LESSON ASSIGNMENT

LESSON 1  The Human Digestive System.

TEXT ASSIGNMENT Paragraph 1-1 through 1-24.

LESSON OBJECTIVES After completing this lesson, you should be able to:

1-1. Given a group of statements, select the statement that best defines the human digestive system.

1-2. From a list of names of organs, select the organ which is part of the human digestive system.

1-3. Given a group of statements, select the statement that best describes the function of a digestive enzyme.

1-4. Given a diagram of the human digestive system and a list of names of organs of the human digestive system, match the name of an organ with its location on the diagram.

1-5. Given the name of a part of the human digestive system and a group of statements, select the statement that best describes that part of the human digestive system.

1-6. Given the name of a part of the human digestive system and a group of statements, select the statement(s) that best describe the function(s) of that part of the digestive system.

1-7. From a group of statements, select the statement that best describes the digestion of fats, carbohydrates, or proteins.

1-8. Given the name of a disease or disorder of the human digestive system and a group of statements, select the statement that best describes that disease or disorder.

SUGGESTION After completing the assignment, complete the exercises at the end of this lesson. These exercises will help you to achieve the lesson objectives.
LESSON 1

THE HUMAN DIGESTIVE SYSTEM

Section I. INTRODUCTION

1-1. GENERAL

a. Definition. The human digestive system is a group of organs designed to take in foods, initially process foods, digest the foods, and eliminate unused materials of food items. It is a hollow tubular system from one end of the body to the other end. See figure 1-1.

Figure 1-1. The human digestive system.
b. **Major Organs.** The major organs involved in the human digestive system are listed below. They are each discussed later in this lesson.

   (1) Mouth or oral complex.
   (2) Pharynx.
   (3) Esophagus.
   (4) Stomach.
   (5) Small intestines and associated glands.
   (6) Large intestines.
   (7) Rectum.
   (8) Anal canal and anus.

   c. **Digestive Enzymes.** A **catalyst** is a substance that accelerates (speeds up) a chemical reaction without being permanently changed or consumed itself. A **digestive enzyme** serves as a catalyst, aiding in digestion. **Digestion** is a chemical process by which food is converted into simpler substances that can be absorbed or assimilated by the body. Enzymes are manufactured in the salivary glands of the mouth, in the lining of the stomach, in the pancreas, and in the walls of the small intestine.

   **1-2. FOODS AND FOODSTUFFS**

   Examples of food items are a piece of bread, a pork chop, and a tomato. Food items contain varying proportions of foodstuffs. **Foodstuffs** are the classes of chemical compounds that make up food items. The three major types of foodstuffs are carbohydrates, lipids (fats and oils), and proteins. Food items also contain water, minerals, and vitamins.
Section II. THE SUPRAGASTRIC STRUCTURES

1-3. ORAL COMPLEX

The oral complex consists of the structures commonly known together as the mouth. It takes in and initially processes food items. See figure 1-2.

Figure 1-2. Anatomy of the oral complex.

a. Teeth.

(1) A tooth (figure 1-3) has two main parts, the crown and the root. The root canal passes up through the central part of the tooth. The root is suspended within a socket (called the alveolus) of one of the jaws of the mouth. The crown extends up above the surface of the jaw. The root and inner part of the crown are made of a substance called dentin. The outer portion of the crown is covered with a substance known as enamel. Enamel is the hardest substance of the human body. The nerves and blood vessels of the tooth pass up into the root canal from the jaw substance.

(2) There are two kinds of teeth, anterior and posterior. The anterior teeth are also known as incisors and canine teeth. The anterior teeth serve as choppers. They chop off mouth-size bites of food items. The posterior teeth are called molars. They are grinders. They increase the surface area of food materials by breaking them into smaller and smaller particles.

(3) Humans have two sets of teeth, deciduous and permanent. Initially, the deciduous set includes 20 baby teeth. These are eventually replaced by a permanent set of 32.

DECIDUOUS = to be shed
b. Jaws. There are two jaws, the upper and the lower. The upper is called the maxilla. The lower is called the mandible.

(1) In each jaw, there are sockets for the teeth. These sockets are known as alveoli. The bony parts of the jaws holding the teeth are known as alveolar ridges.

(2) The upper jaw is fixed to the base of the cranium. The lower jaw is movable. There is a special articulation, (T-MJ, temporo-mandibular joint), with muscles to bring the upper and lower teeth together to perform their functions.

c. Palate. The palate serves as the roof of the mouth and the floor of the nasal chamber above. Since the anterior two-thirds is bony, it is called the hard palate. The posterior one-third is musculo-membranous, and is called the soft palate. The soft palate serves as a trap door to close off the upper respiratory passageway during swallowing.

d. Lips and Cheeks. The oral cavity is closed by a fleshy structure around the opening. Forming the opening are the lips. On the sides are the cheeks.
e. **Tongue.** The tongue is a muscular organ. The tongue is capable of *internal* movement to shape its body. It is moved as a whole by muscles outside the tongue. Interaction between the tongue and cheeks keeps the food between the molar teeth during the chewing process. When the food is properly processed, the tongue also initiates the swallowing process.

f. **Salivary Glands.** Digestion is a chemical process that takes place at the wet surfaces of food materials. The chewing process has greatly increased the surface area available. The surfaces are wetted by saliva produced by glands in the oral cavity. Of these glands, three pairs are known as the *salivary glands proper*.

g. **Taste Buds.** Associated with the tongue and the back of the mouth are special clumps of cells known as *taste buds*. These taste buds literally taste the food. That is, they check its quality and acceptability.

1-4. **PHARYNX**

The pharynx (pronounced “FAIR-inks”) is a continuation of the rear of the mouth region, just anterior to the vertebral column (spine). It is a common passageway for both the respiratory and digestive systems.

1-5. **ESOPHAGUS**

The esophagus is a muscular, tubular structure extending from the pharynx, down through the neck and the thorax (chest), and to the stomach. During swallowing, the esophagus serves as a passageway for the food from the pharynx to the stomach.

**Section III. THE STOMACH**

1-6. **STORAGE FUNCTION**

The stomach is a sac-like enlargement of the digestive tract specialized for the storage of food. Since food is stored, a person does not have to eat continuously all day. One is freed to do other things. The presence of *valves* at each end prevents the stored food from leaving the stomach before it is ready. The *pyloric valve* prevents the food from going further. The inner lining of the stomach is in folds to allow expansion.

1-7. **DIGESTIVE FUNCTION**

a. While the food is in the stomach, the digestive processes are initiated by juices from the wall of the stomach. The musculature of the walls thoroughly mixes the food and juices while the food is being held in the stomach. In fact, the stomach has an extra layer of muscle fibers for this purpose.

b. When the pyloric valve of the stomach opens, a portion of the stomach contents moves into the small intestine.
Section IV. THE SMALL INTESTINES AND ASSOCIATED GLANDS

1-8. GENERAL

a. Digestion is a chemical process. This process is facilitated by special chemicals called digestive enzymes. The end products of digestion are absorbed through the wall of the gut into the blood vessels. These end products are then distributed to body parts that need them for growth, repair, or energy.

b. There are associated glands, the liver and the pancreas, which produce additional enzymes to further the process.

c. Most digestion and absorption takes place in the small intestines.

1-9. ANATOMY OF THE SMALL INTESTINES

a. The small intestines are classically divided into three areas, the duodenum, the jejunum, and the ileum. The duodenum is C-shaped, about 10 inches long in the adult. The duodenum is looped around the pancreas. The jejunum is approximately eight feet long and connects the duodenum and ileum. The ileum is about 12 feet long. The jejunum and ileum are attached to the rear wall of the abdomen with a membrane called a mesentery. This membrane allows mobility and serves as a passageway for nerves and vessels (NAVL) to the small intestines.

DUODENUM = Length equal to width of 12 fingers

JEJUNUM = empty

ILEUM = lying next to the illume (bone of the pelvic girdle)

PELVIS = basin

b. The small intestine is tubular. It has muscular walls that produce a wave-like motion called peristalsis moving the contents along. The small intestine is just the right length to allow the processes of digestion and absorption to take place completely.

c. The inner surface of the small intestine is NOT smooth like the inside of new plumbing pipes. Rather, the inner surface has folds (plicae). On the surface of these plicae are fingerlike projections called villi (villus, singular). This folding and the presence of villi increase the surface area available for absorption.
Section V. THE LARGE INTESTINES

1-10. GENERAL FUNCTION

The primary function of the large intestines is the salvaging of water and electrolytes (salts). Most of the end products of digestion have already been absorbed in the small intestines. Within the large intestines, the contents are first a watery fluid. Thus, the large intestines are important in the conservation of water for use by the body. The large intestines remove water until a nearly solid mass is formed before defecation, the evacuation of feces.

1-11. MAJOR SUBDIVISIONS

The major subdivisions of the large intestines are the cecum (with vermiform or “worm-shaped” appendix), the ascending colon, the transverse colon, the descending colon, and the sigmoid colon. The fecal mass is stored in the sigmoid colon until passed into the rectum.

1-12. RECTUM, ANAL CANAL, AND ANUS

Rectum means “straight”. However, this six inch tubular structure would actually look a bit wave-like from the front. From the side, one would see that it was curved to conform to the sacrum (at the lower end of the spinal column). The final storage of feces is in the rectum. The rectum terminates in the narrow anal canal, which is about 1 1/2 inches long in the adult. At the end of the anal canal is the opening called the anus. Muscles called the anal sphincters aid in the retention of feces until defecation.

Section VI. ASSOCIATED PROTECTIVE STRUCTURES

1-13. GENERAL

Within the body, there are many structures that aid in protection from bacteria, viruses, and other foreign substances. These structures include cells that can phagocytize (engulf) foreign particles or manufacture antibodies (which help to inactivate foreign substances). Collectively, such cells make up the reticuloendothelial system (RES). Such cells are found in bone marrow, the spleen, the liver, and lymph nodes.

1-14. STRUCTURES WITHIN THE DIGESTIVE SYSTEM

Lymphoid structures make up the largest part of the RES. Lymphoid structures are collections of cells associated with circulatory systems.

a. Tonsils are associated with the posterior portions of the respiratory and digestive areas in the head, primarily in the region of the pharynx. The tonsils are masses of lymphoid tissue.
b. Other lymphoid aggregations are found in the walls of the small intestines.

c. The **vermiform appendix**, attached to the cecum of the large intestine, is also a mass of lymphoid tissue. It is the “tonsil” of the intestines.

**Section VII. ACCESSORY STRUCTURES OF THE DIGESTIVE SYSTEM**

**1-15. THE LIVER**

The liver is a massive glandular organ. In fact, the liver is the largest gland in the body. The major function of the liver, as far as digestion is concerned, is the production of bile, a substance that aids in the digestion of lipids (fats). There are salts contained in the bile (bile salts) that help to emulsify fat globules so that they can be digested by intestinal lipases. Bile also aids in making the end products of fat digestion more soluble so that they are absorbed through the intestinal mucosa. Bile is continuously being made and excreted by the liver. Bile is stored in the gallbladder until it is needed. The function of the gallbladder is to store bile and release it when it is needed in the small intestine. The liver also has functions that are not related to the digestive system.

a. **Glycogen Storage.** When carbohydrates are digested and the end product sugars are not immediately utilized by the body, they are made into a substance called glycogen and stored in the liver in that form until needed.

b. **Hematoipoiesis.** The liver is an important organ in the hematopoietic system. It functions as a blood reservoir during venous pooling and it polices up iron from destroyed red cells so that it can be used for synthesis of new red cells by the bone marrow.

c. **Phagocytosis.** The liver has phagocytic cells called Kupffer's cells that can remove bacteria and foreign particles from the blood.

d. **Detoxification.** This is not the most accurate word to describe this function, but the liver is responsible for metabolizing many drugs and other substances in the blood from an active to an inactive form. For example, alcohol is active and is metabolized by the liver to an inactive substance and the drink wears off.

e. **Vitamin Storage and Synthesis.** The liver can store large quantities of Vitamins A and B₁₂. It also functions in the synthesis of Vitamin D from precursors in the body, a very important vitamin affecting bone structure and function, and blood Ca++ levels.

f. **Blood Coagulation.** The liver is the organ responsible for the production of fibrinogen, prothrombin, and other factors important in the blood clotting mechanism. Impairment could result in inhibition of the clotting process.
g. Antibody (Ab) Production. Antibodies are an important defense mechanism against infection and invasion of body tissues by bacteria. They are formed in the plasma cells found in lymphoid tissue. The liver contains a very large amount of lymphoid tissue, lymph nodes, and lymph. Damage may severely impair the immune process of the body.

1-16. THE PANCREAS

The other accessory organ important to the gastrointestinal tract is the pancreas. The pancreas functions as both an endocrine and exocrine gland and it is the exocrine portion that is concerned with digestion. The pancreas secretes lipases and proteases that are responsible for the digestion of fats and proteins in the small intestine. The endocrine portion of the pancreas is composed of groups of cells scattered throughout the pancreas called the islets of Langerhans. There are alpha and beta cells in the pancreas. These alpha and beta cells have specific functions. The alpha cells secrete glucagon, a hormone which promotes the breakdown of glycogen and sugar stores and causes their release into the bloodstream. The beta cells secrete insulin, a hormone which promotes the movement of glucose from the bloodstream into the cells and the subsequent oxidation of the glucose. The release of insulin promotes a lowering of blood sugar. Diabetics have insulin deficiency and hence have unusually high blood sugar levels that "spill over" into the urine.

Section VIII. ABSORPTION AND METABOLISM IN THE DIGESTIVE SYSTEM

1-17. INTRODUCTION

Once foodstuffs are taken into the body and have passed through the gastrointestinal tract, their end products are either stored or used by our cells for energy. The only substance that can be used by our body cells for the purpose of obtaining energy is glucose. Our bodies can obtain glucose directly from the absorption and digestion of carbohydrates or from the production of glucose from other substances (if necessary).

1-18. THE DIGESTION OF CARBOHYDRATES

a. The digestion of carbohydrates begins in the mouth by the enzyme alpha-amylose or ptyalin, which is found in saliva. The process of turning complex carbohydrates (starches) into simple disaccharide units thus begins in the mouth. The mouth is very important in the digestion of carbohydrates--food is chewed, mixed with saliva, and swallowed. This occurs within a very short period of time, which allows for only about five percent of the starch to split. As the bolus moves on to the stomach, the low pH of the stomach prevents further action by salivary amylase. Hence, very little further digestion of carbohydrates occurs in the stomach.
b. After the carbohydrates pass into the small intestine, their digestion is completed. In the small intestine, pancreatic amylase acts on the remaining starch and completely breaks it down to disaccharide (maltose and isomaltose). Sucrose, maltase, isomaltase, and lactase finally break down this disaccharide, along with other disaccharides ingested in foods (sucrose, lactose) to the monosaccharides glucose, fructose, and galactose. These simple sugars are the end products of carbohydrate digestion and are absorbed through the intestinal mucosa into the bloodstream via a carrier-mediated transport system. They can be either oxidized immediately by the cells to do work or they can be stored until they are needed by the body. They can be stored in two ways:

1. Synthesized to glycogen in the liver.
2. Synthesized to fat and stored in fat cells.

1-19. THE DIGESTION OF FAT

a. There is virtually no fat digestion in the mouth or stomach. The first step in the digestion of fats is emulsification, the physical break up of fat globules into small droplets. This occurs in the small intestine by the action of bile and bile salts. Emulsification permits the digestive enzymes (lipases) to act upon the fat molecules and break them down into monoglycerides, fatty acids, and glycerol, the end products of fat digestion and the form in which they are absorbed through the intestinal mucosa.

b. The absorption occurs through a rather complex and poorly understood mechanism. The end products of lipid digestion can be either oxidized by the cells or transformed into glucose that, in turn, is then oxidized by the cells to do work. They may also be stored as fat.

1-20. THE DIGESTION OF PROTEINS

The digestive process of proteins begins in the stomach. In the stomach, pepsin, an enzyme activated by the low pH of the stomach, breaks apart long chain polypeptides and proteins into simpler short-chain peptides referred to as proteoses and peptones. Further hydrolysis of these fragments to dipeptides and amino acids is accomplished in the small intestine by the enzymes chymotrypsin and trypsin. Ultimately, all peptide fragments are broken down to their constituent amino acids, the end products of protein digestion, by various carboxypeptidases and aminopeptidases present all along the walls of the small intestine. The mechanism by which the amino acids are absorbed across the small intestine walls is poorly understood.
Section IX. DISORDERS AND DISEASES OF THE DIGESTIVE TRACT

1-21. INTRODUCTION

There are several common disorders of the digestive system. Many of these disorders can be treated by drugs that you will dispense in the pharmacy.

1-22. DISORDERS OF THE MOUTH CAVITY

a. Dental Caries (Tooth Decay). Dental caries is a weakening or decay of the enamel coating of teeth. If allowed to progress unchecked, eventual destruction of the entire tooth (including the root and pulp) can result. Destruction of the root necessitates extraction.

b. Mumps. Mumps are a typical childhood disease in which the salivary glands (principally the parotid) become swollen and inflamed. Mumps are caused by a virus and the condition is highly infectious. There is a vaccine available that can protect persons from mumps.

c. Trench Mouth (Vincent’s Disease). Trench mouth is an acute inflammation of the gums. Bleeding and pain are usually present. Probably the disease is not communicable and may be due to poor oral hygiene, mononucleosis, or nonspecific viral infection. This disorder is treated with antibiotics and oxygenating mouthwashes such as hydrogen peroxide.

d. Thrush. Thrush is due to an overgrowth of a normally occurring oral fungus, Candida albicans. Thrush is characterized by creamy-white, curd-like patches that may occur anywhere in the mouth. Pain and fever are usually present and treatment must include the removal of the causative factor. The patient should have a nutritious diet with adequate intake of vitamins and rest. Saline rinses help promote healing. If thrush is not treated, it can lead to ulcers and stomach problems.

1-23. DISORDERS OF THE STOMACH

a. Peptic Ulcer. Probably the best known stomach disease is peptic ulcer. Peptic ulcers are presumed to be caused by the action of pepsin upon the stomach lining until it becomes eroded, exposing the layers of the cells underneath. Continual secretion of stomach acid irritates the exposed layers of the stomach lining resulting in pain and bleeding. There is no specific cure or treatment for ulcers and the cause or initiating factor in the disease process is not known. People who have peptic ulcers usually are told to avoid stress and are maintained on strict diets. Ulcers may eventually erode completely through a region of the stomach (called a perforation) and cause excessive bleeding.
b. **Duodenal Ulcer.** Duodenal ulcers are ulcers that occur in the duodenum, usually along the initial two inch segment just distal to the stomach. The symptoms for a duodenal ulcer are virtually the same as for a stomach ulcer, but duodenal ulcers are much more common and death due to perforation and hemorrhage is a major problem. Duodenal ulcers also appear to penetrate other organs (migration of the ulcerative crater). Treatment usually consists of preventing or controlling stress in the patient and maintaining the patient on a strictly controlled diet and administering certain drugs (like sucralfate or cimetidine). Although the ulcer will “heal” in three to four weeks, periodic recurrence has never successfully been prevented. The origin of the condition is not understood.

c. **Cancer.** The stomach is susceptible to cancer or neoplasms of the mucosal lining. A cancer is an uncontrollable growth of cells. Neither the cause nor the cure for cancer of the stomach is known. If discovered early, surgery can prove beneficial.

1-24. **DISORDERS OF THE INTESTINES**

a. **Sprue.** Sprue, or malabsorption of nutrients from the small intestine, can be very serious. It usually involves impaired absorption of fats and vitamins that leads to vitamin deficiency and anemia (inadequate red blood cell count). Treatment of sprue usually consists of a high carbohydrate, low protein, low fat diet with vitamin supplements. Emergency replenishment of vital nutrients, if necessary, can be accomplished by intravenous injection.

b. **Diarrhea.** Diarrhea is the frequent excretion of excessive, soft, or watery stools. In some cases, the excretion may be totally liquid. Nausea and vomiting may be present. Although the condition is obviously unpleasant for the patient, mild diarrhea is usually not serious. However, if a patient has severe diarrhea, loss of nutrients and electrolytes may occur which requires replacement therapy and medical care. Cholera, a very serious condition, is characterized by a large loss of fluids and nutrients in watery stools.

c. **Colitis.** Colitis is simply an inflammation of the colon that sometimes results in diarrhea. If the condition is ulcerative colitis, then changes in the colon wall and scar tissue formation may result. Anemia, malaise, and weakness may be present. Treatment of colitis usually consists of rest, careful administration of anti-infectives, and restricted diet. Symptoms usually go away after a period of two to three weeks, but there is no cure for the condition.

d. **Appendicitis.** Appendicitis is simply an inflammation of the veriform appendix, usually due to an obstruction. Treatment consists of surgical removal. If left untreated, perforation into the peritoneal cavity with generalized peritonitis usually results.
e. **Hemorrhoids (Piles).** Hemorrhoids (or piles) are ulcerations of the hemorrhoidal vein (a vein which lies in close proximity to the external mucosa of the anus). Pain, itching, and general discomfort are the usual symptoms associated with hemorrhoids. However, complications such as infection or obstruction may arise. It is surgically possible to remove hemorrhoids.

f. **Hepatitis.** There are two types of hepatitis, serum (or long-term incubation) and infectious (or short-term incubation). Infectious hepatitis is spread via the oral route and the danger of an epidemic exists in close environments such as military bases and hospitals. Serum hepatitis is transmitted by blood transfusion or by the use of an unsterilized syringe or “dirty” needle. The incubation period for hepatitis ranges from six weeks to six months. The type of hepatitis a patient has can be identified in some patients. There can be a wide variety of clinical symptoms and signs of hepatitis ranging from mild infection to death. The disease is usually centered in the liver and jaundice (yellow coloration of skin) is usually present along with hepatomegaly (enlarged liver). Liver damage may result in hepatitis. Most patients recover from hepatitis. Bed rest is usually required during the first phase of the disease. Hepatitis is viral in nature. Therefore, there is no specific treatment or cure other than to let the disease run its course. The physician treating a person who has hepatitis must carefully observe the patient and treat symptoms and complications when they arise.

g. **Cirrhosis.** Cirrhosis is a disease of the liver characterized by degeneration and necrosis of liver cells with fatty deposits. Although the specific cause is unknown, malnutrition, vitamin deficiency, and alcoholism definitely are causative factors and contribute to progression of the disease process. The liver has a number of vital functions in the body and, hence, cirrhosis is a serious condition. A wide variety of symptoms may be present, but treatment almost always consists of adequate rest, abstinence from alcohol, and a carefully selected diet. Vitamin supplements may be necessary for the patient. There is no “cure” for cirrhosis and the outlook for the improvement of the patient is not good. Only 50 percent of the patients who have cirrhosis survive beyond two years and only 35 percent survive beyond five years.

h. **Cholecystitis.** Cholecystitis is an inflammation of the gallbladder. An infection may be the source of the inflammation. If an infection is present, the patient may be prescribed antibiotics. Cholecystitis is usually treated by placing the patient on a low-fat diet. The gallbladder may be surgically removed if the inflammation becomes too severe.

i. **Cholelithiasis.** Cholelithiasis is the presence of gallstones, calcified deposits of cholesterol, bilirubin, and bile salts. Cholecystitis usually must be treated with the surgical removal of the gallstones.
j. **Diabetes Mellitus.** Diabetes mellitus is insulin deficiency. This insulin deficiency results in the inability of body cells to take up and use glucose. Therefore, the glucose (sugar) remains in the blood and the blood levels eventually rise to extremely high levels and eventually “spill over” into the urine. This is one of the classic signs of diabetes mellitus. There is no cure for diabetes mellitus--treatment consists of insulin replacement therapy with commercially available insulin and a very strictly controlled diet.

k. **Ascites.** Ascites is edema or the presence of fluid in the peritoneal cavity. Ascites can be caused by a variety of factors, with cardiac or renal insufficiency or disease being the most common.
EXERCISES, LESSON 1

INSTRUCTIONS: The following exercises are to be answered by marking the lettered response that best answers the question or best completes the incomplete statement or by writing the answer in the space provided.

After you have completed all the exercises, turn to “Solutions to Exercises” at the end of the lesson and check your answers.

1. The human digestive system is best defined as:
   a. A group of organs intended to provide energy to the body.
   b. A group of organs designed to take in, process, and digest foods and eliminate unused materials of food items.
   c. A group of organs involved in the absorption of foods.
   d. A group of organs which convert food into simpler substances which can be used by the body.

2. Which of the organs below is part of the human digestive system? (More than one response may be correct.)
   a. Esophagus.
   b. Spleen.
   c. Large intestines.

3. What is a function of the stomach? (More than one response may be correct.)
   a. The digestion of food.
   b. The initiation of food digestion.
   c. The salvaging of water and electrolytes from the food.
4. The esophagus is best described as:
   a. A continuation of the rear of the mouth region which is just anterior to the vertebral column.
   b. A structure with tubular muscular walls that has villi on the inner surfaces which moves the food through an action called peristalsis.
   c. A mass of lymphoid tissue that is located just anterior to the stomach.
   d. A muscular, tubular structure that serves as a passageway for the food from the pharynx to the stomach.

5. Which of the statements below best describes the digestion of fats?
   a. Fats are emulsified by bile and bile salts in the small intestine and absorbed as fatty acids in the large intestine.
   b. Fats are emulsified in the stomach and then broken down to fatty acids, monoglycerides, and glycerol which are absorbed in the small intestine.
   c. Fats are emulsified by bile and bile salts in the large intestine and are then absorbed as fatty acids and glucose through the intestinal mucosa.
   d. Fats are emulsified in the stomach and are absorbed as fatty acids, monoglycerides, and glycerol through the intestinal mucosa.

6. What is the major function of the liver (as far as digestion is concerned)?
   a. The production of insulin.
   b. The production of bile.
   c. The production of fatty acids and monoglycerides.
   d. The production of Vitamins A and B\textsubscript{12}.
7. Mumps is best described as a viral infection of the:
   a. Salivary glands.
   b. Liver.
   c. Esophagus.
   d. Ileum.

8. Appendicitis is best described as:
   a. An inflammation of the veriform appendix typically caused by an obstruction.
   b. An inflammation of the liver characterized by degeneration and necrosis of the cells with fatty deposits.
   c. An inflammation of the colon which sometimes results in diarrhea.
   d. An inflammation of the small intestines due to an infection usually caused by a gallstone.

9. Which of the following best describes "ascites"?
   a. An inflammation of the gallbladder due to infection that is usually precipitated by a gallstone.
   b. An inflammation of the colon that usually results in diarrhea.
   c. A condition in which there is malabsorption of nutrients from the small intestine.
   d. Edema or the presence of fluid in the peritoneal cavity.
SPECIAL INSTRUCTIONS FOR EXERCISES 10 THROUGH 12. The drawing below is used in questions 10, 11, and 12. Match the question in Column A to its correct location in Column B.

10. Which letter is pointing to the pancreas? ________
11. Which letter is pointing to the small intestines? ________
12. Which letter is pointing to the rectum? ________

Check Your Answers on Next Page
SOLUTIONS TO EXERCISES, LESSON 1

1. b  (para 1-1a)

2. a and c  (para 1-1b (3), (6))

3. a and b  (para 1-6, 1-7)

4. d  (para 1-5)

5. b  (para 1-19)

6. b  (para 1-15)

7. a  (para 1-22b)

8. a  (para 1-24d)

9. d  (para 1-24k)

10. D  (figure 1-1)

11. J  (figure 1-1)

12. K  (figure 1-1)

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