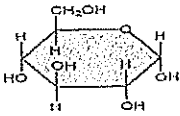
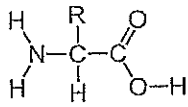
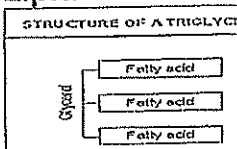
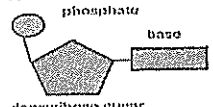


Topic 2: Biochemistry

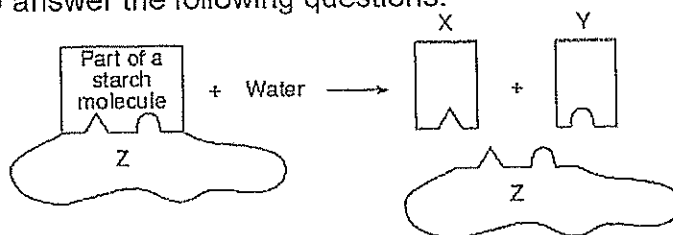
Organic Compounds: Must contain both \_\_\_\_\_ and \_\_\_\_\_

| Organic compound/ structure   | Building block/ subunit            | Examples and functions  |
|---|------------------------------------|---|
| Carbohydrate<br>   | monosaccharides<br>(simple sugars) | Glucose → used in cellular respiration  |
| Protein<br>        | amino acids                        | 20 different amino acids → used in the synthesis of proteins such as enzymes and hormones |
| Lipid<br>          | glycerol and fatty acid            | Phospholipids → make up cell membranes<br>triglycerides → store energy                    |
| Nucleic acid<br> | nucleotides                        | Used in the synthesis of DNA and RNA  |

Enzymes: organic catalysts

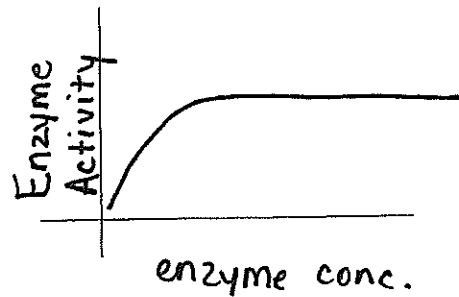
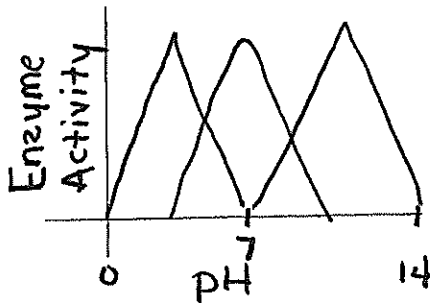
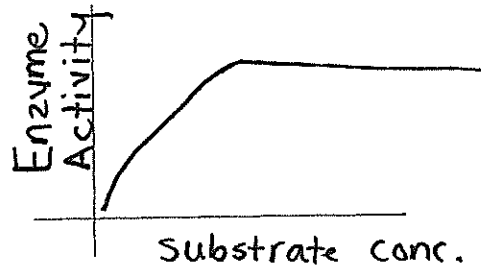
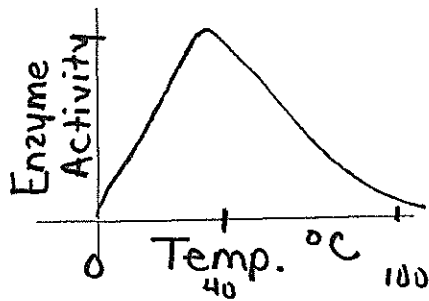
- Not changed or used up during a reaction, can be used over again
- Specific shape, only work on one type of substrate
- Often end in -ase
- Denature: enzyme changes shape at high temperatures

Use the picture below to answer the following questions.



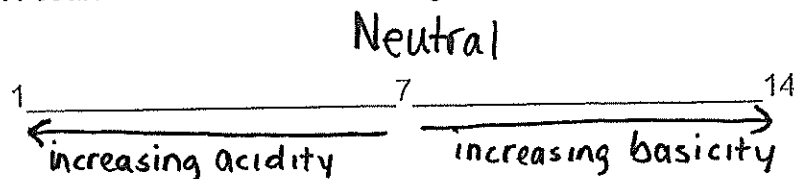
- The enzyme is represent by letter Z
- The products are represented by letters X and Y
- Is this diagram showing synthesis or hydrolysis? hydrolysis
- How did you know? The substrate was broken down

Draw graphs to show the relative rate of enzyme action for each of the factors that affect the rate of enzyme activity.

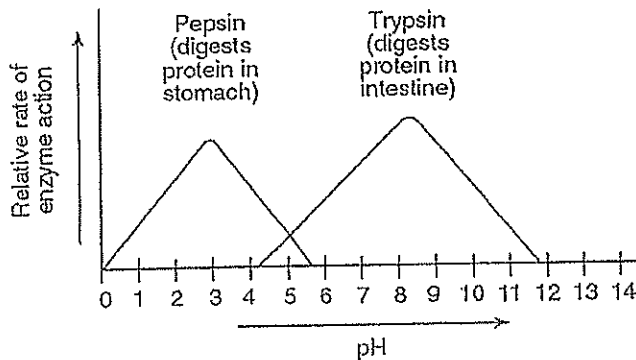


Answer the following questions:

- What is meant by the optimum temperature? Best temp. for the highest enz. activity
- What happens to enzymes at higher temperatures? Activity ↑ from 0-40, then decreases
- What is the optimum temperature for most enzymes in humans? 37°C (body temp.)
- Label the pH scale below with the following terms: base, acid, neutral:



Use the graph below to answer the following questions.



The optimum pH for pepsin is 3 and for trypsin is 8.5.

What happens to the active site of pepsin at a pH of 6?  
It denatures (changes shape)

What happens to enzyme activity of trypsin at a pH of 2?  
The activity stops completely

Dehydration Synthesis and Hydrolysis:

Dehydration Synthesis:

Process that joins monomers together to form polymers  
by releasing water.

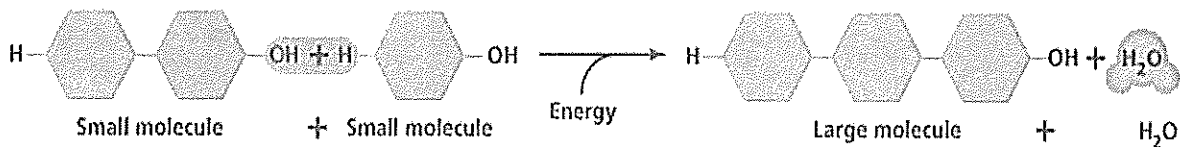
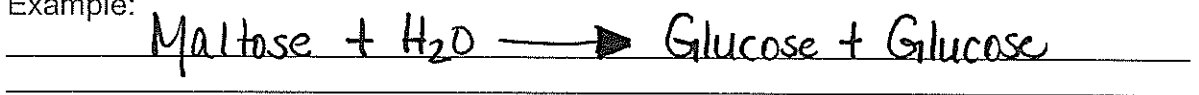
- Example:



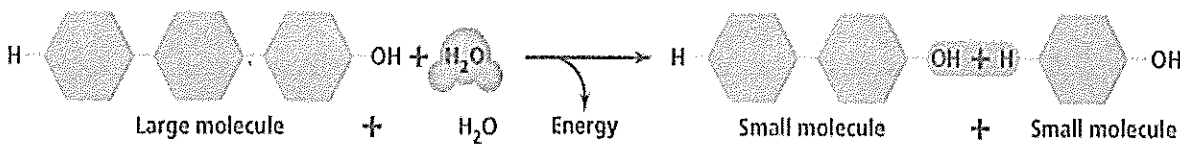
Hydrolysis:

Process that breaks polymers down into simple compounds  
by adding water.

- Example:

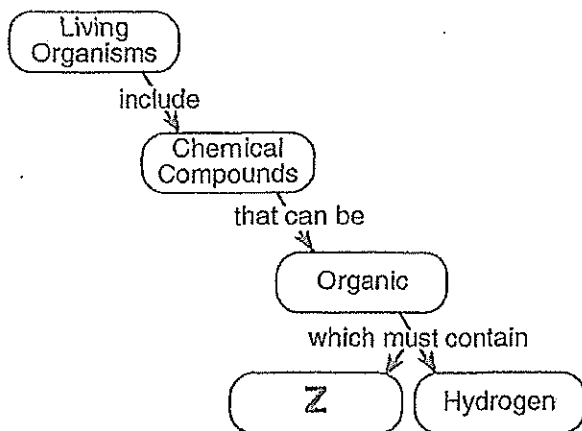


(a) Dehydration synthesis

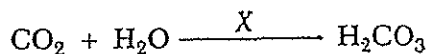


(b) Hydrolysis

- Which elements are present in all organic compounds?
  - hydrogen and oxygen
  - nitrogen and carbon
  - nitrogen and oxygen
  - hydrogen and carbon
- Which substances dissolved in the cytoplasm of an amoeba enable it to carry on life-sustaining activities?
  - inorganic compounds, only
  - organic compounds, only
  - both inorganic and organic compounds
  - neither inorganic nor organic compounds
- In the diagram below, which substance belongs in area Z?

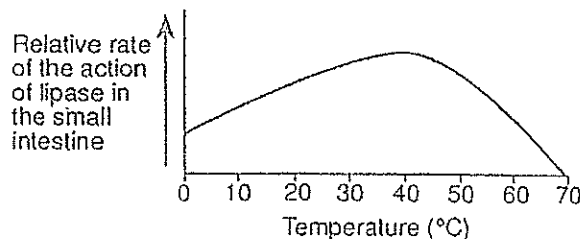


- water
  - oxygen
  - nitrogen
  - carbon
- Which substance is an inorganic compound?
  - water
  - glucose
  - maltase
  - insulin
- Compound X increases the rate of the reaction shown below.

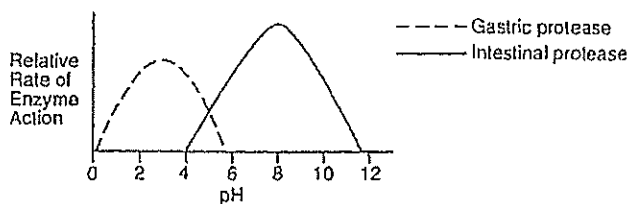


- Compound X is most likely
- an enzyme
    - a lipid molecule
    - an indicator
    - an ADP molecule
  - Which statement best describes enzymes?
    - They slow down the rate of breathing.
    - They are the building blocks of polymers.
    - They speed up the conduction of impulses along a nerve cell.
    - They influence the rate of chemical reactions.

- According to the graph below, at what temperature will the denaturation of lipase begin?

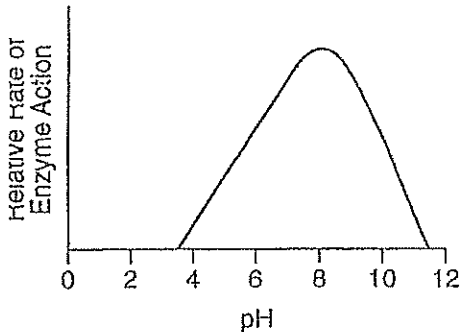
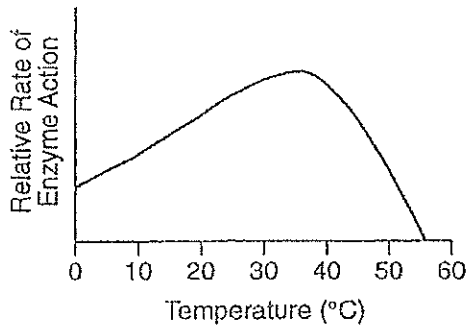


- below 0°C
  - between 0°C and 38°C
  - at 40°C
  - at 68°C
- Base your answer to the following question on the graph below and on your knowledge of biology.



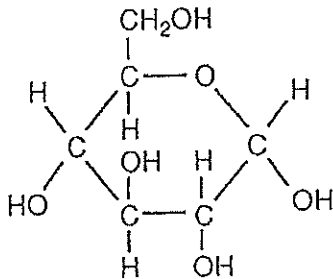
- Which is a true statement about the relationship with their substrates in a single test tube in regards to pH and enzyme action?
  - only gastric protease would be active if the pH of the mixture was basic
  - intestinal protease would be more active than gastric protease at pH 4
  - both enzymes would exhibit some activity at pH 5
  - gastric protease would be more active than intestinal protease at pH 6
- A certain enzyme will hydrolyze egg white but not starch. Which statement best explains this observation?
  - Enzymes are specific in their actions.
  - Starch molecules are too large to be hydrolyzed.
  - Starch is composed of amino acids.
  - Egg white acts as a coenzyme for hydrolysis.
- Which organic compound is correctly matched with the subunit that composes it?
  - maltose—amino acid
  - starch—glucose
  - protein—fatty acid
  - lipid—sucrose
- The process by which glucose is converted to starch is known as
  - protein hydrolysis
  - dehydration synthesis
  - chemical digestion
  - cellular respiration

12. Which statement best describes the enzyme represented in the graphs below?



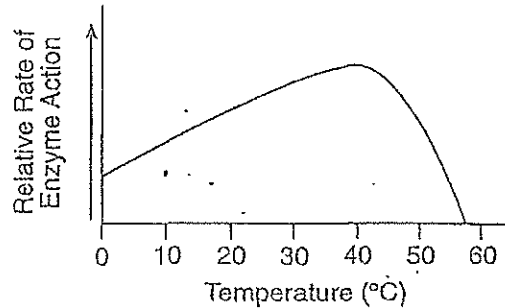
- 1) This enzyme works best at a temperature of 35°C and a pH of 8.
- 2) This enzyme works best at a temperature of 50°C and a pH of 12
- 3) Temperature and pH have no effect on the action of this enzyme.
- 4) This enzyme works best at a temperature above 50°C and a pH above 12.

13. Which compound has the structural formula shown below?



- 1) starch
  - 2) PGAL
  - 3) ATP
  - 4) glucose
14. A disaccharide combines with water to produce two monosaccharides in the process known as
- 1) hydrolysis
  - 2) dehydration synthesis
  - 3) aerobic respiration
  - 4) photosynthesis

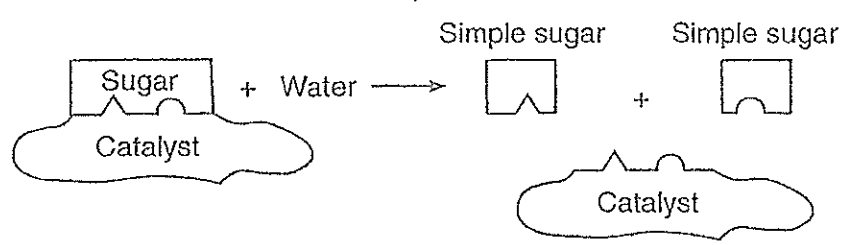
15. Base your answer to the following question on the graph below and on your knowledge of biology.



Which factor most likely accounts for the change in the rate of enzyme action as the temperature increases from 40°C to 58°C?

- 1) Excess acids have been building up, causing the enzyme to become fatigued.
  - 2) Too much substrate is present at these high temperatures.
  - 3) Not enough substrate is present at these high temperatures.
  - 4) The high temperature causes the shape of the enzyme to be altered.
16. Vegetable oils, such as corn oil, belong to which general class of organic substances?
- 1) lipids
  - 2) proteins
  - 3) carbohydrates
  - 4) salts
17. In living organisms, lipids function mainly as
- 1) sources of stored energy and transmitters of genetic information
  - 2) sources of stored energy and components of cellular membranes
  - 3) transmitters of genetic information and catalysts of chemical reactions
  - 4) catalysts of chemical reactions and components of cellular membranes
18. Enzymes are produced as a direct result of which process?
- 1) protein synthesis
  - 2) photosynthesis
  - 3) respiration
  - 4) enzymatic hydrolysis
19. The shape of a protein molecule is influenced by
- 1) whether it is organic or inorganic
  - 2) the sequence of amino acids in it
  - 3) the number of genes found in the nucleus
  - 4) the number of chromosomes in the cell

20. The diagram below illustrates a biochemical process that occurs in organisms.



The substance labeled "catalyst" is also known as

- 1) a hormone
- 2) an enzyme
- 3) an antibody
- 4) an inorganic compound

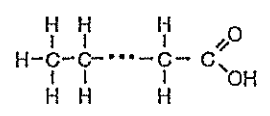
21. Base your answer to the following question on the chart below and on your knowledge of biology.

| Class of Substance | Basic Unit of Structure | One Possible Function                  | Examples    |
|--------------------|-------------------------|--|-------------|
| A                  |                         | B                                      | C           |
| Carbohydrate       | D                       | Structural component of cell walls     | E           |
| F                  | G                       | Structural component of cell membranes | Fats, waxes |
| H                  |                         | Protein synthesis                      | I           |

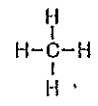
Which belongs in section G ?

1) O=C=O

2)



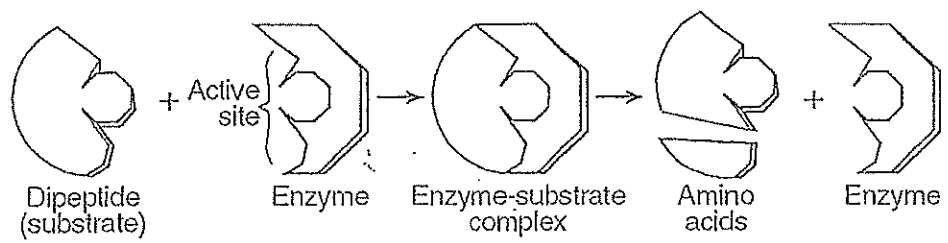
3)



4) H-O-H

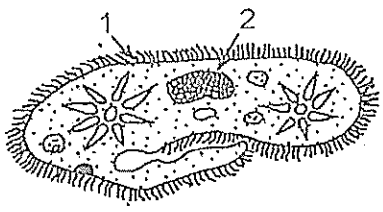
Name: \_\_\_\_\_

22) A process that occurs in the human body is shown in the diagram below.



What would happen if a temperature change caused the shape of the active site to be altered from its optimal shape?

- A) The dipeptide would digest slower or not at all.
  - B) The dipeptide would digest faster.
  - C) The amino acids would combine slower or not at all.
  - D) The amino acids would combine faster.
- 23) The diagram below shows two different structures, 1 and 2, that are present in many single-celled organisms. Structure 1 contains protein A, but not protein B, and structure 2 contains protein B, but not protein A.



Shape determines Function !!!

Which statement is correct concerning protein A and protein B?

- A) Proteins A and B have the same function but a different sequence of bases (A, C, T, and G).
  - B) Proteins A and B have the same function and the same sequence of bases (A, C, T, and G).
  - C) Proteins A and B have different functions and different amino acid chains.
  - D) Proteins A and B have different functions but the same amino acid chains.
- 24) Which statement describes all enzymes?
- A) They affect the rate of chemical reactions.
  - B) They control the transport of materials.
  - C) They absorb oxygen from the environment.
  - D) They provide energy for chemical reactions.
- 25) The diagram below provides some information concerning proteins.



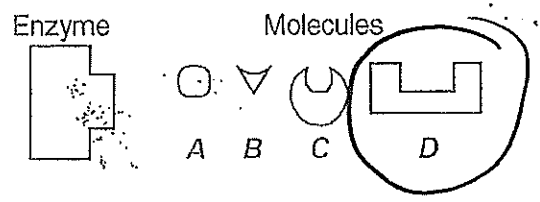
Great 😊 Diagram!

Which phrase is represented by A?

- A) sequence of ATP molecules
  - B) sequence of amino acids
  - C) sequence of simple sugars
  - D) sequence of starch molecules
- 26) A characteristic of hormones and enzymes that allows them to work effectively with other organic molecules is their
- A) small size
  - B) high-energy bonds
  - C) specific shape
  - D) concentration of carbon and hydrogen atoms

Questions 48 through 49 refer to the following:

The diagram below represents a human enzyme and four types of molecules present in a solution in a flask.



27) State what would most likely happen to the rate of reaction if the temperature of the solution in the flask were increased gradually from 10°C to 30°C.

The reaction rate would increase

28) Which molecule would most likely react with the enzyme? [Explain your answer.]

D will react with the enzyme because it has the specific shape

29) Molecules A and B come in contact with the cell membrane of the same cell. Molecule A passes through the membrane readily, but molecule B does not. Which statement could describe molecules A and B?

- A) Molecule A is a protein, and molecule B is a fat.
- B) Molecule A is an amino acid, and molecule B is a simple sugar.
- C) Molecule A is a simple sugar, and molecule B is a starch.
- D) Molecule A is a starch, and molecule B is a simple sugar.

30) Explain how carbohydrates provide energy for life functions.

Carbohydrates are the immediate energy source of cells. Glucose is converted into ATP during cellular respiration

31) Enzyme molecules are affected by changes in conditions within organisms.

Explain how a prolonged, excessively high body temperature during an illness could be fatal to humans. Your answer must include:

- (1) the role of enzymes in a human
- (2) the effect of this high body temperature on enzyme activity
- (3) the reason this high body temperature can result in death

• Enzymes are needed to catalyze reactions in cells  
 • High temps. above 40°C denature enzymes  
 • The altered shape prevents the substrate from fitting with the enzyme

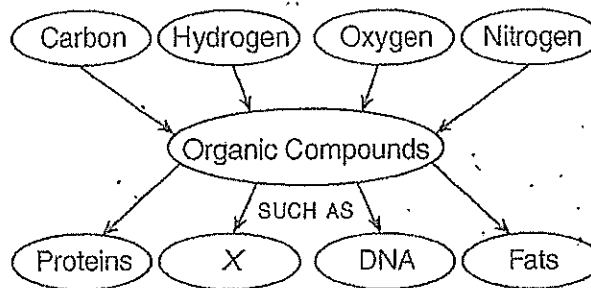
• Without enzymes, metabolic activity stops

32) Which words best complete the lettered blanks in the two sentences below?

Organic compounds, such as proteins and starches, are too (a) 2 to diffuse into cells. Proteins are digested into (b) 2 and starches are digested into (c) 2.

- A) (a) small; (b) amino acids; (c) simple sugars
- B) (a) small; (b) simple sugars; (c) amino acids
- C) (a) large; (b) simple sugars; (c) amino acids
- D) (a) large; (b) amino acids; (c) simple sugars

33) What substance could be represented by the letter X in the diagram below?



- A) carbohydrates
- B) water
- C) ozone
- D) carbon dioxide