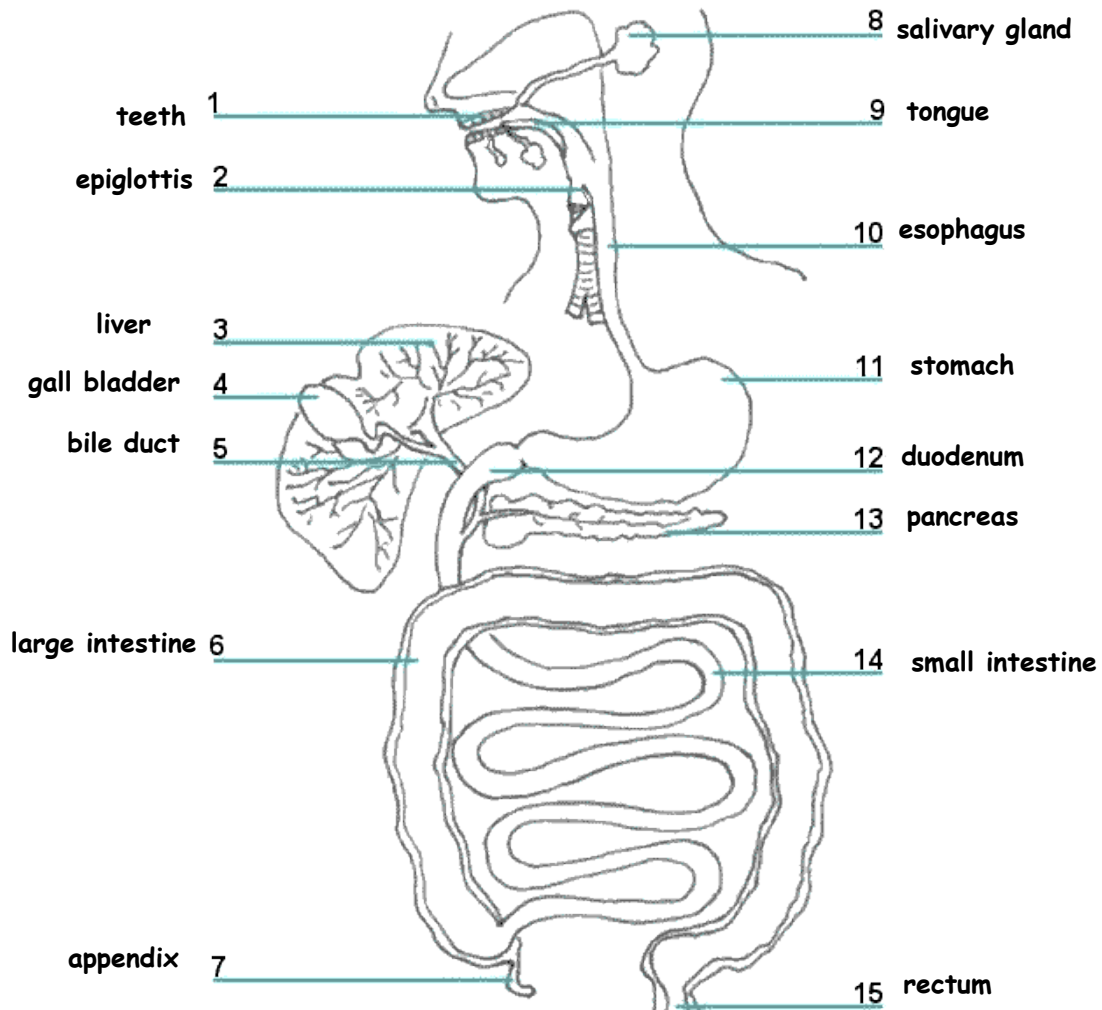


UNIT 4 ANSWER KEY

1. Label the diagram below of the digestive system with the following terms:

- | | | |
|--|--------------------------------------|---------------------------------------|
| <input type="radio"/> gall bladder | <input type="radio"/> salivary gland | <input type="radio"/> teeth |
| <input type="radio"/> large intestine | <input type="radio"/> esophagus | <input type="radio"/> appendix |
| <input type="radio"/> epiglottis | <input type="radio"/> stomach | <input type="radio"/> bile duct |
| <input type="radio"/> rectum | <input type="radio"/> pancreas | <input type="radio"/> small intestine |
| <input type="radio"/> duodenum/small intestine | <input type="radio"/> tongue | <input type="radio"/> liver |



2. Describe the key functions for each of the following structures:

- a. Mouth = ingestion of food, mechanical digestion via teeth and tongue, chemical digestion of starches via salivary amylase
- b. Tongue = mechanical digestion of food, moves food to back of pharynx for swallowing, taste buds
- c. Teeth = mechanical digestion of food (grinding)
- d. salivary glands = provides moisture in form of saliva to make food easier to swallow, releases salivary amylase which begins chemical digestion of starch to maltose, helps to produce a moist ball of food called a bolus
- e. pharynx = region at back of throat where food and air must cross pathways to go down the appropriate "tubes" (food down esophagus, air down trachea)
- f. epiglottis = structure that closes off glottis (opening of trachea) preventing food from entering lungs during swallowing
- g. esophagus = muscular tube that moves food from mouth to stomach via peristalsis
- h. cardiac sphincter = circular muscle between trachea and stomach that opens to allow food into stomach but closes to prevent food and acid from coming back up the esophagus
- i. stomach = j-shaped muscular organ that stores food (typically expands to 1 L but can go up to 4 L); churns to perform mechanical digestion; produces hydrochloric acid to kill bacteria, and to activate pepsin; pepsin begins the chemical breakdown of proteins to peptides; produces a soupy/acidic food mixture called acidic chyme
- j. pyloric sphincter = circular muscle between stomach and small intestine that opens and closes to allow chyme to enter the small intestine
- k. duodenum = ~ first 30 cm of small intestine, accepts secretions from the pancreas that include enzymes to digestion of proteins, nucleic acids, carbohydrates and lipids (trypsin, nucleases, pancreatic amylase and lipases respectively); produces and secretes enzymes that continue digestion of peptides, nucleic acids and maltose (nucleosidases, peptidases and maltase, respectively)
- l. liver = multiple body functions, but with respect to digestion, produces bile necessary to emulsify lipids (a form of mechanical digestion) so that fat molecules can be accessed by enzymes for chemical digestion
- m. gall bladder = stores and concentrates bile
- n. pancreas = exocrine (enzyme) functions include producing pancreatic juices that contain bicarbonate ions (to neutralize acidic chyme so that it does not harm the small intestine), trypsin which digests proteins to peptides, pancreatic amylase which digests starch to maltose, nucleases which digest nucleic acids and lipases which digest lipids (fats and oils) to glycerol and fatty acids; endocrine (hormone) functions include releasing glucagon when glucose blood levels are low and insulin when blood glucose levels are high
- o. appendix = once thought to be a vestigial organ (non-functional remnant of evolution) it appears that it may serve as a "safe room" for commensal bacteria when the body is under attack by harmful bacteria
- p. large intestine (colon) = absorption of salt, water and vitamins, storage of waste (feces), elimination of waste (defecation)

- q. rectum = specific area of colon that store feces until the appropriate time for defecation; contains nerves necessary for trigger and delaying the defecation response
- r. anus = exit point for elimination of waste (feces) from the body

3. Identify the key digestive enzymes that are produced by each of the following glands/organs:

- a. =The salivary glands produces salivary amylase which works in the mouth at pH 7 to break starch down into maltose.
- b. The stomach produces pepsin which works in the stomach at pH 2 to break proteins down into peptides.
- c. The pancreas produces trypsin which works in the small intestine at pH 7.5-8.0 to break proteins down into peptides.
- d. The pancreas produces lipase which work in the small intestine at pH 7.5-8.0 to break lipids down into glycerol and 3 fatty acids.
- e. The pancreas and small intestine produce nucleases which work in the small intestine at pH 7.5-8.0 to break nucleic acids down into nucleotides.
- f. The pancreas produces pancreatic amylase which works in the small intestine at pH 7.5-8.0 to break carbohydrates (starches) down into maltose.
- g. The small intestine produces maltase which works in the small intestine at pH 7.5-8.0 to break maltose down into glucose.
- h. The small intestine produces peptidase which works in the small intestine at pH 7.5-8.0 to break peptides down into amino acids.
- i. The small intestine produces Nucleosidases which works in the small intestine at pH 7.5-8.0 to break nucleotides down into phosphate, sugar, base.

4. Using the letters of each statement above, place them with the corresponding molecule in the table below and in order.

Biomolecule	Order of digestion from previous question
<i>Carbohydrates</i>	a → f → g
<i>Proteins</i>	b → c → h
<i>Lipids</i>	d
<i>Nucleic Acids</i>	e → i

5. Identify the following components produced by the pancreas:

- j. Four key digestive enzymes:
 - i. pancreatic amylase
 - ii. trypsin
 - iii. lipase
 - iv. nuclease

- k. Two key hormones that regulate blood sugar levels
- v. insulin (released when blood sugar is too high)
 - vi. glucagon (released when blood sugar is too low)
- l. One compound key for regulate pH within the small intestine:
- vii. sodium bicarbonate

6. Compare and contrast the terms exocrine and endocrine.

= exocrine refers to the release/secretion of enzymes into nearby structures

= endocrine refers to the release of hormones (chemical messengers) into the blood, these hormones can influence nearby or more distant organs

7. Please describe the effects of:

a. glucagon on the body

= glucagon is release by the pancreas when blood glucose levels fall causing the liver to convert glycogen to glucose which is then added to the blood such that blood glucose levels return to a homeostatic level

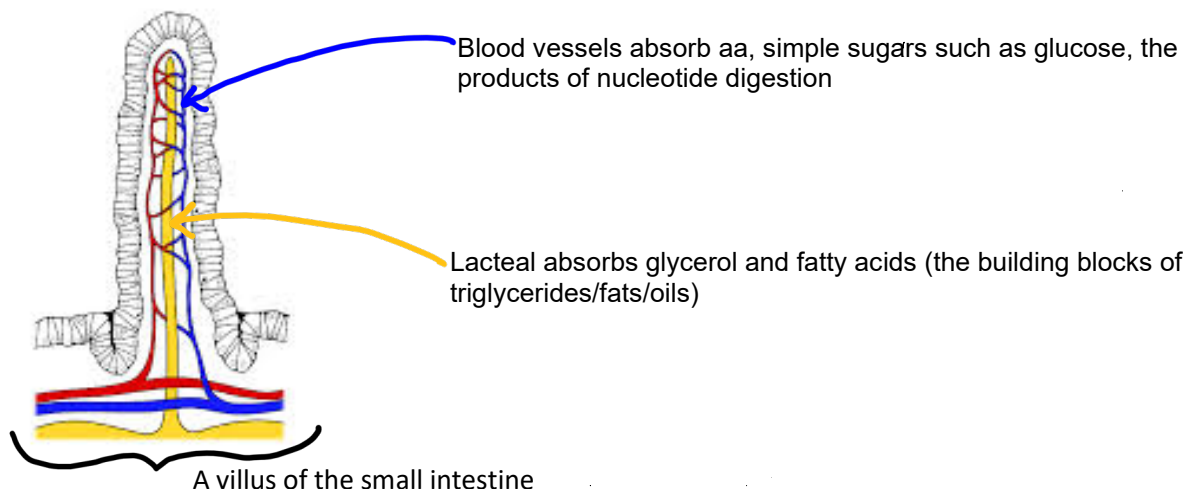
b. insulin on the body

= insulin is by the pancreas when blood glucose levels are too high causing cells to transport glucose from the blood into the cell and causing liver cells to convert the glucose to glycogen for storage

8. Describe how fats are emulsified, digested and absorbed in the small intestine.

= bile is produced in the liver, stored and released from the gall bladder into the small intestine where it emulsifies lipids increasing their surface area and such that lipases (from the pancreas) can begin chemical digestion of fat molecules into glycerol and 3 fatty acids. The glycerol and fatty acids are then absorbed by the lacteals of the micro-villi from the small intestine into the lymphatic system.

9. Draw and label a villus. Indicate which nutrients are absorbed by the blood vessels and which are absorbed by the lacteals.



10. Describe three key functions of the large intestine.

= absorb salt, water and vitamins

= storage of waste (feces)

= elimination of waste (defecation)