Review Questions for Digestive Enzymes topic

Review questions will not be collected and are not worth any points. Doing them will, however, help you prepare for the midterms and quizzes in this course. Furthermore, some of these review questions will appear on the final exam (although the numbers within the questions may be changed).

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1) The major monosaccharide in the blood
   A) Amino acids
   B) Oxygen
   C) Glucose
   D) Water

2) High blood sugar is called
   A) Hyperglycemia
   B) Hypertonic
   C) Diabetes
   D) Hypotonic

3) The major source of glucose for the body is _____ in our diet.
   A) Sweets
   B) Glycogen
   C) Proteins
   D) Starch

4) The enzyme _____ digests starch into disaccharide sugar molecules.
   A) Insulin
   B) Glucagon
   C) Amylase
   D) Pancreas

5) When glucose levels in the blood are high (such as after a carbohydrate-rich meal) the _____ (an organ) stores the glucose.
   A) Adipose
   B) Liver
   C) Pancreas
   D) Small intestine

6) The liver stores carbohydrate as a polymer of glucose called

A) Starch
B) Glucagon
C) Insulin
D) Glycogen

7) Identify the cells of the stomach mucosa that secrete:

a) HCl: _____
b) Pepsin enzyme: _____

8) Which is **not** a correct sequence of digestion of a macromolecule?

A) Glucose -> Amino acids -> Starch
B) Protein -> Peptides -> Amino acids
C) Polysaccharides -> Disaccharides -> Monosaccharides
D) Fat globules -> Triglycerides -> Glycerol and fatty acids

9) Define the following terms as they were defined in class

a) Enzyme

b) Substrate

c) Product

d) Denature

10) Enzymes that break down larger molecules into smaller molecules are called _____ enzymes.

11) The two organs that produce the most digestive enzymes are the _____ and the _____.

12) Large carbohydrates (such as starch) are called polysaccharides. They are polymers of the monosaccharide _____.

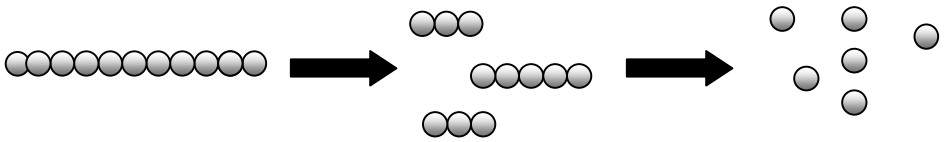
13) When a large carbohydrate molecule, such as starch, is eaten, the first digestive enzyme breaks it down into _____, which is a carbohydrate made of two glucose sugars linked together. Any carbohydrate made of two monosaccharides linked together is called a _____.

14) The polysaccharide from plants that provides most of our glucose is called _____. Major sources of this polysaccharide are potatoes, bread, pasta, and rice. In our bodies, glucose monomers are linked together to form a polysaccharide called _____.

15) Person X eats a starchy meal (like pasta). Person Z eats a meal with lots of maltose sugar. Starch and maltose are both made of glucose sugars linked together. Which person's blood sugar will increase faster? _____ Justify your answer using concepts about how digestion of food molecules is carried out by enzymes.

16) Proteins in foods are first digested by enzymes into smaller chains of amino acids called _____. Triglycerides (fats and oils) in foods are digested by enzymes into _____ and _____ molecules.

17) The drawing below represents the digestion of a large nutrient macromolecule (on the left) in the digestive system. First it is digested into smaller chains of monomers (the middle part of the drawing). Then each of the smaller chains is digested into individual monomers (on the right). The arrows represent digestive enzymes.



a) The macromolecules will/will not (circle one) be absorbed into the body.

b) The small chains of monomers will/will not (circle one) be absorbed into the body.

c) The monomers will/will not (circle one) be absorbed into the body.

d) Justify your answers to questions a - c.

e) If the macromolecule on the left is a protein, the specific term for the first enzyme is a(n) _____ enzyme. The short chains of monomers are called _____. The specific term for the second enzyme is a(n) _____ enzyme. The monomers on the right are _____.

f) If the macromolecule on the left is starch, the specific term for the first enzyme is _____ enzyme. The short chains of monomers shown in the middle would be two of the monomers linked together. These molecules made of two of the monomers linked together are a disaccharide called _____. The specific term for the second enzyme is a(n) _____ enzyme. The monomers on the right are _____.

18) The nutrient monomers that are absorbed into the body by the digestive system (such as monosaccharides, amino acids, and fatty acids) serve two major purposes. What are those two purposes? In other words, why do we need to eat?

19) The table below lists the three major macromolecule nutrients on the top row and some traits on the left hand column. Fill in the table.

	Protein	Carbohydrates	Fats
It is first digested into a smaller molecules called	_____	_____	_____
It is then digested into monomers called	_____	_____	_____
Are its monomers a major cell energy source? (Yes/No)	_____	_____	_____

20) After each digestive enzyme listed below, write which organ makes the enzyme. Also, circle the enzyme(s) on the list that require an acidic environment to properly digest their substrate molecules.

a) Lipase: _____
b) Protease: _____ (two organs make this enzyme. List both)
c) Amylase: _____ (two organs make this enzyme. List both)
d) Maltase: _____
e) Peptidase: _____

21) What are brush boarder enzymes?

22) Enzymes work best when they are in their natural environment conditions. In lab, you deliberately carried out some enzyme digestions where the enzyme was not in its natural environment conditions. Those digestions usually showed little (if any) digestion of the substrate by the enzyme. List three environmental conditions that caused some of your enzyme digestions to digest poorly.

23) Does boiling temperature cause digestive enzymes to digest their substrates poorly? If yes, explain at a molecular level why a boiled enzyme digests poorly.

24) Do cold, icy temperatures cause digestive enzymes to digest poorly? If yes, explain at a molecular level why an ice cold enzyme digests poorly.

25) Would returning a boiled enzyme to body temperature restore its ability to digest substrate molecules well? Why or why not?

26) Would returning an ice cold enzyme to body temperature restore its ability to digest substrate molecules well? Why or why not?

27) Bile is not an enzyme, but it plays an important role in the digestion of fats and oils. Explain bile's role in the digestion of those substances.

28) In the starch digestion experiment, which tube (s) contained the most starch following incubation? Which tube (s) contained the most maltose? What conclusion can you draw from these results?

29) In the protein digestion experiment, which tube showed the most digestion of egg albumin? What can you conclude about the pH optimum of pepsin?

30) Compare the effects of HCl (hydrochloric acid) on protein digestion by pepsin enzyme with the effects of HCl on starch digestion by amylase enzyme. Explain the physiological significance of these effects.

31) In the triglyceride digestion experiment, which test tube displayed the most rapid fall in pH? Explain the reason for this, including an explanation of how the digestion of fat can cause a fall in the pH of the solution, and the function of bile salts.

32) Suppose, in performing the starch digestion experiment, the test for starch and for maltose in a tube came out positive after a 1-hour incubation, but after the tube was incubated for 2 hours, the test for maltose was still positive but the test for starch came out negative. How could you explain these results?

33) Reviewing your data from the starch digestion experiment, in which regions of the GI tract does starch digestion take place, and in which regions does it not take place?

34) Reviewing your data from the protein digestion experiment, explain why frozen food keeps longer than food kept at room temperature.

Answers for Review Questions for Diffusion/Osmosis Review topic:

1) C

2) A

3) D

4) C

5) B

6) D

7) a) Parietal cells
b) Chief cells

8) A

9) a) Enzyme = A protein that carries out a chemical reaction.

b) Substrate = The molecule that enters an enzyme and that will be changed by the enzyme.

c) Product = The molecule that exits an enzyme and that results from the enzyme changing the substrate molecule.

d) When an enzyme becomes unfolded and permanently non-functional.

10) Digestive enzymes

11) Pancreas
Small intestine

12) Glucose

13) Maltose
Disaccharide

14) Starch
Glycogen

15) Person Z, who ate the maltose, will have a faster rise in blood sugar. The reason for this is that the carbohydrates in a meal must be fully digested to glucose monosaccharide before they can be absorbed into the blood. It takes two digestive enzyme steps to fully digest starch into glucose (Amylase enzyme first digests starch into maltose sugar, then maltase enzyme digests maltose sugar into glucose), whereas it only takes one digestive enzyme step to digest maltose to glucose (Maltase enzyme digests maltose directly into glucose in one step).

16) Peptides
Glycerol and fatty acids

17) a) Will not

b) Will not

c) Will

d) The mucosa of the GI tract will only absorb monomers into the blood. The macromolecules and the short chains of monomoers are too large to be absorbed by the GI tract mucosa.

e) Protease enzyme
Peptides
Peptidase enzyme
Amino acids

f) Amylase enzyme
Maltose
Maltase enzyme
Glucose

18) One purpose of the monomers that are absorbed into our blood stream is to provide fuel for cellular energy. Glucose monosaccharides are one of the most common monomers that are used for energy. The second purpose of the monomers that are absorbed into the body is to provide building blocks for our own macromolecules. Amino acids are one of the most common monomers that is used as a building block for the body's own macromolecules.

19)	Protein	Carbohydrates	Fats
It is first digested into a smaller molecules called	**Peptides**	**Maltose**	**(not digested)**
It is then digested into monomers called	**Amino acids**	**Glucose**	**Glycerol and fatty acids**
Are its monomers a major cell energy source? (Yes/No)	**No**	**Yes**	**Yes**

20)

a) Lipase = From the pancreas

b) Protease = From the stomach and the pancreas

c) Amylase = From the salivary glands (in the mouth) and the pancreas

d) Maltase = From the small intestine

e) Peptidase = From the small intestine

21) Brush boarder enzymes are digestive enzymes made by the small intestine.

22) Ice-cold temperature
Boiling temperature
Acidic pH

23) Yes, boiling does cause digestive enzymes to digest their substrates poorly. This occurs because high temperature denatures (unfolds) enzymes, so they can no longer bind to their substrate molecules.

24) Yes, ice cold temperatures do cause digestive enzymes to digest their substrates poorly. This occurs because low temperature slows down enzymes, so they carry out their chemical reaction on their substrate molecules very slowly.

25) Returning a boiled enzyme to room temperature would not restore its ability to digest substrate molecules well. Boiling denatures enzymes, which makes them permanently unfolded.

26) Returning an ice cold enzyme to room temperature will restore its ability to digest substrate molecules well. Cold temperatures slow enzymes, but do not denature the enzyme. Returning the cold enzyme to body temperature will cause it to speed up to its normal speed again.

27) When we eat fats or oils in out diet, they form fat globules in our GI tract. Fat globules are large groups of triglyceride molecules. Because the globules are so large, lipase digestive enzyme has difficulty digesting the individual triglyceride molecules within the globule. Bile helps in digesting the fats by emulsifying the fat globules. This means that bile breaks apart large globules of fat into much smaller globules. The smaller globules of fat are small enough that lipase enzyme can digest the triglycerides into glycerol and fatty acids.

28) The tubes that contained the most starch were the tubes with the boiled amylase enzyme and with HCl. This is because boiling or adding HCl denatures amylase enzyme. The tube with body temperature amylase enzyme and no HCl had the most maltose, which indicates the most digestion of starch by the emzyme. This shows that amylase enzyme works best at body temperature (not boiling) and at a moderate pH (not an acidic pH).

29) The tube that contained pepsin enzyme and HCl at body temperature had the most digestion. This shows that pepsin enzyme has an acidic (a very low pH) optimum. This is to be expected because the natural environment of pepsin is in the stomach.

30) The HCl helped the pepsin enzyme digestion of protein but the HCl stopped the amylase enzyme digestion of starch. This is to be expected because pepsin is a stomach enzyme and therefore its natural environment is one with an acidic (low) pH, whereas amylase enzyme's natural environments are the oral cavity and the small intestine, both of which have more a more neutral (non-acidic) pH. In other words, acids denature amylase enzyme but not pepsin enzyme.

31) The test tube with lipase enzyme and bile salt had the most rapid fall in pH. The lipase enzyme digests the triglyceride (fat and oil) molecules into glycerol and fatty acids. The fatty acids that are generated by the digestion are what cause the pH in the test tube to fall. The bile salts increase the efficiency of digestion by lipase enzyme by emulsifying the large fat globules into much smaller ones, spreading out the triglycerides and therefore making them more accessible to the lipase enzyme.

32) The explanation was that the enzyme is able to only partially digest the starch in one hour, but the enzyme is able to fully digest the starch in two hours. After one hour, when the starch is partially digested, some starch remains (so a positive starch test will result) but some maltose has been produced (so a positive maltose test will result). After two hours, the starch has been fully digested into maltose, so a negative starch test and a positive maltose test will result.

33) The data from the starch digestion experiment indicate that amylase enzyme works best at neutral (non-acidic) pH, and is denatured at acidic pH. The oral cavity and the small intestine both contain amylase enzyme and have neutral pH, so starch digestion will take place in those two regions of the GI tract. The stomach receives amylase enzyme from the oral cavity when we swallow, but due to the acidic pH of the stomach, this amylase enzyme becomes denatured. Therefore no starch digestion occurs in the stomach. The large intestine receives no starch because starch is fully digested in the small intestine. Therefore no starch digestion occurs in the large intestine.

34) In the protein digestion experiment, it was shown that pepsin enzyme works much more slowly at ice cold temperature than at warmer temperature. This is a general trait of all enzymes: Enzymes are slowed at colder temperatures. Foods that are stored frozen will last longer because the enzymes of bacteria that spoil food are slowed at the cold temperature, whereas if the food is at room temperature, the enzymes of the bacteria work much faster to spoil the food.