

Digestive System

Course

Anatomy and Physiology

Unit XIV

Digestive System

Essential Question

What are the tissues and systems of the human body?

TEKS

130.206 (c)
2E,2F,2G,2H
3A,3B,3C,3D,
3E,3F
4A,4B,4C,D

Prior Student Learning

Basic anatomy terms

Estimated time

5-10 hours

Rationale

To pursue a career in health care, proficiency in anatomy and physiology is vital.

Objectives

Upon completion of this lesson, the student will be able to:

- Define terms pertaining to the digestive system
- Distinguish the major organs of the digestive system
- Research diseases and disorders of the digestive system
- Examine the effect of salivary amylase
- Outline the digestive process

Engage

How does the digestive system work? One test that physicians use to see how the digestive system works is a fluoroscopy. Fluoroscopy is an imaging technique to obtain real-time moving images of the internal structures of a patient through the use of a fluoroscope. Google fluoroscopy of esophagus for many great images.

Key Points

- I. Introduction
 - A. General function: physical /chemical breakdown of foodstuffs so it can be absorbed into the bloodstream and used by the cells/ tissues while it eliminates non-digestible substances produced during metabolism
 - B. Digestion: process of changing foodstuffs into usable substances
 - C. Absorption: transfer of nutrients into the blood stream
 - D. Digestive processes
 1. Ingestion: process of taking food into the digestive tract
 2. Propulsion: process of moving food through the alimentary canal (swallowing, peristalsis)
 3. Mechanical digestion: physical preparation of food for chemical digestion; mastication, mixing of food with saliva by tongue, churning and mixing of food in stomach, segmentation in intestine (rhythmic local constrictions of the intestine)
 4. Chemical digestion: catabolic process in which large food molecules are broken down into smaller molecules by enzymatic hydrolysis (simple sugars=monosaccharides, glycogen, starch, amino

- acids, polypeptides, peptides, fatty acids, glycerol)
- 5. Absorption: transport of digested end products from the GI tract into the capillaries and lymph vessels
- 6. Defecation: elimination of indigestible materials and waste from the body

II. Alimentary Canal: long muscular tube approximately 30 feet long

A. Oral cavity

1. Mouth
 - a. Receives and tastes food
 - b. Physical breakdown of food
 - c. Partial digestion by saliva
 - d. Lubrication of food
 - e. Stomatitis: inflammation of the mouth (viral, bacterial, trauma, irritants)
 - f. Buccal: pertaining to the cheek
 - g. Deglutition: the act of swallowing (root phag/o- = to eat)
 - h. Dysphagia: difficulty swallowing
2. Hard palate: bony structure, roof of mouth, separates mouth from nasal cavity
3. Tooth
 - a. 20 deciduous form 6 months to 2 years
 - b. 32 permanent: incisors, canines, premolars/molars, cuspids/bicuspids
 - c. Enamel, dentin, pulp cavity, cementum
 - d. Mastication: chewing
 - e. Bolus: mass of chewed food
 - f. Dento/donto = teeth; gingivo = gums
 - g. Crown: exposed portion of the tooth – found above the gums; white in color and covered with enamel
 - h. Neck: constricted junction line of the tooth located between the crown and the root
 - i. Root: contains one to three projections of the tooth which is embedded in the sockets of the alveolar processes of the mandible and the maxillae; holds tooth in place
4. Gingiva: another name for the gums which surround the teeth
5. Periodontal Ligament: dense fibrous connective tissue which is attached to the socket walls and the cemental surfaces of the root(s) of the tooth; it helps anchor the teeth in position and absorbs shock during chewing
6. Enamel: covers the crown of the tooth and protects the tooth from wear and tear; the hardest substance in the

body; composed primarily of calcium phosphate and calcium carbonate

7. Dentin: calcified connective tissue, (bony part of the tooth) which gives the tooth its basic shape, strength, and rigidity
8. Pulp: fleshy part of the tooth; found in the pulp cavity, a large cavity enclosed by the dentin; contains the nerve and blood vessels
9. Root Canal: contains openings within the root(s) of the tooth which allow for the passage of nerve and blood vessels into and out of the pulp cavity
10. Functions of the Tooth: mastication, or the mechanical breakdown of food

B. Salivary glands: accessory organ

1. Parotid: Stensen's duct - ear/upper jaw
2. Submandibular: Wharton's duct
3. Sublingual: Rivinus's duct
4. Saliva: (root sialo = Latin for spit) lubricates food for swallowing; body produces 1500 ml in 24 hours
5. Lubricates mouth during speech and chewing
6. Moistens food for swallowing
7. Contains enzyme (salivary amylase) which begins chemical breakdown of carbohydrates and starches into sugars

C. Tongue: accessory organ; muscular organ with taste buds (sweet, salt, sour, bitter) on sides of papillae; for maintaining placement of food for chewing and swallowing, and speech

D. Pharynx and Esophagus

1. Passageways 10 inches long; food only here 4-8 seconds; no chemical changes take place
2. Pharynx: throat -- tube that carries food and air; 3 sections -- nasopharynx, oropharynx and laryngopharynx
3. Epiglottis: flap that covers the trachea (windpipe) when food or water is swallowed
4. Esophagus: muscular tube dorsal (behind) to the trachea; carries food to the stomach by rhythmic wavelike motion (peristalsis=involuntary motion throughout digestive system)
5. Esophageal hiatus: opening in the diaphragm for the esophagus
6. Peristalsis: progressive wave-like smooth muscle contraction, distention
7. Stricture: narrowing due to trauma, infection, spasms, tumors
8. Regurgitation: backward flow of foodstuffs from stomach into esophagus
9. Reflux esophagitis: (GERD) inflammation due to regurgitation
10. Esophageal varices: dilation/rupture of veins; usually due to scarring in the liver causing obstruction of the portal vein

- forcing blood back into the lower veins of the esophagus
11. Hiatal hernia: protrusion of stomach upward into mediastinal area
- E. Stomach: food stays 3-4 hours for physical and chemical breakdown
1. Abdomen: stomach is located in the Left Upper Quadrant (LUQ)
 - a. Peritoneum: membranes that line abdomen, decreases friction of organs (peritonitis)
 - b. Mesentery: greater and lesser omentum forms protective covering that insulates organs and holds them in place
 2. Stomach
 - a. Greater and lesser curvatures
 - b. Fundus, body, antrum
 - c. Rugae: folds in stomach to increase surface area
 - d. Sphincters: cardiac (ring of muscle where esophagus and stomach join; keeps stomach contents from moving up into the esophagus) and pyloric (ring like muscle between the stomach and small intestine); keeps food in stomach 30 minutes to 4 hours so that digestion can occur); prevents reflux
 - e. Pyloric stenosis
 - f. Gastric enzymes: pepsin (protein), rennin, lipase (fats), HCl (kills bacteria, helps in absorption of Fe, activates pepsin)
 - g. Chyme: gastric juices plus digested food (paste, creamy semi-fluid)
 3. Disorders
 - a. Eructation: belching gas from the stomach
 - b. Vagotomy: incision of vagus nerve
 - c. Emesis: vomiting
 - d. Hematemesis: bright red or coffee ground vomit
 - e. Botulism: food poisoning; bacterial (infant botulism related to SIDS)
 - f. Gastric lavage: emptying stomach contents
 - g. Pyrosis: heartburn
 - h. Gastritis: epigastric pain, indigestion, burning in stomach area
 - i. Gastric ulcer: open sore in stomach; pain and internal bleeding
- F. Small Intestine: Approximately 21 feet long/1 inch in diameter; 80% of absorption occurs here; 3 sections
1. Duodenum
 - a. 1st 10-12 inches
 - b. Ducts from pancreas and gallbladder (sphincter of

- Oddi) enter here
- c. Receives chyme
- d. Pancreatic juices: amylase (sugars), trypsin (proteins), lipase (fats)
- e. Gallbladder: bile (emulsifies and breaks down fats)
- f. Intestinal juices: maltase/sucrase/lactase (breakdown sugars)
- 2. Jejunum: 8 feet
- 3. Ileum
 - a. Final 12 feet
 - b. Connects to large intestine at cecum
 - c. Process of digestion completed
 - d. Most absorption occurs here
 - e. Villi: fingerlike projections containing blood capillary loop and lacteals (lymphatic vessels) for absorption
 - f. Enzymes stimulate intestinal secretions
 - g. Hormones inhibit intestinal secretions
 - h. Peyer's patches: lymph nodes in intestine to aid in defense/protection
- 4. Disorders
 - a. Duodenal ulcers: peptic ulcers (gnawing pain 1-3 hours after eating)
 - b. Diverticulum: outpocketing of intestinal mucosa
 - c. Enteritis: abdominal cramping, diarrhea
 - d. Gastroenteritis: vomiting, abdominal cramps, diarrhea
 - e. Crohn's disease: regional enteritis
 - f. Dyspepsia: painful digestion, indigestion
 - g. Ileostomy: surgical opening in abdomen into ileum
 - h. Ileus: intestinal obstruction with colic
 - i. Intussusception: telescoping of intestines (often found in infants, children)
- G. Large Intestine: 5 feet/2 inches in diameter
 - 1. Ileocecal valve: circular, sphincter muscle; prevents food from returning to ileum
 - 2. Cecum: blind pouch at first portion of the large intestines; lower end is the vermiform appendix (RLQ)
 - 3. Colon: absorbs water, remaining nutrients, electrolytes; storage of indigestible materials until elimination; transport waste out of the body
 - a. Ascending (right side)
 - b. Transverse
 - c. Descending (left side)
 - d. Sigmoid
 - 4. Rectum (final 6-8 inches): storage of feces
 - 5. Anal canal: anus; outlet of rectum; 2 sphincters
 - 6. Fecal matter: non-digestible waste products and bacteria

- 7. Defecation: emptying of fecal matter from rectum
- 8. Disorders
 - a. Intestinal bleeding: black, tarry stools
 - b. Stools without bile: clay-colored
 - c. Reduced digestion of foods: green
 - d. Flatus: gas
 - e. Constipation: infrequent defecation
 - f. Diarrhea: frequent, watery stools
 - g. Appendicitis: inflammation of the appendix
 - h. Tenesmus: spasmodic contraction of anal sphincter (involuntary straining)
 - i. Hemorrhoids: dilated veins in rectum
 - j. Fissure: linear ulcer
 - k. Fistula: abnormal tube-like passageway from one cavity/organ to another
 - l. Ulcerative colitis: chronic disorder; inflammatory disease of colon
 - m. Colostomy: opening of colon through the abdomen
 - n. Intestinal obstruction: a true emergency
 - o. Paralytic ileus: paralysis of intestines, occurs after some abdominal surgeries
 - p. Dysentery: inflammation of intestines, can be bacterial or viral
 - q. IBS: irritable bowel syndrome
 - r. Cancer of colon or rectum: 15% of population
 - s. Borborygmus: gurgling, rumbling sound in bowels caused by gas passing through
- H. Accessory Organs
 - 1. Liver: accessory organ;
 - a. largest gland/solid organ of body;
 - b. RUQ under diaphragm
 - c. Secretes 1 liter of bile /24 hours
 - d. Biliary tree: composed of hepatic duct, cystic duct, and common bile duct
 - e. Functions
 - i. Manufactures blood proteins (i.e. antibodies), blood clotting factors (i.e. heparin)
 - ii. Stores iron, copper, vitamin A/D/B₁₂, glycogen
 - iii. Produces bile for fat digestion
 - iv. Detoxifies blood (poisons absorbed in small intestine)
 - f. Disorders
 - i. Hepatomegaly
 - ii. Hepatitis: viral (A=oral transmission, B=blood transmission, C, D)
 - iii. Obstructive jaundice: usually from stones or

- tumors
- iv. Ascites: accumulation of fluid in abdomen usually due to inflamed liver
- v. Paracentesis: puncture to remove fluid from the abdominal cavity
- vi. Cirrhosis: chronic liver disease with death of cells due to nutritional deficiencies, toxins (alcohol, drugs), viral/bacterial infections; cells damaged, scarring limits function
- 2. Gallbladder: accessory organ
 - a. Pear-shaped muscular sac under the liver
 - b. Stores bile (500-600 ml. stored)
 - c. Fatty foods enter duodenum → stimulates CCK hormone → contracts GB to release bile → emulsifies fats and stimulates peristalsis
 - d. Bile pigments: bilirubin
 - e. Bile + water forms foaming antiseptic and purgative (laxative)
 - f. Obstruction → icterus and jaundice
 - g. Chole/o = gallbladder
 - h. Cholelithiasis: gallstones = cholesterol and bile salts
 - i. Cholecystectomy: removal of GB
 - j. Choledoch = root for common bile duct
- 3. Pancreas: accessory organ; behind the stomach; head attached to duodenum, tail reaching to spleen
 - a. Exocrine functions: acini cells secrete digestive juices and bicarbonate ions (to adjust pH and)
 - b. Endocrine functions: for CHO (carbohydrate) metabolism
 - i. Insulin and glucagon: secreted from the islets of Langerhans for CHO metabolism
 - ii. Diabetes mellitus: decreased secretion of insulin, therefore glucose is increased in blood
 - c. Pancreatitis: inflammation caused by overproduction of pancreatic juices
- I. Eating Disorders- see *eating disorder power point*
 - 1. Anorexia Nervosa- Intense fear of gaining weight or becoming fat, even though they are already under-weight
 - a. Distorted body image (i.e., claiming to “feel fat” even when emaciated), with an undue influence of body weight or shape on self-perception
 - b. Weight loss to less than 85% of normal body weight
 - c. Refusal to maintain body weight over a minimal normal weight for age and height
 - d. Denial of the seriousness of the current weight loss
 - e. Absence of at least three consecutive menstrual

- cycles
2. Bulimia Nervosa- Recurrent episodes of binge eating, characterized by the following
 - a. Purging - compensating for the food binge to prevent weight gain,
 - b. Binge eating and purging, on average, at least twice a week for three months.
 - c. Evaluating self-worth according to body shape and weight
 3. Compulsive Eating- A large percentage of individuals with eating disorders are compulsive eaters
 - a. Keeps eating beyond the time when hunger has been satisfied; eating driven by anxiety, fear, frustration, or anger, rather than by hunger or even pleasure
 - b. Does not eat for pleasure
 - c. Weight does not indicate compulsive eating
 4. Bigger-exia- individuals who use steroids and other ergogenic aids to build muscles
 - a. Compulsive and excessive about body building workouts
 - b. Sees extreme size as something to aspire to
 - c. Many health problems associated with the use of steroids

Activity

- I. Identify anatomical structures of digestive system on dissected cat. *(This can be accomplished as a virtual tour on the internet, or if your budget allows, the students can dissect cats.)*
- II. Complete the Salivary Amylase Laboratory Investigation
- III. Complete the Mechanism of Swallowing Laboratory Investigation
- IV. Research in cooperative groups, a cause and effect relationship of the following:
 - a) consequences of poor nutrition
 - b) effects of aging
 - c) stress
 - d) congenital anomalies
 - e) chemical imbalance
 - f) effects of vomiting on electrolytes
 - g) effects of bingeing and purgingPresent to class.
- V. Complete The Journey Inside Activity
- VI. Complete the Digestive System Worksheet.

Assessment

Successful completion Digestive Worksheet

Materials

Activity I- Dissection cat 1 for every 2-4 students, and dissection tools AND/OR computers with internet access

Activity II- Two saltines, clock, mouth, and copy of lab per student

Activity III- Flashlight, gloves, tongue Blade, cup of water, Stethoscope, 2-3 saltines and copy of lab per students

<http://www.bioedonline.org/>

Utah State Office of Education, (2005). *Medical Anatomy and Physiology Teacher Resource CD*. Utah.

Accommodations for Learning Differences

For reinforcement, the student will label a diagram of digestive system

For enrichment, the students research and report on the major enzymes involved in digestion, their source, and action. Explain what might happen if enzymes were not present

National and State Education Standards

National Health Science Cluster Standards

HLC01.01 Academic Foundations

Health care workers will know the academic subject matter required (in addition to state high school graduation requirements) for proficiency within their area. They will use this knowledge as needed in their role.

HLC10.01 Technical Skills

Health Care Workers will apply technical skills required for all career specialties. They will demonstrate skills and knowledge as appropriate.

TEKS

130.206(c)(2)(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;

130.206(c)(2)(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;

130.206(c)(2)(G) analyze, evaluate, make inferences, and predict trends

from data;

130.206(c)(2)(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports;

130.206(c)(3)(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

130.206(c)(3)(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;

130.206(c)(3)(C) draw inferences based on data related to promotional materials for products and services;

130.206(c)(3)(D) evaluate the impact of scientific research on society and the environment;

130.206(c)(3)(E) evaluate models according to their limitations in representing biological objects or events;

130.206(c)(3)(F) research and describe the history of science and contributions of scientists;

130.206(c)(4)(A) analyze the chemical reactions that provide energy for the body;

130.206(c)(4)(B) evaluate the means, including the structure and function of the digestive system, by which energy is processed and stored within the body;

130.206(c)(4)(C) analyze the effects of energy deficiencies in malabsorption disorders such as diabetes, hypothyroidism, and Crohn's disease; and

130.206(c)(4)(D) analyze the effects of energy excess in disorders such as obesity as it relates to cardiovascular and musculoskeletal systems.

Texas College and Career Readiness Standards

English Language Arts

II. B. Understand new vocabulary and concepts and use them accurately in reading, writing, and speaking.

III. B. Develop effective speaking styles for both group and one-on-one situations.

IV. A. Apply listening skills as an individual, and as a member of a group, in a variety of settings.

IV. B. 2. Listen actively and effectively in one-on-one communication situations.

Science

1.A.1. Utilize skepticism, logic, and professional ethics in science.

1.A.2. Use creativity and insight to recognize and describe patterns in natural phenomena.

1.A.3. Formulate appropriate questions to test understanding of a natural

phenomenon.

1.A.4. Rely on reproducible observations of empirical evidence when constructing analyzing, and evaluating explanations of natural events and processes.

1.E.2. Use essential vocabulary of the discipline being studied.

3.A.1. Use correct applications of writing practices in scientific communication.

Salivary Amylase Laboratory Investigation

Purpose:

In this lab, students will perform a task to help them understand the effect of salivary amylase.

Background Information:

Salivary amylase is the starch digesting enzyme produced by the salivary glands.

Materials:

2 saltine crackers

Your mouth

Clock

Procedure:

1. Chew two saltine crackers until a watery texture forms in your mouth. You have to fight the urge to swallow so you can pay attention to the taste of the crackers.

NO SWALLOWING ALLOWED!

2. Chew and observe taste sensation every 30 seconds (for 5 minutes).

Data:

	1 minute	2 minutes	3 minutes	4 minutes	5 minutes
Cracker taste					

Conclusions:

1. Explain why the cracker change flavor?
2. Describe how the taste you observe after a few minutes of chewing the saltine cracker explains the function of the enzyme.

The Mechanism of Swallowing

Objective:

Students will become familiar with the anatomy and basic physiology of the mouth, pharynx and swallowing.

Materials:

Flashlight	Cup of water
Gloves	Stethoscope
Tongue blade	2-3 saltine crackers

Strategy: Students will work as partners to begin this activity.

1. Put on a pair of gloves; with the aid of a tongue blade and flashlight, look into the mouth of your lab partner and identify the following structures: mucous membrane, hard palate, soft palate, uvula, molars, premolar, canines, incisors, tongue and frenulum.
2. This portion of the lab is to be done by yourself. Study the movements that are associated with swallowing. Slowly sip a glass of water and note the direction of the water's movement. Place a stethoscope over the left surface of the abdomen, about where the rib margin is. This should be where the esophagus enters the stomach. Swallow another sip and listen for the sound of water as it enters the stomach. Now gently place your hand over your larynx and swallow another sip of water. Note the movement of the larynx. Swallow another sip of water and see if you can prevent the larynx from moving while you swallow.
3. This portion of the lab is also to be done on yourself. Study the initial digestion of carbohydrates: chew one saltine cracker normally and swallow it. Does any taste change occur in this process? Chew another cracker slowly for at least a full minute. Do you notice any change in taste occurring now?

Discussion:

1. Were you able to prevent the larynx from moving as you swallowed?
Why or why not?
Why might this be important to you?
2. Describe the steps of swallowing.
3. Explain how mechanical digestion occurs in the mouth.
4. Explain how chemical digestion occurs in the mouth.
5. Explain why so little chemical digestion occurs in the mouth.

("Medical anatomy and," 2005)

The Journey Inside Review

Instructions:

As you review the basic structures, processes, and enzymes, take the next step and look at how it all really works together. Write a story in which you are a cheeseburger with everything on it; and describe what happens on your trip through the digestive system. In your story, include and underline the following terms:

These structures and how each contributes to digestion:

1. mouth
2. salivary glands
3. pharynx/epiglottis
4. esophagus
5. stomach
6. small intestine (name the 3 regions)
7. large intestine
8. liver
9. gallbladder
10. pancreas

These digestive processes and where they occur:

1. ingestion
2. propulsion
3. mechanical digestion
4. chemical digestion
5. absorption
6. defecation

These food groups, what part of the hamburger they come from, and where they are digested:

1. carbohydrates
2. proteins
3. lipids
4. nucleic acids

Name the major enzymes involved in digestion, their source, and actions.

The Journey Inside Review

- I. Digestive System
 - a. Alimentary Canal - Structure food travels through, from the mouth to the anus. Breaks food down into usable molecules
 - b. Accessory Organs - Organs that aid in digestion
- II. Digestive Processes:
 - a. Ingestion - Process of taking in food
 - b. Mechanical Digestion - Physically breaks down food (mastication)
 - c. Swallowing - Voluntary movement of food from mouth to esophagus
 - d. Chemical Digestion - Process in which large food nutrient molecules are broken down into chemicals small enough to be absorbed by the lining of the small intestine
 - e. Absorption - Transport of nutrients from the gastrointestinal tract to the blood
 - f. Defecation - Elimination of indigestible substances from the body in the form of feces
- III. Anatomy of the Digestive System
 - a. Alimentary Canal:
 - 1. Mouth - site of ingestion.
 - a. Teeth - tear and grind food.
 - b. Tongue - mixes food with saliva to form bolus.
 - c. Salivary Glands - secrete saliva to: moisten food and breakdown carbohydrates (enzyme = salivary amylase)
 - 2. Pharynx - passageway for food propelled by peristalsis
 - 3. Esophagus - passageway for food propelled by peristalsis
 - 4. Stomach - temporary storage pouch for food; converts food to chyme; secretions include:
 - a. Hydrochloric acid - activates other enzyme.
 - b. Pepsinogen - digests protein
 - c. Intrinsic Factor - required for vitamin B-12 absorption
 - d. Gastrin - regulates secretions and contractions
 - e. Mucus - produced by goblet cells to protect the stomach wall from hydrochloric acid
 - 5. Small Intestine - major organ for absorption of nutrients; three regions are duodenum, jejunum, ileum; secretions include:
 - a. Intestinal juice - mixture of enzymes able to breakdown carbohydrates and proteins
 - b. Mucus - neutralizes chyme

6. Large Intestine - dries out indigestible food residues by absorbing water and eliminating feces

IV. Accessory Digestive Organs

1. Salivary Glands
2. Liver - produces bile, a fat emulsifier; stores vitamins A, E, D, & K; aids in detoxification
3. Gallbladder - stores and concentrates bile
4. Pancreas - produces pancreatic juice capable of breaking down proteins, carbohydrates, and nucleic acids

V. Digestive Enzymes

Digestive System Worksheet

1. Describe the differences between chemical and mechanical digestion. _____

2. Differentiate between the alimentary canal and accessory organs. Give examples of each.

3. List the three pairs of salivary glands.

a. _____

b. _____

c. _____

4. Describe the functions of saliva. _____

5. Arrange the following tooth regions in order from the most superficial to the deepest:

_____ root
_____ crown
_____ neck

6. Arrange the following tooth structures in order from the most superficial to the deepest.

_____ pulp cavity
_____ enamel
_____ dentin

7. Arrange the following tooth structures in order from the hardest substance to the softest substance.

_____ pulp cavity
_____ enamel
_____ dentin

8. What is another name for the gums? _____

9. Describe the action of salivary amylase. _____

10. What term means...

- a. chewing: _____
- b. swallowing: _____
- c. gastric mixing movements: _____
- d. ball of food formed in the mouth: _____
- e. liquid paste formed by food and gastric juice: _____
- f. wave-like smooth muscle contractions that move food: _____
- g. folds in the stomach that allow it to stretch: _____

11. Answer the following questions about the stomach.

- a. The stomach connects to the esophagus at the _____.
- b. The stomach connects to the duodenum at the _____.

12. Answer the following questions about the pancreas.

- a. The digestive enzymes are produced by the _____ cells.
- b. Pancreatic juices flow through the pancreatic duct and into the _____.

13. Answer the following questions about the gallbladder:

- a. The gallbladder is located on the underside of the _____.
- b. The gallbladder _____ and _____ bile.
- c. The bile flows through the _____ and into the small intestine where it _____ fat.
- d. The principle pigment of bile is _____.

14. Name the three sections (in order) of the small intestine.

- a. _____
- b. _____
- c. _____

15. What are the modified structures of the small intestine which increase the surface area for absorption? _____

16. What are the two major functions of the small intestine?

- a. _____
- b. _____

17. Name the structures (in order) of the large intestine.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____
- g. _____
- h. _____

18. List three major functions of the large intestine.

- a. _____
- b. _____
- c. _____

WORKSHEET – Digestive Review – KEY

1. Chemical digestion occurs when the food substances (carbohydrates, proteins, and lipids) are broken down into their building blocks (glucose, amino acids, fatty acids and glycerol).

Mechanical digestion occurs when the food substances are broken down into smaller pieces.

2. The alimentary canal is also known as the GI tract. Food directly passes through these organs as it is moved along and processed. Examples include the mouth, esophagus, stomach, small and large intestines.

The accessory organs provide additional enzymes, bile, other fluids, and surface area to aid in both the chemical and mechanical digestion of food.

3. The three pairs of salivary glands are: parotid, sublingual, and submaxillary.
4. Saliva has several functions including mixing with food to form a ball of food or bolus, to help maintain the pH of the mouth, to help clean the teeth, and to chemically digest starch.
5. From the most superficial to the deepest: crown, neck, and root.
6. From the most superficial to the deepest: enamel, dentin, and pulp cavity.
7. From the hardest to the softest: enamel, dentin, and pulp cavity.
8. Gingiva
9. Salivary amylase breaks down starch (amylase) into maltose molecules. (Maltose is a disaccharide).
10.
 - A. mastication
 - b. deglutition
 - c. haustral churning
 - d. bolus
 - e. chyme
 - f. peristalsis
 - g. rugae
11.
 - a. cardiac region
 - b. pyloric region

- 12.
 - a. acini
 - b. small intestine (duodenum)
- 13.
 - a. liver
 - b. stores and concentrates
 - c. common bile duct, emulsifies
 - d. bilirubin
- 14.
 - a. duodenum
 - b. jejunum
 - c. ileum
- 15. villi and microvilli
- 16.
 - a. complete digestion of all nutrients
 - b. absorption of nutrients
- 17.
 - a. cecum
 - b. ascending colon
 - c. transverse colon
 - d. descending colon
 - e. sigmoid colon
 - f. rectum
 - g. anal canal
 - h. anus
- 18.
 - a. absorption of water
 - b. absorption of electrolytes
 - c. formation of wastes
 - d. production of vitamin K
 - e. elimination of solid wastes

Laboratory Investigation Rubric

Student: _____

Course: _____

Date: _____

Scoring Criteria	4 Excellent	3 Good	2 Needs Some Improvement	1 Needs Much Improvement	N/A
Problem is appropriately identified.					
Problem is precise, clear, and relevant.					
Association between the problem and the predicted results is direct and relevant.					
All variables are clearly operationalized.					
Demonstrates comprehension of the use of scientific concepts and vocabulary.					
All significant data is measured.					
Data is recorded effectively and efficiently.					
Data table is well designed to the task requirements.					
All graphs are appropriate.					
All data accurately plotted.					
Graph visually compelling; highlights conclusions of the study.					
Conclusion relates directly to hypothesis.					
Conclusion has relevancy in resolution of the original problem.					
Conclusion relates the study to general interest.					