. Reflux

ANS: A DIF: Bloom's: Remember REF: Common digestive problems
OBJ: Outline strategies to prevent or alleviate common GI problems.

67. People who have frequent, regular bouts of heartburn and indigestion have a medical condition known as:
- a. colitis
 - b. watery stools
 - c. lymphatic malabsorption
 - d. gastro-oesophageal reflux
 - e. coeliac disease

ANS: D DIF: Bloom's: Understand REF: Common digestive problems
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68. Which nutrient is most associated with increased production of intestinal gas?
- a. Iron
 - b. Fats
 - c. Proteins
 - d. Carbohydrates
 - e. Fat-soluble vitamins

ANS: D DIF: Bloom's: Remember REF: Common digestive problems
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69. Untreated gastroesophageal reflux increases the risk for the more serious condition known as:
- a. Graves' disease
 - b. Sinclair's gastrum
 - c. Barrett's oesophagus
 - d. Zollinger–Ellison cancer
 - e. Huntington's chorea

ANS: C DIF: Bloom's: Remember REF: Common digestive problems
OBJ: Outline strategies to prevent or alleviate common GI problems.

70. The primary treatment for an ulcer caused by the presence of *H. pylori* is:
- a. fibre
 - b. surgery
 - c. antacids
 - d. antibiotics
 - e. dietary changes

ANS: D DIF: Bloom's: Remember REF: Common digestive problems
OBJ: Outline strategies to prevent or alleviate common GI problems.

COMPLETION

1. Blood leaving the digestive system goes by way of the _____ to the liver.

ANS: hepatic portal vein

DIF: Bloom's: Remember

REF: The circulatory system

OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.

2. _____ circulates between the cells of the body and collects into tiny vessels.

ANS: Lymph

DIF: Bloom's: Remember

REF: The circulatory system

OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.

3. The hormone that responds to food in the stomach and is secreted by the stomach walls is _____.

ANS: gastrin

DIF: Bloom's: Remember

REF: The health and regulation of the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

4. _____ responds to acidic chyme in the small intestine and stimulates the pancreas.

ANS: Secretin

DIF: Bloom's: Remember

REF: The health and regulation of the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

5. _____ responds to fat or protein in the small intestine and stimulates both the pancreas and the gall bladder.

ANS: Cholecystokinin

DIF: Bloom's: Remember

REF: The health and regulation of the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

6. _____ refers to the maintenance of constant internal conditions (such as blood chemistry, temperature and blood pressure) by the body's control systems.

ANS: Homeostasis

DIF: Bloom's: Remember

REF: The health and regulation of the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

7. _____ is an autoimmune disease characterised by inflammation of the small intestine that occurs in response to foods that contain gluten, a protein commonly found in wheat, barley, rye, and possibly oats.

ANS: Coeliac disease

DIF: Bloom's: Remember

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

8. _____ is the potentially harmful internal washing of the large intestine with a powerful machine.

ANS: Colonic irrigation

DIF: Bloom's: Remember

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

9. The medical term for the disorder that occurs when the lower oesophageal sphincter allows the stomach contents to reflux into the oesophagus is _____.

ANS: gastroesophageal reflux

DIF: Bloom's: Remember

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

10. One of the major causes of ulcers is infection with _____.

ANS: *Helicobacter pylori* (or *H. pylori*)

DIF: Bloom's: Remember

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

MATCHING

- | | |
|--------------|------------------------|
| a. Liver | k. Epiglottis |
| b. Villus | l. Gall bladder |
| c. Goblet | m. Carbohydrase |
| d. Pylorus | n. Hepatic portal vein |
| e. Enzyme | o. Hepatic vein |
| f. Gastrin | p. Ileocecal valve |
| g. Secretin | q. Cholecystokinin |
| h. Capillary | r. Active transport |
| i. Appendix | s. Hydrochloric acid |
| j. Diffusion | t. Lymphatic system |

1. Prevents food from entering the windpipe when swallowing
2. Organ that stores lymph cells
3. Controls the entry of chyme into the duodenum
4. Controls the entry of chyme into the colon
5. Enzyme that digests starch
6. Substance that helps make or break a chemical bond
7. A component of gastric juice
8. Organ that releases bile into the small intestine
9. Organ that synthesises bile
10. Fingerlike projection of small intestinal lining
11. Type of cell that secretes mucus
12. Absorption mechanism that requires energy
13. Absorption mechanism that does not require energy
14. Connects an artery to a vein
15. Vessel that carries blood from liver to heart

16. Vessel that carries blood from GI tract to liver
17. Carries fat-soluble vitamins
18. Hormone that signals release of pancreatic bicarbonate
19. Hormone that triggers release of gastric acid
20. Hormone that signals release of bile

1. ANS: K DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.
2. ANS: I DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.
3. ANS: D DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.
4. ANS: P DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.
5. ANS: M DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.
6. ANS: E DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.
7. ANS: S DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.
8. ANS: L DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.
9. ANS: A DIF: Bloom's: Remember REF: Digestion
OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.
10. ANS: B DIF: Bloom's: Remember REF: Absorption
OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.
11. ANS: C DIF: Bloom's: Remember REF: Absorption
OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.
12. ANS: R DIF: Bloom's: Remember REF: Absorption
OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.
13. ANS: J DIF: Bloom's: Remember REF: Absorption
OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.
14. ANS: H DIF: Bloom's: Remember REF: The circulatory systems
OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.
15. ANS: O DIF: Bloom's: Remember REF: The circulatory systems
OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.
16. ANS: N DIF: Bloom's: Remember REF: The circulatory systems
OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.
17. ANS: T DIF: Bloom's: Remember REF: The circulatory systems
OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and

- identify which nutrients enter the blood directly and which must first enter the lymph.
18. ANS: G DIF: Bloom's: Remember REF: The health and regulation of the GI tract
OBJ: Describe how bacteria, hormones, and nerves influence the health and activities of the GI tract.
19. ANS: F DIF: Bloom's: Remember REF: The health and regulation of the GI tract
OBJ: Describe how bacteria, hormones, and nerves influence the health and activities of the GI tract.
20. ANS: Q DIF: Bloom's: Remember REF: The health and regulation of the GI tract
OBJ: Describe how bacteria, hormones, and nerves influence the health and activities of the GI tract.

ESSAY

1. What factors are involved in experiencing taste sensations?

ANS:

During chewing, teeth crush large pieces of food into smaller ones, and fluids from foods, beverages, and salivary glands blend with these pieces to ease swallowing. Fluids also help to dissolve the food so that the tongue can taste it; only particles in solution can react with taste buds. When stimulated, the taste buds detect one, or a combination, of the five basic taste sensations: sweet, sour, bitter, salty and umami, a savory flavour commonly associated with monosodium glutamate. In addition to these chemical triggers, aroma, appearance, texture and temperature also affect a food's flavour.

DIF: Bloom's: Understand

REF: Digestion

OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

2. Name and describe the functions of the four major sphincter muscles that divide the GI tract into its principal regions.

ANS:

The oesophagus has a sphincter muscle at each end. During a swallow, the upper oesophageal sphincter opens. The bolus then slides down the oesophagus, which passes through a hole in the diaphragm to the stomach. The lower oesophageal sphincter at the entrance to the stomach closes behind the bolus so that it proceeds forward and does not slip back into the oesophagus.

The stomach retains the bolus for a while in its upper portion. Little by little, the stomach transfers the food to its lower portion, adds juices to it, and grinds it to a semi-liquid mass called chyme. Then, bit by bit, the stomach releases the chyme through the pyloric sphincter, which opens into the small intestine, and then closes behind the chyme.

Having travelled the length of the small intestine, the remaining contents arrive at another sphincter, the ileocecal valve, located at the beginning of the large intestine (colon) in the lower-right side of the abdomen.

DIF: Bloom's: Understand

REF: Digestion

OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

3. Describe the major events of digestion that occur in the mouth, stomach, and small intestine.

ANS:

Mouth: The process of digestion begins in the mouth. During chewing, teeth crush large pieces of food into smaller ones, and fluids from foods, beverages and salivary glands blend with these pieces to ease swallowing. Fluids also help dissolve the food so that the tongue can taste it; only particles in solution can react with taste buds. When stimulated, the taste buds detect one, or a combination, of the five basic taste sensations: sweet, sour, bitter, salty and umami, a savory flavour commonly associated with monosodium glutamate. In addition to these chemical triggers, aroma, appearance, texture and temperature also affect a food's flavor.

The tongue provides taste sensations and moves food around the mouth, facilitating chewing and swallowing. When a mouthful of food is swallowed, it passes through the pharynx, a short tube that is shared by both the digestive system and the respiratory system. To bypass the entrance to the lungs, the epiglottis closes off the airway so that choking does not occur when swallowing. After a mouthful of food has been chewed and swallowed, it is called a bolus.

Oesophagus: The oesophagus has a sphincter muscle at each end. During a swallow, the upper oesophageal sphincter opens. The bolus then slides down the oesophagus, which passes through a hole in the diaphragm to the stomach. The lower oesophageal sphincter at the entrance to the stomach closes behind the bolus so that it proceeds forward and does not slip back into the oesophagus.

Stomach: The stomach retains the bolus for a while in its upper portion. Little by little, the stomach transfers the food to its lower portion, adds juices to it, and grinds it to a semiliquid mass called chyme. Then, bit by bit, the stomach releases the chyme through the pyloric sphincter, which opens into the small intestine, and then closes behind the chyme.

Small intestine: At the beginning of the small intestine, the chyme bypasses the opening from the common bile duct, which is dripping fluids, into the small intestine from two organs outside the GI tract – the gall bladder and the pancreas. The chyme travels on down the small intestine through its three segments, the duodenum, the jejunum, and the ileum – over three metres of tubing coiled within the abdomen.

DIF: Bloom's: Understand

REF: Digestion

OBJ: Explain how foods move through the digestive system, describing the actions of the organs, muscles and digestive secretions along the way.

4. What is the function of hydrochloric acid, and why is it necessary in the process of digestion?

ANS:

In the stomach, gastric glands secrete gastric juice, a mixture of water, enzymes and hydrochloric acid, which acts primarily in protein digestion. The acid is so strong that it causes the sensation of heartburn if it happens to reflux into the oesophagus.

The strong acidity of the stomach prevents bacterial growth and kills most bacteria that enter the body with food. It would destroy the cells of the stomach as well, but for their natural defenses. To protect themselves from gastric juice, the cells of the stomach wall (in fact, of the entire gastrointestinal lining) secrete mucous, a thick, slippery, white substance that coats the cells, protecting them from the acid, enzymes and disease-causing bacteria that might otherwise cause harm.

The stomach enzymes work most efficiently in the stomach's strong acid, but the salivary enzymes, which are swallowed with food, do not work in acid this strong. Consequently, the salivary digestion of carbohydrates gradually ceases when the stomach acid penetrates each newly swallowed bolus of food. Once in the stomach, salivary enzymes simply become other proteins to be digested.

DIF: Bloom's: Understand

REF: Digestion

OBJ: Explain how foods move through the digestive system, describing the actions of the organs,

muscles and digestive secretions along the way.

5. Describe anatomical features of the small intestine that facilitate absorption.

ANS:

The inner surface of the small intestine looks smooth and slippery, but when viewed through a microscope, it turns out to be wrinkled into hundreds of folds. Each fold is contoured into thousands of fingerlike projections, as numerous as the hairs on velvet fabric. These small intestinal projections are called villi. A single villus, magnified still more, turns out to be composed of hundreds of cells, each covered with its own microscopic hairs, called microvilli.

In the crevices between the villi lie the crypts – tubular glands that secrete the intestinal juices into the small intestine. Nearby goblet cells secrete mucous. The villi are in constant motion. Each villus is lined by a thin sheet of muscle, so it can wave, squirm, and wriggle like the tentacles of a sea anemone. Any nutrient molecule small enough to be absorbed is trapped among the microvilli and then drawn into the cells. Some partially digested nutrients are caught in the microvilli, digested further by enzymes there, and then absorbed into the cells.

The cells of the villi are among the most amazing in the body, for they recognise and select the nutrients the body needs and regulate their absorption. As already described, each cell of a villus is coated with thousands of microvilli, which project from the cell's membrane. In these microvilli, and in the membrane, lie hundreds of different kinds of enzymes and 'pumps', which recognise and act on different nutrients. Descriptions of specific enzymes and pumps for each nutrient are presented in later chapters, where appropriate; the point here is that the cells are equipped to handle all kinds and combinations of foods and their nutrients.

A further refinement of the system is that the cells of successive portions of the intestinal tract are specialised to absorb different nutrients. Foods eaten together can enhance each other's use by the body. For example, vitamin C in a pineapple or other citrus fruit can enhance the absorption of iron from a meal of chicken and rice or other iron-containing foods.

When a nutrient molecule has crossed the cell of a villus, it enters either the bloodstream or the lymphatic system. Both transport systems supply vessels to each villus. The water-soluble nutrients and the smaller products of fat digestion are released directly into the bloodstream and guided directly to the liver, where their fate and destination will be determined.

The larger fats and the fat-soluble vitamins are insoluble in water, however, and blood is mostly water. The intestinal cells assemble many of the products of fat digestion into larger molecules. These larger molecules cluster together with special proteins, forming chylomicrons. Because chylomicrons carry fats, they are released into the lymphatic system. They move through the lymph until they can enter the bloodstream at a point near the heart. Consequently, chylomicrons bypass the liver at first.

DIF: Bloom's: Understand

REF: Absorption

OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.

6. Discuss the validity of the art of 'food combining' to enhance digestion/absorption.

ANS:

The idea that people should not eat certain food combinations (for example, fruit and meat) at the same meal, because the digestive system cannot handle more than one task at a time, is a myth. The art of 'food combining' – which actually emphasises 'food separating' – is based on this myth, and it represents faulty logic and a gross underestimation of the body's capabilities. In fact, the contrary is often true; foods eaten together can enhance each other's use by the body. For example, vitamin C in a pineapple or other citrus fruit can enhance the absorption of iron from a meal of chicken and rice or other iron-containing foods.

DIF: Bloom's: Understand

REF: Absorption

OBJ: Describe the anatomical details of the intestinal cells that facilitate nutrient absorption.

7. Describe the parts of the vascular system that are involved in digestion and absorption of water-soluble and fat-soluble nutrients.

ANS:

The routing of the blood leaving the digestive system has a special feature. The blood is carried to the digestive system (as to all organs) by way of an artery, which (as in all organs) branches into capillaries to reach every cell. Blood leaving the digestive system, however, goes by way of a vein. The hepatic portal vein directs blood not back to the heart but to another organ, the liver. This vein branches into a network of large capillaries, so that every cell of the liver has access to the blood. Blood leaving the liver then collects into the hepatic vein, which returns blood to the heart.

The liver's placement ensures that it will be first to receive the nutrients absorbed from the GI tract. In fact, the liver has many jobs to do in preparing the absorbed nutrients for use by the body. Of all the body's organs, the liver is the most metabolically active. In addition, the liver defends the body by detoxifying substances that might cause harm and preparing waste products for excretion. This is why, when people ingest poisons that succeed in passing the first barrier (the intestinal cells), the liver quite often suffers the damage – from viruses such as hepatitis, from drugs such as barbiturates or alcohol, from toxins such as pesticide residues, and from contaminants such as mercury.

The lymphatic system provides a one-way route for fluid from the tissue spaces to enter the blood. Unlike the vascular system, the lymphatic system has no pump; instead, lymph circulates between the cells of the body and collects into tiny vessels. The fluid moves from one portion of the body to another as muscles contract and create pressure here and there. Ultimately, much of the lymph collects in the thoracic duct behind the heart. The thoracic duct opens into the subclavian vein, where the lymph enters the bloodstream. Thus, nutrients from the GI tract that enter lymphatic vessels (large fats and fat-soluble vitamins) ultimately enter the bloodstream, circulating through arteries, capillaries and veins like the other nutrients, with a notable exception – they bypass the liver at first.

DIF: Bloom's: Understand

REF: The circulatory system

OBJ: Explain how nutrients are routed in the circulatory systems from the GI tract into the body and identify which nutrients enter the blood directly and which must first enter the lymph.

8. Compare the properties of prebiotics and probiotics. Give examples of each type.

ANS:

Prebiotics: Food components (such as fibres) that are not digested by the human body, but are used as food by the GI bacteria to promote their growth and activity

Probiotics: Living microorganisms found in foods and dietary supplements that, when consumed in sufficient quantities, are beneficial to health

Examples will vary.

DIF: Bloom's: Understand

REF: The health and regulation of the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

9. List several beneficial roles of the gastrointestinal microbiome.

ANS:

A healthy GI tract is home to a vibrant community of some 100 trillion microbes – bacteria, viruses, fungi, protozoa and other microorganisms, collectively known as the human microbiome. Weighing less than 500 grams in total, these microbial cells outnumber the body's cells tenfold. The bacteria alone represent more than 400 different species and sub-species. The prevalence of different microbes in various parts of the GI tract depends on such factors as pH, peristalsis, diet, and other microbes. Relatively few microbes can live in the low pH of the stomach, with its somewhat rapid peristalsis, whereas the neutral pH and slow peristalsis of the lower small intestine and the large intestine permit the growth of a diverse and abundant population.

Recent research has revealed that a person's health reflects the relative stability, disturbance, and resilience of the microbiome. Its composition and activity may contribute to dozens of common diseases, including inflammatory bowel disease and obesity.

The microbiome population and environment change dramatically in response to diet – both in the short term (daily meals) and in the long term (habitual diet patterns). Consider, for example, that fibres that cannot be digested by the human body provide a major source of energy for bacteria, fostering their growth. As GI bacteria digest and metabolise fibres and other nutrients, they produce compounds such as short fragments of fat, which can influence energy metabolism and immunity. Fibres and some other food components are called *prebiotics* because they encourage the growth and activity of bacteria. Research suggests that prebiotics may reduce the risk of GI infections, inflammation, and disorders; increase the bioavailability of nutrients; and regulate appetite and satiety.

Some foods contain *probiotics*, live microbes that change the conditions in the GI tract in ways that seem to benefit health. For example, yoghurt contains *lactobacillus* and other living bacteria. The potential GI health benefits of probiotics or products of their metabolism include helping to alleviate diarrhoea, constipation, inflammatory bowel disease, ulcers, allergies, lactose intolerance, and infant colic; enhance immune function; and protect against colon cancer. Research studies continue to explore how diet influences GI bacteria and which foods – with their prebiotics and probiotics – affect GI health. In addition, research studies are beginning to reveal several health benefits beyond the GI tract, such as improving blood pressure and immune responses.

Bacteria in the GI tract also produce several vitamins, including biotin, folate, pantothenic acid, riboflavin, thiamin, vitamin B₆, vitamin B₁₂ and vitamin K. Because the amount produced is insufficient to meet the body's needs, these vitamins are considered essential nutrients that must be provided by the diet.

DIF: Bloom's: Understand

REF: The health and regulation of the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

10. Discuss the role of bacteria in the GI tract and factors that help regulate their proliferation.

ANS:

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Some foods contain *probiotics*, live microbes that change the conditions in the GI tract in ways that seem to benefit health. For example, yoghurt contains *lactobacillus* and other living bacteria. The potential GI health benefits of probiotics or products of their metabolism include helping to alleviate diarrhoea, constipation, inflammatory bowel disease, ulcers, allergies, lactose intolerance, and infant colic; enhance immune function; and protect against colon cancer. Research studies continue to explore how diet influences GI bacteria and which foods – with their prebiotics and probiotics – affect GI health. In addition, research studies are beginning to reveal several health benefits beyond the GI tract, such as improving blood pressure and immune responses.

Bacteria in the GI tract also produce several vitamins, including biotin, folate, pantothenic acid, riboflavin, thiamin, vitamin B6, vitamin B12 and vitamin K. Because the amount produced is insufficient to meet the body's needs, these vitamins are considered essential nutrients that must be provided by the diet.

DIF: Bloom's: Understand

REF: The health and regulation of the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

11. Why don't digestive enzymes damage the pancreas?

ANS:

The pancreas protects itself from harm by producing an inactive form of the enzymes. It releases these proteins into the small intestine, where they are activated to become enzymes. In pancreatitis, the digestive enzymes become active within the infected pancreas, causing inflammation and damaging the delicate pancreatic tissues.

DIF: Bloom's: Remember

REF: The health and regulation of the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

12. What is the most likely explanation for the observation that a person may experience 'upset digestion' upon changing the diet?

ANS:

The pancreas does know what its owner has been eating, and it secretes enzyme mixtures tailored to handle the food mixtures that have been arriving recently (over the past several days). Enzyme activity changes proportionately in response to the amounts of carbohydrate, fat and protein in the diet. If a person has been eating mostly carbohydrates, the pancreas makes and secretes mostly carbohydrates; if the person's diet has been high in fat, the pancreas produces more lipases; and so forth. Hormones from the GI tract, secreted in response to meals, keep the pancreas informed as to its digestive tasks. The lag of a day or two between the time a person's diet changes dramatically and the time digestion of the new diet becomes efficient explains why dietary changes can 'upset digestion' and should be made gradually.

DIF: Bloom's: Understand

REF: The health and regulation of the GI tract

OBJ: Describe how bacteria, hormones and nerves influence the health and activities of the GI tract.

13. Name and describe the functions of three major hormones involved in digestion/absorption.

ANS:

Food entering the stomach stimulates cells in the stomach wall to release the hormone *gastrin*. Gastrin, in turn, stimulates the stomach glands to secrete the components of hydrochloric acid. When pH 1.5 is reached, the acid itself turns off the gastrin-producing cells; they stop releasing gastrin, and the glands stop producing hydrochloric acid.

The presence of chyme stimulates the cells of the duodenal wall to release the hormone *secretin* into the blood. When secretin reaches the pancreas, it stimulates the pancreas to release its bicarbonate-rich juices. Thus, whenever the duodenal signals that acidic chyme is present, the pancreas responds by sending bicarbonate to neutralise it. When the need has been met, the cells of the duodenal wall are no longer stimulated to release secretin, the hormone no longer flows through the blood, and the pancreas no longer receives the message and stops sending pancreatic juice. Nerves also regulate pancreatic secretions.

Fat in the intestine stimulates cells of the intestinal wall to release the hormone *cholecystokinin* (CCK). This hormone travels by way of the blood to the gallbladder and stimulates it to contract, which releases bile into the small intestine. Cholecystokinin also travels to the pancreas and stimulates it to secrete its juices, which releases bicarbonate and enzymes into the small intestine. Once the fat in the intestine is emulsified and enzymes have begun to work on it, the fat no longer provokes release of the hormone, and the message to contract is cancelled.

DIF: Bloom's: Understand

REF: The health and regulation of the GI tract

OBJ: Describe how bacteria, hormones, and nerves influence the health and activities of the GI tract.

14. What are common factors that initiate choking? What are the preferred methods to assist a person who is choking? What foods are commonly associated with choking?

ANS:

Sometimes a sip of a beverage or a tiny bit of food 'slips down the wrong pipe'. The body's first response is to cough, and quite often coughing clears the passage. When someone is truly choking, however, food has slipped into the trachea and completely blocked the air passageways. Thus, the person cannot cough – or even breathe. Without oxygen, the person may suffer permanent brain damage within five minutes, or may even die. For this reason, it is imperative that everyone learn to recognise the universal distress signal for choking (hands wrapped around the throat) and act promptly.

Because the larynx is in the trachea and makes sounds only when air is pushed across it, a person who is choking will be unable to speak. For this reason, to help a person who is choking, first ask, 'Can you speak?' If the person is coughing, breathing adequately or able to speak, do not interfere. Whatever you do, do not hit him or her on the back, as the particle may become lodged more firmly in the air passageway. If the person cannot speak or cough, shout for help and perform the Heimlich manoeuvre. Almost any food can cause choking, although some are cited more often than others: chunks of meat, hot dogs, nuts, whole grapes, raw carrots, marshmallows, hard or sticky candies, gum, popcorn, and peanut butter. These foods are particularly difficult for young children (especially those four years of age and younger) to safely chew and swallow. Each year more than 10 000 children (14 years old or younger) in the United States choke; more than half choke on food. An adult should be present and alert to the dangers of choking whenever young children are eating. To prevent choking, cut food into small pieces, chew thoroughly before swallowing, don't talk or laugh with food in your mouth, and don't eat when breathing hard.

DIF: Bloom's: Understand

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.

15. Describe the similarities and differences in fluid and nutrient losses between vomiting and diarrhea.

ANS:

Vomiting can be a symptom of many different diseases, or may arise in situations that upset the body's equilibrium, such as air or sea travel. For whatever reason, the contents of the stomach are propelled up through the oesophagus to the mouth and expelled. Sometimes the muscular contractions will extend beyond the stomach and carry the contents of the duodenum, with its green bile, into the stomach and then up the oesophagus. Although certainly unpleasant and wearying for the nauseated person, vomiting is often not a cause for alarm. Vomiting is one of the body's adaptive mechanisms to rid itself of something irritating. The best advice is to rest and drink small amounts of liquids as tolerated until the nausea subsides.

A physician's care may be needed, however, if vomiting causes such large losses of fluid as to threaten dehydration. As fluid is lost from the GI tract, the body's other fluids redistribute themselves, taking fluid from every cell of the body. Fluid leaving the cells is accompanied by salts that are absolutely essential to the life of the cells. Replacing salts and fluid is difficult if the vomiting continues, and intravenous feedings of saline and glucose may be necessary. Vomiting and dehydration are especially serious in an infant, and a physician should be contacted without delay.

Diarrhoea is characterised by frequent, loose, watery stools. Such stools indicate that the intestinal contents have moved too quickly through the intestines for fluid absorption to take place, or that water has been drawn from the cells lining the intestinal tract and added to the food residue. Like vomiting, diarrhoea can lead to considerable fluid and salt losses, but the composition of the fluids is different. Stomach fluids lost in vomiting are highly acidic, whereas intestinal fluids lost in diarrhoea are nearly neutral. When fluid losses require medical attention, correct replacement is crucial.

Diarrhoea is a symptom of various medical conditions and treatments. It may occur abruptly in a healthy person as a result of infections (such as foodborne illness) or as a side effect of medications. When used in large quantities, food ingredients such as the sugar alternative sorbitol and the fat alternative olestra may also cause diarrhoea in some people. If a food is responsible, then that food must be omitted from the diet, at least temporarily. If medication is responsible, a different medicine, when possible, or a different form (injectable versus oral, for example) may alleviate the problem. Diarrhoea may also occur as a result of disorders of the GI tract, such as irritable bowel syndrome or colitis.

DIF: Bloom's: Understand

REF: Common digestive problems

OBJ: Outline strategies to prevent or alleviate common GI problems.