1. A gallstone that blocked the common bile duct would cause the fat content of feces to:
   a. Increase
   b. Decrease
   c. Stay the same

2. Norepinephrine will cause secretion of stomach acid to:
   a. Increase
   b. Decrease
   c. Stay the same

3. A rise in plasma levels of gastrin will cause the activity of the stomach's muscularis externa to:
   a. Increase
   b. Decrease
   c. Stay the same

4. A decline in plasma levels of CCK will cause gastric activity to:
   a. Increase
   b. Decrease
   c. Stay the same

5. If plasma levels of secretin and CCK increased, the volume of bile in the gallbladder would _________ and the pH of the duodenum would __________.
   a. Decrease – decrease
   b. Increase – decrease
   c. Increase – increase
   d. Decrease – increase

6. During the cephalic phase of gastric activity, the concentration of hydrogen in the gastric lumen will:
   a. Increase
   b. Decrease
   c. Stay the same

7. A ___________ in plasma glucose levels will cause an increase in the release of ___________ from pancreatic ___________ cells.
   a. Rise - glucagon – alpha
   b. Drop - insulin – alpha
   c. Rise - insulin – beta
   d. Drop - glucagon – beta

8. Which of the following cells secrete pepsinogen?
   a. Parietal cells
   b. Stem cells
   c. Chief cells
   d. Alpha cells

9. As blood flows from a portal venule to a central vein, its plasma protein content will most likely:
   a. Increase
   b. Decrease
   c. Stay the same

10. A lack of functioning parietal cells would cause red blood cell count to:
    a. Increase
    b. Decrease
    c. Stay the same
11. All of the following are TRUE of the pancreas EXCEPT:
   a. Pancreatic juice contains a high concentration of hydrogen ions and is released by pancreatic acinar cells.
   b. The head of the pancreas is right next to the duodenum, while the tail of the pancreas is right next to the spleen.
   c. The pancreas is considered an accessory digestive organ.
   d. Pancreatic duct cells are stimulated by secretin.

12. Which of the following is NOT TRUE of bile?
   a. It's produced by hepatocytes in the gallbladder.
   b. It acts as an emulsifier, i.e., it separates large fat droplets into small fat droplets.
   c. It contains bilirubin, which is a breakdown product of hemoglobin.
   d. It contains bile salts.

13. During defecation, the external anal sphincter will __________ and the rectal muscularis will __________.
   a. Relax – contract
   b. Relax - relax also
   c. Contract - contract also
   d. Contract – relax

14. Many years ago, a common procedure for the treatment of ulcers was the cutting of the branches of the vagus nerve going to the stomach. This would cause stomach acid secretion to:
   a. Increase
   b. Decrease
   c. Not change

15. All of the following are TRUE of the stomach EXCEPT:
   a. Chief cells secrete pepsinogen.
   b. Parietal cells secrete intrinsic factor.
   c. The pyloric region of the stomach is a major site of nutrient absorption.
   d. The submucosa of the stomach is adjacent to the inner oblique layer of the muscularis externa.

16. All of the following are TRUE of the liver lobule EXCEPT:
   a. Bile canaliculi transport bile towards the bile ducts located at the corners of the liver lobule.
   b. Sinusoidal capillaries drain into the central vein.
   c. Liver lobules are capable of producing plasma proteins such as albumin.
   d. The portal arteriole takes blood to the liver lobule, while the portal venule takes blood away from the liver lobule.

17. If pancreatic acinar cells failed to function properly, the nutrient content of feces would:
   a. Increase
   b. Decrease
   c. Stay the same

18. All of the following are components of saliva EXCEPT:
   a. Pepsin
   b. IgA antibodies
   c. Mucin
   d. Salivary amylase
19. Lipase is the enzyme that chemically digests fats into:
   a. Amino acids
   b. Lipids
   c. Fatty acids and glycerol
   d. Simple sugars

20. Which of the following is TRUE of the gallbladder?
   a. Its main function is the synthesis of bile
   b. Its removal will not affect pepsinogen secretion
   c. It contains no smooth muscle
   d. It does not respond to hormones or nervous stimulation
   e. It is directly connect to the liver via the seven cystic ducts

21. Which of the following is NOT a function of the liver?
   a. Bile secretion
   b. Storage of fat soluble vitamins
   c. Secretion of emulsifying agents
   d. Detoxification of alcohol
   e. None of the above

22. The small intestine:
   a. Is a site of mechanical but not chemical digestion
   b. Contains paneth cells which secrete lysozyme
   c. Does not secrete hormones
   d. Lacks epithelial cells
   e. Contains 3 regions of equal length

23. Which of the following is TRUE of the liver?
   a. Bile and blood flow in the same direction through the liver lobule
   b. The left lobe is the largest lobe of the liver
   c. Only oxygenated blood is brought to the liver
   d. Each liver lobule is associated with 6 central veins
   e. None of the above

24. Which of the following is TRUE?
   a. The internal anal sphincter is made of skeletal muscle
   b. The defecation reflex can be affected by input from the cerebral cortex
   c. Bile plays no role in triglyceride digestion
   d. Salivary amylase is a protein-digesting enzyme
   e. All of the above

25. Chemical digestion of carbohydrates begins in the _______ whereas chemical digestion of proteins begins in the _________.
   a. Stomach; duodenum
   b. Oral cavity; duodenum
   c. Oral cavity; stomach
   d. Duodenum; stomach
   e. Stomach; oral cavity
26. Damage to the exocrine pancreas would:
   a. Impair protein digestion and hormone secretion
   b. Impair fat digestion and insulin secretion
   c. Impair the digestion and absorption of glucose and glycerol
   d. Impair protein digestion and fat digestion
   e. 2 of the above are correct

27. The bacterium *Streptococcus mutans* is responsible for most dental caries (i.e., cavities). How does increased salivation help decrease the likelihood of tooth decay?
   a. Saliva contains vitamin A
   b. Saliva contains lysozyme and defensins
   c. Saliva increases the pH of the oral cavity
   d. All of the above
   e. 2 of the above

28. Cholera toxin greatly decreases the reabsorption of water in the colon. This results in:
   a. Diarrhea
   b. Constipation

29. Following digestion and absorption most dietary fat content can be found within:
   a. Hepatic capillaries
   b. Intestinal capillaries
   c. Intestinal lacteals
   d. Submucosal chylomicrons
   e. None of the above

30. A function of the ileocecal valve is to prevent backflow from the large intestine to the small intestine.
   a. The above statement is TRUE
   b. The above statement is FALSE

31. A lack of functioning salivary amylase would prevent an individual from being able to digest lactose.
   a. The above statement is TRUE
   b. The above statement is FALSE

32. Bile is responsible for digesting triglycerides into monoglycerides.
   a. The above statement is TRUE
   b. The above statement is FALSE

33. Most of the digestive tract is lined by ______ epithelium.
   a. pseudostratified ciliated columnar
   b. cuboidal
   c. stratified squamous
   d. simple cuboidal with adaptations that increase surface area (e.g., microvilli)
   e. simple columnar

34. Waves of muscular contractions that propel the contents of the digestive tract from one point to another are called:
   a. segmentation.
   b. pendular movements.
   c. peristalsis.
   d. churning movements.
   e. mastication.
35. ‘Gastric pits’ are:
   a. ridges in the body of the stomach.
   b. involved in absorption of liquids from the stomach.
   c. pockets in the lining of the stomach that contain secretory cells.
   d. located in the esophagus.
   e. areas where proteins and non-lipophilic carbohydrates are digested.

36. Plicae and intestinal villi:
   a. increase the surface area of the mucosa of the small intestine.
   b. carry products of digestion that will not pass through the walls or blood capillaries.
   c. produce new cells for the mucosa of the small intestine and gallbladder.
   d. produce hormones such as erythropoietin
   e. 2 of the above

37. Submucosal glands that secrete alkaline mucus are characteristic of the:
   a. duodenum.
   b. jejunum.
   c. ileum.
   d. pancreas.
   e. liver.

38. The portion of the small intestine that attaches to the large intestine is the:
   a. cecum.
   b. appendix.
   c. ileum.
   d. duodenum.
   e. jejunum.

39. An intestinal hormone that stimulates the pancreas to release a watery secretion that is high in bicarbonate ion (and thus quite alkaline) is:
   a. enterocrinin.
   b. secretin.
   c. cholecystokinin.
   d. GIP.
   e. gastrin.

40. An intestinal hormone that stimulates the gallbladder to release bile is:
   a. enterokinase.
   b. secretin.
   c. cholecystokinin.
   d. GIP.
   e. gastrin.

41. In the center of a liver lobule there is a(n):
   a. hepatic duct.
   b. portal area.
   c. sinusoid.
   d. central vein.
   e. portal vein.
42. Each of the following is a function of the liver, except:
   a. synthesis and secretion of bile.
   b. antibody production.
   c. synthesis of plasma proteins such as clotting factors.
   d. inactivation of toxins.
   e. nutrient processing and storage.

43. During the ‘cephalic phase’ of gastric secretion:
   a. the stomach responds to distention.
   b. secretin inhibits parietal and chief cells.
   c. there is an increased flow of action potentials along the vagus nerve to the stomach.
   d. the intestinal reflex inhibits gastric emptying.
   e. production of gastric juice slows down.

44. The ‘gastric phase’ of gastric secretion is triggered by the:
   a. sight, thought or smell of food.
   b. entry of food into the stomach.
   c. entry of chyme into the small intestine.
   d. entry of chyme into the large intestine.
   e. release of cholecystokinin and secretin by the small intestine.

45. Functions of the large intestine include:
   a. chemical digestion of chyme.
   b. temporary food storage.
   c. resorption of water and compaction of feces.
   d. absorption of the products of digestion.
   e. Both b and c

46. Decreased levels of bile salts in the bile would interfere with digestion of:
   a. protein.
   b. fat.
   c. disaccharides.
   d. complex carbohydrates.
   e. vitamins.

47. Mary suffers from a disease that causes a large portion of her gastric mucosa to atrophy. This results in significantly less secretion by the gastric glands. As a result of this condition, you would expect Mary to suffer from:
   a. hepatitis
   b. pernicious anemia.
   c. diarrhea and constipation
   d. dehydration.
   e. obstructive bowel disease.

48. At the junction of the main pancreatic duct and the common bile duct is an enlarged area called the hepatopancreatic ampulla.
   a. The above statement is TRUE
   b. The above statement is FALSE
49. From the esophagus to the anal canal, the walls of every organ of the alimentary canal are made up of the same four basic layers. Arrange them in order from the lumen.
   a. muscularis externa, serosa, mucosa, and submucosa
   b. serosa, mucosa, submucosa, and muscularis externa
   c. submucosa, serosa, muscularis externa, and mucosa
   d. mucosa, submucosa, muscularis externa, and serosa

50. Which of the following is not true of saliva?
   a. Cleanses the mouth
   b. Contains enzymes that begin the breakdown of proteins.
   c. Moistens food and aids in compacting of the bolus.
   d. Dissolves food chemicals so that can be tasted.
   e. Contains chemicals that help repel pathogens

51. Hepatocytes do not:
   a. produce digestive enzymes.
   b. process nutrients.
   c. store fat-soluble vitamins.
   d. detoxify.

52. As the food in the stomach is repeatedly squeezed and mixed with gastric juice, it is converted into a creamy paste called:
   a. a bolus.
   b. chyme.
   c. bile.
   d. feces.
   e. None of the above

53. Select the correct statement about the regulation of gastric secretion.
   a. Vagus stimulation of the stomach results in decreased secretion of gastric juice.
   b. The presence of food in the stomach prevents hormonal control of gastric secretion.
   c. Gastric secretion can be stimulated before food has entered the mouth.
   d. Gastric secretion is enhanced by very low pH (below pH2).
   e. 2 of the above are correct

54. An individual who underwent a complete gastrectomy would be UNABLE to digest proteins
   a. The above statement is TRUE
   b. The above statement is FALSE

55. Which of the following is the MOST INFERIOR?
   a. Fundus of the stomach
   b. Ileocecal valve
   c. Diaphragm
   d. Hepatopancreatic sphincter
   e. Islets of Langerhans

56. Which of the following basic digestive processes involve(s) skeletal muscle?
   a. Ingestion
   b. Propulsion
   c. Defecation
   d. Mechanical digestion
   e. All of the above
57. Which of the following is NOT considered an endocrine organ?
   a. Stomach
   b. Colon
   c. Duodenum
   d. Pancreas
   e. NONE of the above can be considered endocrine organs

58. Which of the following is NOT TRUE?
   a. Muscularis externa is always smooth muscle
   b. Mucosae can secrete mucus
   c. Submucosa contains blood vessels
   d. Mucosa contains blood vessels
   e. Mucosa contains smooth muscle

59. Which of the following secretions is mismatched?
   a. Duodenum – alkaline mucus
   b. Parietal cells – hydrochloric acid
   c. Liver – bile
   d. Pancreas – protein digesting enzymes
   e. Chief cells – gastrin

60. The liver:
   a. Receives blood from the hepatic artery and hepatic portal vein
   b. Produces bile – an emulsifier of fats
   c. Is just inferior to the diaphragm on the right side of the abdominal cavity
   d. Is composed primarily of hepatocytes
   e. All of the above

61. Which of the following is TRUE of the liver lobule?
   a. Bile flows towards the central vein.
   b. Blood flows away from the central vein
   c. Each liver lobule is associated with 4 portal triads
   d. Each portal triad is associated with 2 blood vessels and one bile duct
   e. All of the above

62. Which of the following is TRUE?
   a. Pancreatic acini secrete the hormones insulin and glucagon
   b. Pancreatic juice is bicarbonate rich and thus quite acidic
   c. Pancreatic duct cells secrete digestive enzymes such as pancreatic lipase
   d. The pancreas is the smallest digestive organ
   e. None of the above

63. Which of the following are NOT found in both the large and small intestines?
   a. Goblet cells
   b. Simple columnar epithelial cells
   c. Lamina propria
   d. Tenia coli
   e. Smooth muscle cells
64. Goblet cells:
   a. Secrete mucus
   b. Are found in the small intestine
   c. Are found in the large intestine
   d. All of the above
   e. 2 of the above

65. Xerostomia is a condition marked by diminished saliva secretion. Which of the following would most likely be associated with xerostomia?
   a. ↑ likelihood of dental caries
   b. ↑ ability to digest starch within the oral cavity
   c. ↑ ability to digest protein within the oral cavity
   d. ↑ ability to control the skeletal muscle in the cardiac sphincter
   e. All of the above

66. In a condition known as achalasia, food tends to accumulate within the esophagus. Which of the following sphincters is most likely involved?
   a. Hepatopancreatic
   b. Urinary
   c. Internal anal
   d. Cardiac
   e. Pyloric

67. Pernicious anemia would most likely indicate damage to which of the following?
   a. Crypts of Lieberkühn
   b. Common hepatic duct
   c. Chief cells
   d. Parietal cells
   e. Parotid glands

68. Steatorrhea is a situation where excessive undigested fats are present in the feces. Which of the following is most likely to be a cause of steatorrhea?
   a. Inability to secrete intrinsic factor
   b. Inability to secrete pancreatic lipase
   c. Inability to secrete bile
   d. Inability to secrete lysozyme
   e. More than one of the above

69. Cholecystokinin:
   a. Inhibits gastric secretion and motility
   b. Stimulates contraction of smooth muscle in the gallbladder
   c. Stimulates relaxation of the hepatopancreatic sphincter
   d. Stimulates zymogen secretion by pancreatic acinar cells
   e. All of the above

70. Whales lack the capacity to produce bile. What could be concluded from this fact?
   a. Whale diets typically are low in fats
   b. Whale diets typically are low in protein
   c. Whales do not perform aerobic respiration
   d. Whales lack smooth muscle in their gastrointestinal walls
   e. All of the above
71. During embryonic development the pancreas actually buds out from another organ. Which of the following is the most likely organ?
   a. Parotid
   b. Duodenum
   c. Sigmoid colon
   d. Esophagus
   e. Cecum

72. Which of the following is the MOST SUPERIOR?
   a. Cecum
   b. Vermiform appendix
   c. Sigmoid colon
   d. Hepatic flexure of the colon
   e. Pubic symphysis

73. Which of the following is NOT found in the large intestine?
   a. Goblet cells
   b. Tenia coli
   c. Haustra
   d. Villi
   e. Submucosa

74. Careful examination of the gallbladder mucosa will reveal the presence of rugae. Which of the following could be a function of the rugae?
   a. Allows the gallbladder to contract mightily in response to gastrin.
   b. Allows the surface area of the gallbladder to be increased, so as to facilitate nutrient absorption.
   c. Helps metabolize bile into bilirubin.
   d. Allows the gallbladder to expand as its volume of stored bile increases.
   e. More than one of the above is true.

75. An autoimmune disease in which T cells destroyed the parietal cells of the gastric mucosa could result in:
   a. Pernicious anemia.
   b. A stomach lumen that is more hospitable to bacterial multiplication.
   c. A decreased in the stomach’s ability to digest proteins.
   d. All of the above.
   e. Only 2 of the above.

76. Cystic fibrosis can result in blockages of the main pancreatic duct. This could:
   a. Decrease an individual’s ability to digest fats.
   b. Prevent the release of cholecystokinin.
   c. Decrease the likelihood of acidic chyme damaging the duodenal mucosa.
   d. All of the above.
   e. None of the above

77. Which of the following is TRUE?
   a. Each intestinal villus contains blood and lymphatic capillaries.
   b. The brush border increases intestinal surface area.
   c. The ileum is the longest portion of the small intestine.
   d. All of the above
   e. 2 of the above
78. Which of the following processes is LEAST dependent on muscle tissue?
   a. Ingestion
   b. Propulsion
   c. Defecation
   d. Mechanical digestion
   e. Absorption

79. Certain pancreatic cells secrete bicarbonate. Since this bicarbonate is formed from carbon dioxide and water, these cells contain the enzyme:
   a. Trypsin
   b. Lysozyme
   c. Carbonic anhydrase
   d. Amylase

80. The loss of which of the following organs would have the most detrimental effect on the body?
   a. Pancreas
   b. Submandibular glands
   c. Internal anal sphincter
   d. Gallbladder
   e. Teeth

81. The simple diagram below is of a liver lobule.
   a. Name the vessel in the center.
   b. A portal triad is on the left of the lobule. Label its 3 structures and write down what each carries (be specific).
   c. What type of cells is the interior of the lobule composed of? What are 2 of their functions?

82. In the early 20th century William Bayliss and Ernst Starling made several important physiological discoveries concerning the regulation of pancreatic secretion. In one of their experiments, they put acid into the duodenum of a dog, and noted that pancreatic secretion subsequently occurred in the normal way. Working on the hypothesis that acid caused the release of something from the duodenum into the blood, they scraped some mucosa from the duodenum, added acid to it, ground it up with sand, filtered it and injected it intravenously into an anaesthetized dog. Pancreatic secretion followed a few seconds later.
   a. Why do you think they chose to put acid in the duodenum?
   b. What hormone must their “mucosal scraping” have contained?
   c. Since their injection caused pancreatic secretion to occur, what sphincter must have relaxed in response to the injection?