

Digestive System

Part A – Multiple Choice

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

Part B – Written Answers

Note: The answers provided here are correct, but they may NOT be the only possible answers.

1.
 - a. Transport: The small intestine has both circular and longitudinal muscles and uses them to conduct peristalsis of food materials along the digestive tract. The small intestine is also connected to the stomach by the pyloric sphincter and to the colon by the ileo-caecal valve, which control the entry and exit of food materials.
 - b. Digestion: The small intestine produces enzymes to complete the final chemical digestion of some of the food materials (such as peptidases for protein digestion). The small intestine also receives digestive secretions from other organs (Pancreas and gall bladder) to assist with the digestion of food.
 - c. Absorption: Both of the ways the small intestine is specialized for absorption are related to surface area. The greater the SA, the greater the absorption possible. The small intestine is equipped with villi, which greatly increase the inner surface area, and it is very long allowing time along the SA for absorption.
2. Bacteria (*E. coli*) in the colon live in a symbiotic relationship with humans. They gain nutrients and have a suitable environment in which to live as well as help us breakdown the food materials, whereby manufacturing vitamins and releasing minerals that we absorb along with water.

3.
 - a. between 7:00 AM and 8:00 AM: The blood glucose level is rising during this time. This can be attributed to the fact that the student has just eaten and glucose is being absorbed in the small intestine.
 - b. between 1:00 PM and 2:00 PM: The blood glucose level is dropping during this time. This can be attributed to the fact that the student has recently eaten (an hour ago) and the level is returning to a more normal level after having been elevated as a result of the meal. Excess glucose is being converted to glycogen and being stored by liver cells (insulin function).
 - c. between 4:00 PM and 5:00 PM: The glucose level dips to its lowest point in the day just after 3:00 and then becomes elevated prior to the evening meal. This can be attributed to the exercise the student does as part of her workout followed by the release of glucose from the liver to compensate for the lowered level (glycogen function).
4.
 - a. Bile.
 - b. Emulsification increases the surface area of the fat particles (breaks it into smaller fat droplets). Enzymes work at surfaces where molecules are exposed. The greater the surface, the greater the chemical digestion.
 - c. The production and release of bile into the duodenum would be ongoing. This would not cause a problem unless the person was on a high fat diet when abnormally large amounts of bile may be required. There is the potential that fat would not be completely digested (enzymes would be inefficient) and would form part of feces.
5.
 - a. The digestion that occurs in the digestive system is extracellular – it occurs in the lumen (interior) of the digestive tract.
 - b. The nutrients do not actually enter the body until they have crossed a membrane. This first occurs in the ileum with the absorption of the villi. Until then, the nutrients are located in a tube that runs through the body.

6.

SUBSTANCE	SOURCE OF SUBSTANCE	SITE OF ACTIVITY	PRODUCT OF ACTIVITY
ptyalin	salivary glands	mouth	maltose
pepsin	stomach	stomach	polypeptides
glucagon	pancreas	liver	glucose
lipase	pancreas	small intestine	fatty acids and glycerol

7. The first pH change occurs in the stomach as a result of HCl release. The food material, called acid chyme, ranges in pH depending on the pH when it was ingested. It is usually around 2 or 2.5 in the stomach. This low pH kills any bacteria that are in the food and creates a suitable environment for the activity of pepsin (from pepsinogen).

The second pH change occurs when acidic chyme is buffered by bicarbonate ions released from the pancreas. The bicarbonate ions are an excellent buffer in the body and they maintain the pH between 8 and 8.5, which is the optimum pH range for the various food-digesting enzymes that are active in the duodenum.

8. Protein is physically digested in the mouth by chewing and in the stomach by churning.

Protein is chemically digested in three steps: The first step occurs in the stomach through the action of pepsin. The products, polypeptide chains, further digested in the duodenum by trypsin, are converted into short amino acid sequences called peptides. The peptides are digested in the duodenum by peptidases from the small intestine. The final products are amino acids.

Amino acids are absorbed by the villi and they enter the blood stream to be circulated to body cells.