

Digestive System Concept Questions

1. How do mechanical and chemical digestion work together to break down food? (Mechanical digestion physically breaks food into smaller pieces to increase the surface area for more effective chemical digestion. Chemical digestion breaks large molecules into smaller ones which can be absorbed.)
2. How does chewing aid digestion? (Teeth cut food into smaller pieces, increasing the surface area for chemical digestion. The tongue positions food in the mouth for chewing. Chewing also increases the digestion of starch. Food is mixed with saliva which lubricates and moistens food, and contains amylase for the digestion of starch.)
3. Your friend notices that when they chew soda crackers they start to taste sweet. How would you explain this to your friend? (Crackers are mostly starch which is digested by salivary amylase in the mouth to release sugar.)
4. Your friend bets you that you cannot swallow food while standing on your head. Do you take the bet? (Yes. Peristalsis is a process by which food is swallowed by rhythmic muscles contractions and is independent of gravity.)
6. Imagine you've just eaten a snack during class. In what sense are nutrients from your snack not really "inside" your body? When can they be considered actually "inside"? (While inside your digestive tract, the nutrients are actually in a long tube that is continuous with the outside environment through your mouth and anus. After nutrients cross a cell membrane to be absorbed they are actually inside your body.)
7. What would be the result if the stomach did not have sphincter muscles? (Food would not remain long enough to be digested, acid would splash into the esophagus, and too much chyme would enter the duodenum, causing duodenal ulcers.)
8. Why is it important that pepsin be released as pepsinogen, an inactive form? (Pepsin would digest proteins in the cells producing the enzyme so it is released as the inactive pepsinogen. The HCl in the stomach activates it.)
9. Your friend's father has been diagnosed with a gastric ulcer. Explain to them what this means and give some advice about how to treat it. (A gastric ulcer results when the lining of the stomach is digested by gastric juice. Most are caused by bacteria but stress might be a complicating factor. Treatment includes antibiotics to kill the bacteria, reducing stress, taking antacids and medication to reduce stomach acid. Avoiding spicy foods helps in some cases.)
10. Why is surface area important in the small intestine and what features increase it? (A large surface area is needed for absorption of nutrients. Folds in the small intestine, villi, and microvilli increase the surface area.)
11. How is the structure of villi adapted to their function? (Villi contain blood vessels that absorb nutrients from the small intestine. Each one is covered by microvilli to increase surface area further.)
12. How do food molecules get from the stomach to your blood? (A small variety of molecules are absorbed from the stomach itself. Most are further digested into small molecules in the small intestine and then diffuse into the blood through the villi.)
13. In cases of extreme obesity, surgical procedures can be used to control weight. For each, state the effect on the patient:
 - a) A section of the small intestine is removed. (Absorption would be decreased so fewer calories would be absorbed.)
 - b) The size of the stomach is reduced. (The patient would feel full sooner and so would eat less.)
14. Complete the following table

Organ	Enzyme(s) produced	Function of enzyme(s)
Mouth	(amylase)	(starch to simple sugars)

Stomach	(pepsin)	(proteins to smaller pieces)
Pancreas	(amylase, lipase, trypsin, proteases)	(starch, fats - simple fats, proteins to smaller pieces and to amino acids)
Small Intestine	(lactase, sucrase)	(digest lactose and sucrose)

15. Complete the following table

Nutrient	Digestion Begins	Digestion Completed
Carbohydrates	(mouth)	(small intestine)
Proteins	(stomach)	(small intestine)
Fats	(small intestine)	(small intestine)

16. How is the small intestine protected from the acid chyme? From pepsin? (The presence of acid in the small intestine triggers the release of secretin which, in turn, causes the pancreas to release bicarbonate which neutralizes the acid. The change in pH also deactivates pepsin.)

17. a) A person can live without a gallbladder but not without a liver. Explain. (The gall bladder merely stores the bile produced by the liver.)

b) If the gall bladder is removed, why is the common bile duct left intact? (Without the common bile duct, bile could not flow from the liver to the small intestine.)

18. A family friend has just had their gallbladder removed and she's confused about why her doctor said to limit fatty foods in her diet. How would you explain it? (Bile dissolves fat droplets so they can be efficiently digested by enzymes.)

19. An insulinoma is a cancerous mass of pancreatic beta cells that secrete insulin but do not respond to feedback mechanisms. How would you expect an insulinoma to affect blood glucose levels and liver activity? (The excess production of insulin will cause blood glucose to decrease below the normal level. It will cause the storage of glucose as glycogen in the liver. At the same time, the low blood glucose level will trigger the release of glucagon which will cause the liver to release glucose.)

20. The incidence of colon cancer is highest in countries where people eat the greatest quantities of animal fats and proteins. Individuals who live in countries where cereal grains form the basic diet have a much lower incidence of colon cancer. What conclusion might you draw from these data? Can colon cancer be eliminated by a change in diet? (The fiber in plants helps reduce colon cancer by filling the colon more quickly, causing it to be voided more often, removing carcinogenic compounds. Also, preservatives in meat may increase the risk of colon cancer. Colon cancer cannot be eliminated but the risk can be reduced.)

21. Imagine you are prescribed an antibiotic that kills all the bacteria in your body. How would your digestive system be affected? (You would be unable to make vitamin K. You could develop an infection of bacteria that are normally prevented by the bacteria in the large intestine.)

22. What is the difference between a calorie and a Calorie? (The calorie is a unit for measuring energy while the Calorie is 1000 calories and is used by nutritionists to describe the amount of energy in food.)

23. Humans require all 20 amino acids to make proteins. Why aren't all 20 essential to the human diet? (Humans are able to synthesize 11 amino acids from other molecules. Only 9 are essential.)

24. Hummingbirds are well adapted to obtain sugary nectar from flowers, but they use some of the energy obtained from nectar when they forage for insects or spiders. Explain why this foraging is necessary. (Hummingbirds require protein as well as the sugar they get from nectar.)

25. Most plant proteins are incomplete. What must vegetarians do to ensure they get complete protein? (In order to get all the amino acids they require, a vegetarian would need to eat a variety of plant products.)
26. a) A man has a high level of cholesterol in his blood. What dietary recommendations would you give him? (He should avoid fatty foods and animal products.)
- b) The man asks if he should avoid all fat at all costs. What would you say? (Fat is important for the synthesis of some hormones, nerve function and cell membranes as well as energy storage. Plant fat is desirable to animal fat.)
27. Why is fat a good choice for energy storage? (Fat stores twice the amount of energy compared to carbohydrates.)
28. What would happen if you did not eat enough
- a) carbohydrates? (You would feel low energy and would lose weight because your body would use its fat reserves to compensate. The lack of fiber could cause constipation.)
- b) fats? (During prolonged periods of fat deprivation, there might be a depletion of fat-soluble vitamins and lipid-based hormones. The nervous system could be impaired. Leptin level would be low.)
- c) proteins? (Almost every body function would be affected because proteins are important components in all cells. You would start digesting your own proteins to be recycled into essential proteins. Abdominal distension would result.)
29. Fad diets that claim rapid weight loss often suggest eating a limited variety of foods. Explain why these diets are usually an unhealthy way to lose weight. (These diets usually suggest avoiding a certain food group altogether - carbohydrates, proteins, or fats. In fact, all three are needed for optimal health and the limited variety required by many fad diets is less than ideal and may not contain all the nutrients required for good health.)