Biology 12
Digestive System

Name: KEY
Per: _____ Date: _____

Chapter 9 – The Digestive System

Complete using BC Biology 12, page 262 – 293

9.1 The Digestive Tract — pages 266 - 271

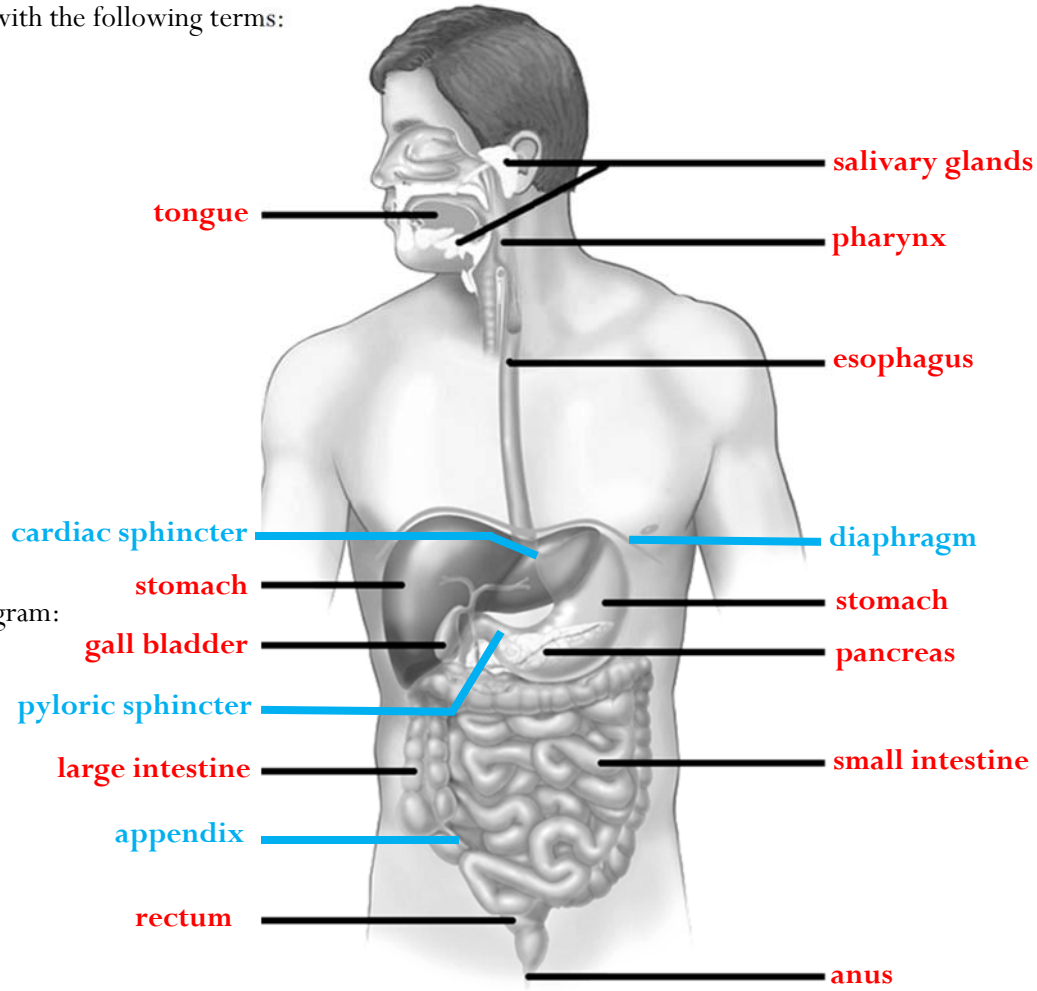
1. Put these functions of the digestive system in order from beginning to end: *absorb, digest, eliminate, ingest,*

   First step of digestion — ingest
   digest
   absorb
   Last step of digestion — eliminate

2. Distinguish between *mechanical digestion* and *chemical digestion*.
   Refer to both the process and give an example of a digestive structure that performs that process.
   Mechanical digestion: the PHYSICAL breakdown of food into smaller pieces (e.g. the **teeth** chewing up food in the **mouth**, muscular churning of the stomach)
   Chemical digestion: the ENZYMATIC breakdown of food by hydrolytic enzymes from polymers to monomers that the body can absorb (e.g. salivary amylase in the **mouth**, pepsin in the **stomach**)

3. Complete the diagram with the following terms:
   - *A. anus*
   - *B. esophagus*
   - *C. gallbladder*
   - *D. large intestine*
   - *E. liver*
   - *F. pancreas*
   - *G. pharynx*
   - *H. rectum*
   - *I. salivary glands*
   - *J. stomach*
   - *K. small intestine*
   - *L. tongue*

4. Labels to add to the diagram:
   - *M. appendix*
   - *N. diaphragm*
   - *O. cardiac sphincter*
   - *P. pyloric sphincter*



5. Match the above parts to their correct functions below

J_____ referred to by the term "gastric"; begins breakdown of proteins; acidic contents kills most bacteria

C_____ small, pear-shaped muscular sac attached to liver; storage of bile

O_____ relaxation of this muscle allows food to enter stomach, constriction reduces chance of hearturn

F_____ produces sodium bicarbonate (neutralize stomach acid), digestive enzymes, insulin and glucagon

A_____ elimination of solid wastes from the body

L_____ manipulates food to create a soft ball called a "bolus"

D_____ absorption of water, salts and some vitamins

G_____ passageway for both food and air

P_____ regulates the passage of partially digested food from stomach to small intestine

H_____ end of the large intestine; storage of indigestible material

K_____ absorption of nutrients; inner surface has high surface area due to folds called "villi"

B_____ tube allowing passage of food from mouth to stomach

M_____ wormlike projection found at the end of the cecum; thought to have a role in fighting infection

N_____ sheet of muscle that separates the abdominal and thoracic cavities

E_____ largest gland in the body; numerous functions including production of bile and detoxifying blood

I_____ makes food moist for ease of passage; produce a digestive enzyme to begin breakdown of starch

6. **Mouth**: Bound externally by the lips_____ and the cheeks_____. Sensory receptors called tastebuds_____ are located on the tongue_____ which is composed of skeletal_____ muscle. The roof of the mouth separates the nasal cavity_____ from the mouth preventing ingested food from entering that area. The roof has two parts: an anterior hard palate_____ and a posterior soft_____ palate_____. The hard palate consists of several bones_____ but the soft_____ palate is composed of muscles_____ and connective_____ tissue. The soft palate ends in a finger-shaped projection called the uvula_____.

7. Discuss the **salivary glands** using at least 3 different points.
   - 3 pairs (1 pair above jaw and 2 pairs below)_____
   - Release digestive enzymes to break down starch (salivary amylase)____
   - Moistens food to allow it to easily pass down the esophagus_____

8. As the pharynx serves as a passageway for both food and air, what process is stopped while swallowing?
   Breathing

9. Describe the process of swallowing in a minimum of 3 steps.
   - Oral phase: turning food into bolus, using tongue to push it to the back of the mouth___
   - Pharyngeal phase: larynx moves up under epiglottis to block the airway_____
   - Esophageal phase: peristalsis pushes bolus down to the stomach_____

10. What is an "Adam's apple"? front of the larynx_____

11. Define **peristalsis**: rhythmic muscular contractions that push food along the digestive tract_____

    *What is **reverse peristalsis** more commonly known as?* vomiting_____

12. When stomach acid comes in contact with the esophagus, the result is called heartburn or acid reflux. A more serious form of this is gastroesophageal reflux disease (GERD) which may lead to more problems such as ulcers, difficulty swallowing, or even esophageal cancer.

13. Fill in the table below regarding an adult **stomach**

Average length	25 cm
Diameter	varies
Maximum volume	4 L
Chemical contents	gastric juice (HCl, pepsin, mucus)
pH	2
# of muscle layers	3
Length of time food spends here	2-6 hours

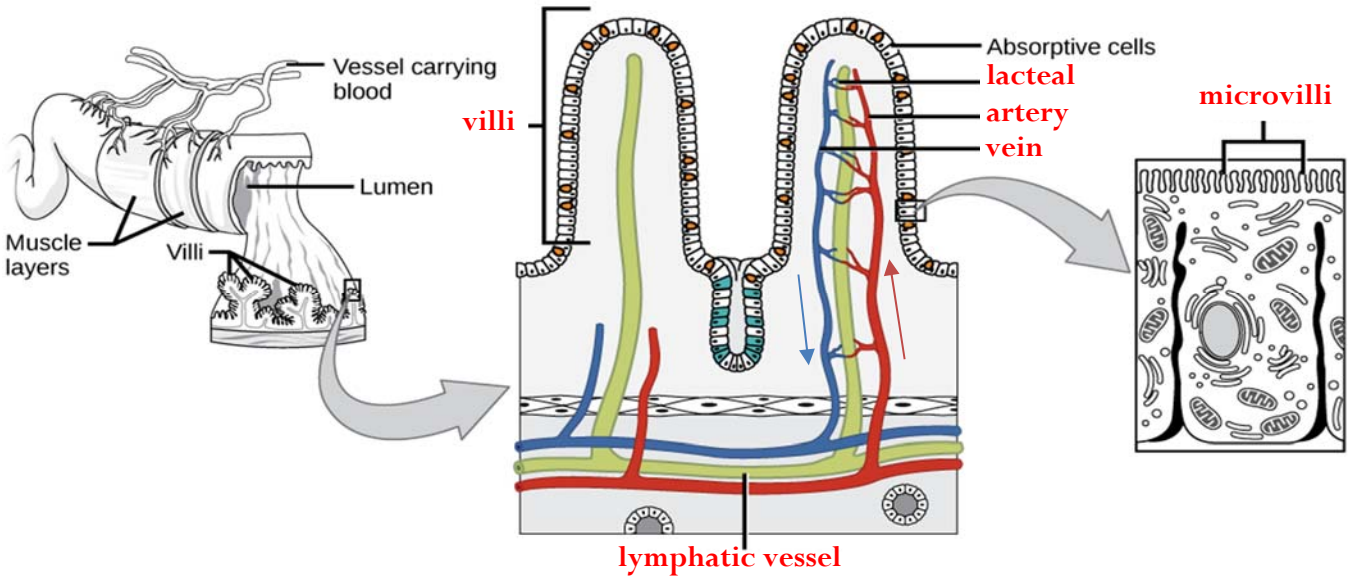
14. What is the difference between a *bolus* and *chyme*? Bolus is chewed up food mixed with saliva in the mouth, chyme is created once the bolus is mixed with gastric juices (a soupy liquid)

15. Compare the following organs.

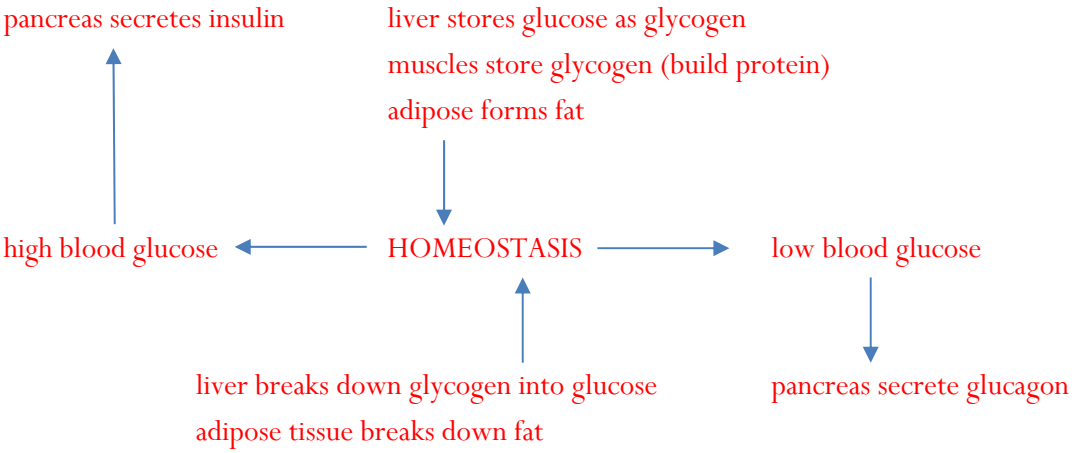
	Small Intestine	**Large Intestine**
Diameter	2.5 cm	6.5 cm
Length	6 m	1.5 m
Absorbs	nutrients	water

16. What is the name of the beginning section of the small intestine? duodenum
What is special about this section? Ducts from the liver and gallbladder send in bile, ducts from the pancreas send in sodium bicarbonate and digestive enzymes

17. The inner surface of the small intestine contains fingerlike projections.
On the diagram below, label: artery, lacteal (*lymphatic capillary*), lymphatic vessel, microvilli, vein, villi



18. Using the terms from the last question, fill in the blanks.
    Glycerol and fatty acids are packaged and enter the lacteal.
    Sugars and amino acids enter the arteries and veins.
19. Name the hormones that promote the secretion of various digestive juices.
    gastrin stimulated after eating a protein rich meal
    secretin stimulated by acid present in chyme
    cholecystokinin stimulated by partially digested protein and fat
20. Give the four components of the **large intestine**:
    - cecum
    - colon
    - rectum
    - anal canal
21. Along with the salivary glands, the pancreas, liver and gall bladder are considered to be accessory digestive organs. What do you think the term "accessory" means in this context? Food does not pass directly through them but they produce materials necessary for digestion to occur properly
22. Briefly describe the endocrine and exocrine functions of the pancreas.
    - Endocrine: secretes insulin and glucagon to regulate blood sugar levels
    - Exocrine: pancreatic juice (sodium bicarbonate and enzymes)
23. Draw a diagram to explain the role of insulin and glucagon. *See Figure 9.9 on page 272 for guidance.*



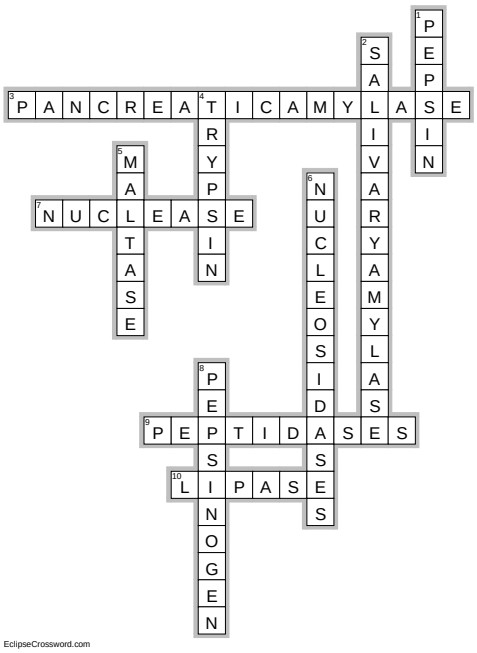
24. List seven functions of the liver (there are actually hundreds of known functions!)
    1. Detoxifies blood by removing and metabolizing poisonous substances
    2. Stores iron and vitamins A, D, E, K, and B12
    3. Makes many plasma proteins (e.g. fibrinogen) from amino acids
    4. Stores glucose as glycogen and breaks down glycogen to glucose (maintains homeostatic blood sugar levels)
    5. Produces urea after breaking down amino acids
    6. Removes bilirubin, a breakdown product of hemoglobin, from the blood and excretes it in bile, a liver product
    7. Helps regulate blood cholesterol level, converting some to bile salts

25. Bile is produced by the liver and stored in the gall bladder. The yellowish-green colour is due to the presence of bilirubin derived from the breakdown of hemoglobin. Bile also contains bile salts derived from breakdown of hemoglobin. Bile is responsible for emulsifying fat in the small intestine allowing it to be acted upon by digestive enzymes.

26. Why can we survive without a gallbladder but not without our liver? Liver is the organ producing the bile (~400-800 mL each day) and the gall bladder only stores it.

9.3 Digestive Enzymes pages 273 – 275

27. The clues describe what is bring broken down, the site of action and the optimum pH for the enzyme.



Across

3. Starch to maltose; small intestine; basic pH
7. RNA & DNA to nucleotides; small intestine; basic pH
9. Peptides to amino acids; small intestine; basic pH
10. Fat droplet to glycerol and fatty acids; small intestine; basic pH

Down

1. Protein to peptides; stomach; acidic pH
2. Starch to maltose; mouth; neutral pH
4. Protein to peptides; small intestine; basic pH
5. Maltose to glucose; small intestine; basic pH
6. Nucleotides to base, sugar and phosphate; small intestine; basic pH
8. Precursor to pepsin

28. What is the role of each of the following in digestion?
    - sodium bicarbonate: neutralizes the stomach acid, provide a basic pH for the enzymes in the small intestine
    - hydrochloric acid: helps turn pepsinogen into pepsin in the stomach, provides the acidic pH required for pepsin to work, kills pathogens entering the stomach
    - mucus: protects the lining of the digestive tract from being damaged by enzymes or acid, provides smooth passage of food
    - water: required for hydrolysis to occur (breakdown of polymers to monomers)

9.4 Disorders of the Digestive System pages 275 - 279

29. These are scattered through the previous sections. Match the term with the description.

A. cleft palate C_____ swelling of the salivary glands caused by a viral infection

B. tonsillitis A_____ bones of hard palate are not fused together, leaving a gap (1 in 700 newborns)

C. mumps D_____ inflammation of lining of abdominal cavity

D. peritonitis B_____ inflammation of the lymphatic glands found at the back of the mouth

30. Complete the table. Your knowledge of the disorders will not be tested but rather is provided for interest.

Disorder	Description
Digestive Tract	
Stomach ulcers	Damage of stomach wall by hydrochloric acid due to the protective layer of mucus lining stomach being broken down. What are the possible causes? • bacteria (*Heliobacter pylori*) (most common) • viral infections • overuse of anti-inflammatory medications
Diarrhea	Loose, watery feces caused by inability of large intestine to absorb sufficient amounts of water. Can lead to dehydration and disturbances in the heart.
Crohn's disease	Chronic diarrhea. Genetic predisposition is a factor, as are several environmental factors.
Constipation	Feces are hard and dry.
Hemorrhoids	Chronic constipation can lead to this.
Polyps	Small growths arising from epithelial lining. Can be benign (harmless) or cancerous.
Accessory Organs	
Pancreatitis	Inflammation of pancreas. Can be caused by excessive alcohol consumption, gallstones, or other unknown factors.
Pancreatic cancer	Almost always fatal (20% survival one year after diagnosis)
Diabetes mellitus	In 2009, 2.4 million Canadians had this condition. Distinguish between type 1 and type 2. Which is more common? Type 1 – do not produce enough insulin Type 2 – cannot properly use the insulin they do produce (more common)
Jaundice	Yellowish colouring in whites of eyes as well as in skin. What is it caused by? Buildup of bilirubin (product of hemoglobin breakdown), normally broken down by the liver
Hepatitis	Inflammation of the liver, most commonly caused by viruses
Cirrhosis	Chronic disease often seen in alcoholics. Preferred treatment is a liver transfer but supply is insufficient to meet the demand for them!
Gallstones	Crystals form in the gallbladder and may block the common bile duct. Particularly common in people who have lost a lot of weight in a short period of time or have undergone gastric bypass procedure

Chapter 9 Questions — pages 288 - 293

1. A
2. A
3. C
4. C
5. D
6. A
7. D
8. A
9. A
10. D
11. C
12. B
13. C
14. A
15. C
16. A
17. B
18. B
19. B
20. C
21. C
22. B
23. C
24. B
25. B
26. C
27. D
28. B
29. C
30. A
31. C
32. C
33. C
34. A
35. C
36. A
37. D
38. D
40. D
41. D
42. B
43. C
44. A

45. Match the descriptions to the part.

a. 3
b. 5
c. 7
d. 7
e. 4
f. 2
g. 2
h. 1
i. 7
j. 10
k. 9
l. 4
m. 7
n. 9
o. 1
p. 6
q. 8
r. 2
s. 9
t. 1

49. Protected by a layer of mucus

50. (key wrong) muscles help mechanical breakdown, rugae help the stomach to expand,

52. Both have enzymes to breakdown proteins

53. Mouth begins (salivary amylase), small intestine (pancreatic amylase)

56. Stomach acid would wreck the small intestine, enzymes would denature

65. Diagram of control of blood glucose level

a. 3
b. 8
c. 6
d. 7
e. 5
f. 1
g. 2
h. 4

68. (X) maltase (Y) peptidases (Z) lipase

69. (X – Z) basic

Mark the review questions using the answer key on pages 541 - 543