

MCAS Review

Chemistry of Life

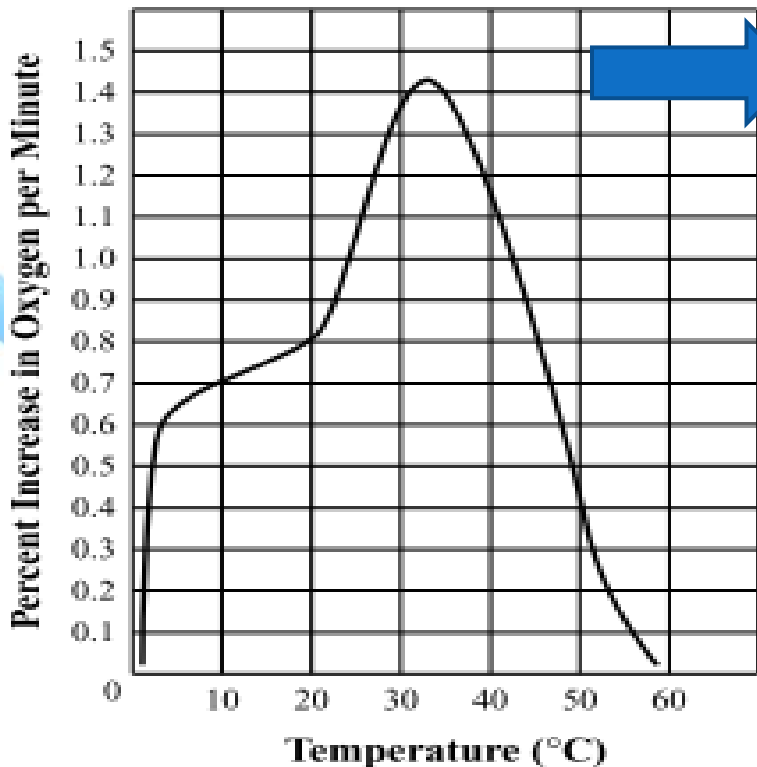
Mr. Lee

Room 320

The graph below shows the rate of activity for the enzyme catalase at different temperatures. Catalase helps convert hydrogen peroxide to oxygen and water. The rate of catalase activity is directly related to the percent increase in oxygen.

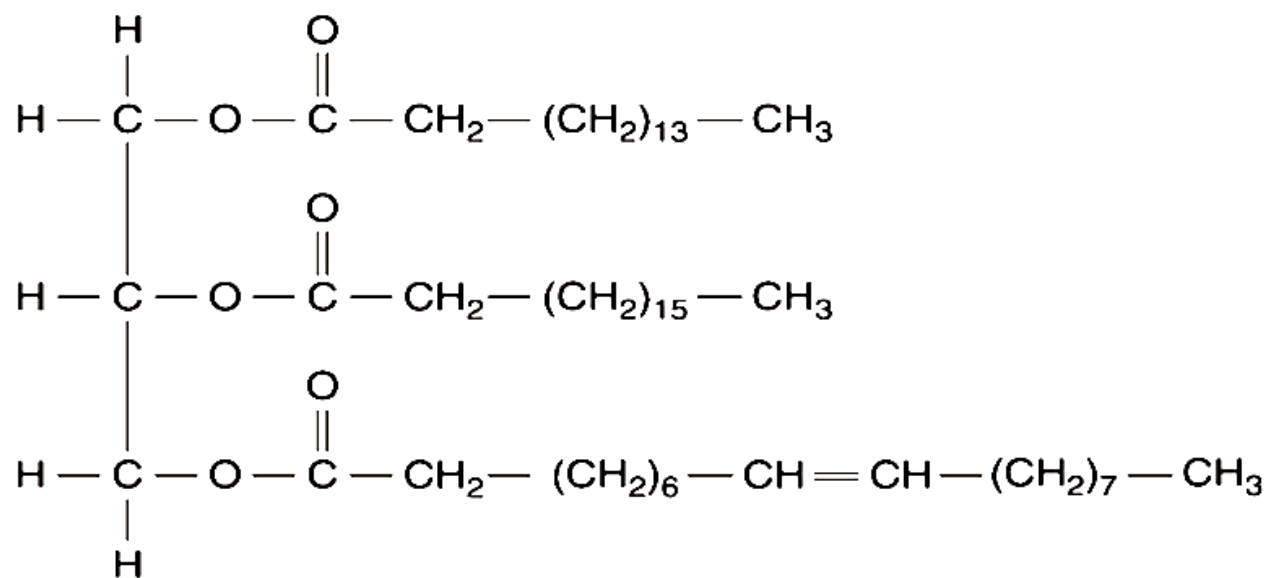
Based on the graph, which of the following conclusions can be made about the functioning of catalase?

Catalase Activity



- A. Catalase works best at 34C.
- B. Catalase is destroyed at 34C.
- C. Catalase cannot function at 51C.
- D. Catalase functions most efficiently at 51C.

The diagram below represents a fat molecule.

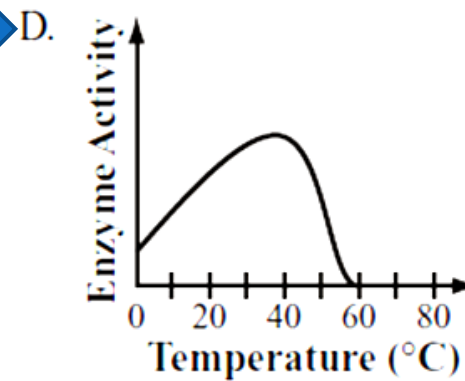
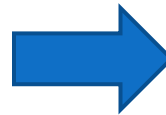
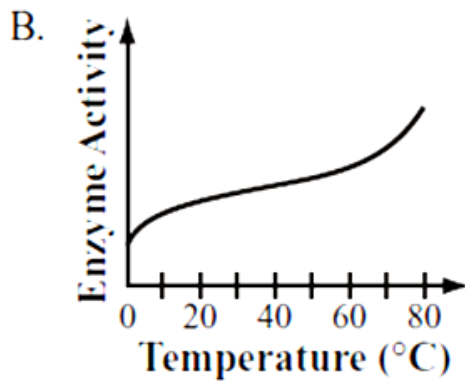
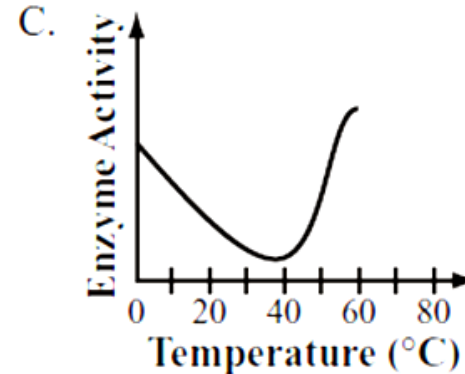
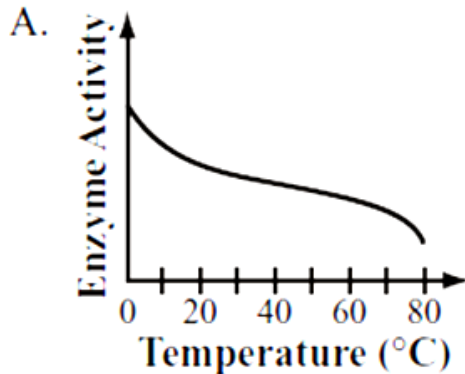


A fat molecule belongs to which category of organic molecules?


- A. proteins
- B. lipids
- C. nucleic acids
- D. carbohydrates

In the human digestive system, the enzyme trypsin acts on proteins. The optimal temperature for the enzyme is approximately 40°C .

Which of the following graphs shows how the activity of the enzyme **most likely** relates to the temperature of the reaction environment?



Which of the following lists of elements contains the most common elements in organic compounds?

- A. calcium, iron, and potassium
-  B. carbon, hydrogen, and oxygen
- C. chlorine, phosphorus, and sodium
- D. copper, magnesium, and sulfur

A teacher displayed some nutrition fact labels for students to examine. Portions of the labels from two different foods are shown below.

Food 1

Nutrition Facts	
Serving Size 51 g	
Amount per Serving	
Calories 50	Calories from Fat 10
Total Fat 1 g	
Cholesterol 0.02 g	
Total Carbohydrate 2 g	
Protein 8 g	

Food 2

Nutrition Facts	
Serving Size 57 g	
Amount per Serving	
Calories 30	Calories from Fat 0
Total Fat 0 g	
Cholesterol 0 g	
Total Carbohydrate 8 g	
Protein 0 g	

- Identify the primary type of molecule found in food 1 and describe the molecular structure of this type of molecule.
- Identify the primary type of molecule found in food 2 and describe the molecular structure of this type of molecule.
- The teacher told the students that one of the foods is a type of fruit and the other is a type of meat. Identify which food is the fruit and which is the meat. Give evidence to support your answer.

The molecule ATP is composed of elements commonly found in organic molecules. Which of the following is one of these elements?

A. aluminum

B. calcium

 C. phosphorus

D. tin

The illustration below shows a Siamese cat.




In Siamese cats, an enzyme determines the color of the fur. On the cooler places of the body, the enzyme causes darker fur. On the warmer parts of the body, the enzyme does not function.

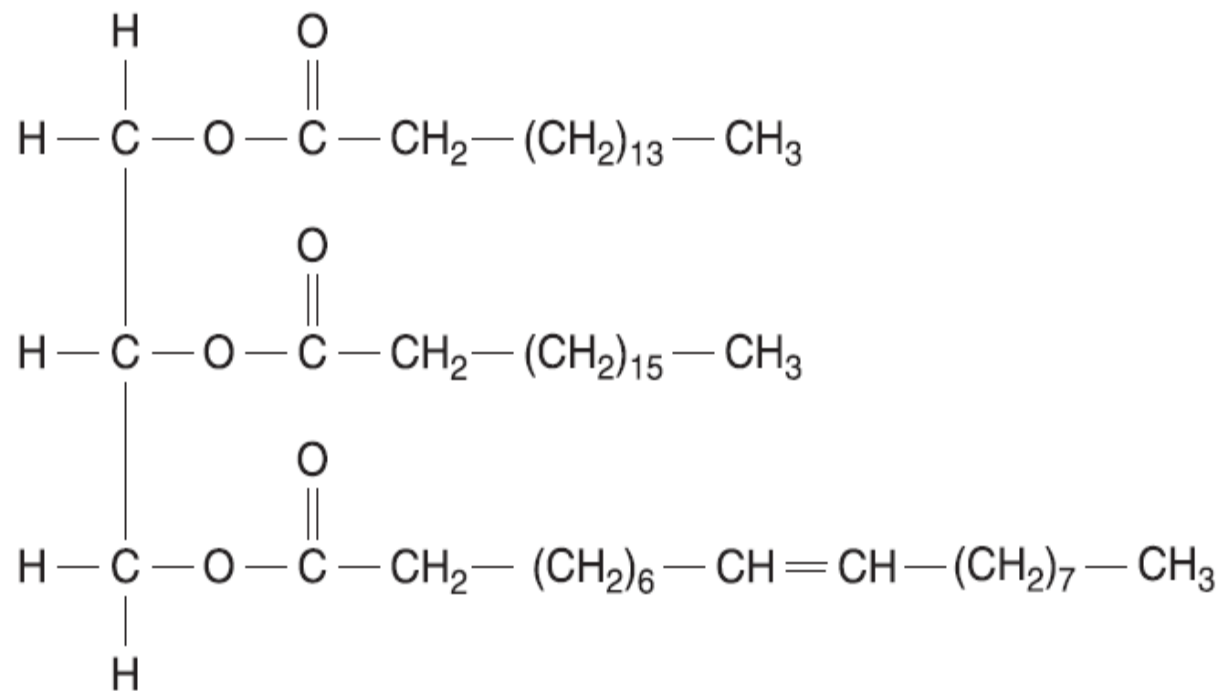
Which of the following statements best explains how temperature affects this enzyme?

- A. Cooler temperatures denature the enzyme.
- B. Cooler temperatures cause more enzyme production.
- C. The enzyme is active in a specific temperature range.
- D. Heat allows the enzyme to break down white pigment.


Which of the following is a central role of carbon in the chemistry of living organisms?

- A. Carbon can only bond with other carbon atoms.
- B. Carbon is a solvent that breaks chemical bonds.
- C. Carbon readily forms ionic bonds that separate easily.
-  D. Carbon can form many types of molecules with covalent bonds.


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If scientists search other planets for possible life, they are likely to focus on the presence of molecules containing which of the following elements?

-  A. carbon
- B. iron
- C. potassium
- D. sodium

Many land plants store energy in starch. When energy is needed, the starch molecules can be broken down quickly. This chemical reaction produces which of the following?

- A. amino acids
- B. lipids
-  C. monosaccharides
- D. RNA chains

Many plants have waxy coatings on some surfaces. This coating reduces water loss because it is not water-permeable. This waxy coating is which of the following types of organic molecule?

A. carbohydrate



B. lipid

C. nucleic acid

D. protein


Which element is the main component of all organic molecules?



- A. carbon
- B. nitrogen
- C. potassium
- D. sodium


One category of organic compounds contains molecules composed of long hydrocarbon chains. The hydrocarbon chains may be saturated or unsaturated.

Which of the following categories of organic compounds contains these molecules?


- A. carbohydrates
-  B. lipids
- C. nucleic acids
- D. proteins

Some bacteria contain a substance called nitrogenase. Nitrogenase catalyzes the chemical reaction that converts atmospheric nitrogen (N_2) into ammonia (NH_3).


Nitrogenase is an example of which of the following?

- A. a sugar
-  B. an enzyme
- C. a nucleotide
- D. an amino acid

Which of the following categories of organic molecules is correctly paired with one of its functions?

- A. nucleic acids—digest dead cells
- B. lipids—give quick energy to cells
- C. carbohydrates—store genetic information
-  D. proteins—provide structure in skin, hair, and nails

Ovalbumin is a protein found in eggs. Which of the following **best** describes the molecular structure of ovalbumin?

- A. a group of six carbon atoms joined in a ring
-  B. a chain of amino acids folded and twisted into a molecule
- C. a set of three fatty acids attached to a molecule of glycerol
- D. a sequence of nitrogenous bases attached to a sugar-phosphate backbone

Milk is an important part of many people's diets. When the word *milk* is mentioned, most people think of dairy milk derived from cows. Many people, however, cannot drink dairy milk because of lactose intolerance. Individuals with this condition are unable to digest a component in the milk called lactose. Lactose is the sugar in dairy milk. It is a disaccharide made from the sugars glucose and galactose. Lactose-intolerant individuals lack the enzyme lactase, which is needed for the digestion of lactose sugar.

Many lactose-intolerant individuals drink soymilk instead of dairy milk. Soymilk is produced from soybeans (the seeds of the soybean plant) and is a nutritious substitute for dairy milk. Soymilk contains protein, calcium, and other essential nutrients just as dairy milk does.

The table below compares some of the nutrition information for a serving of dairy milk and a serving of soymilk.

Dairy Milk and Soymilk Nutrition Information

	Whole Dairy Milk		Unsweetened Soymilk	
	Amount per Serving	% Daily Value	Amount per Serving	% Daily Value
Serving size	8 oz. (240 mL)		8 oz. (240 mL)	
Calories	150		90	
Total fat	8 g	12%	4 g	6%
Saturated fat	5 g	25%	0.5 g	3%
Cholesterol	35 mg	11%	0 mg	0%
Sodium	125 mg	5%	85 mg	4%
Total carbohydrates	12 g	4%	4 g	1%
Sugars	12 g		1 g	
Protein	8 g	16%	7 g	14%
Vitamin A		6%		10%
Vitamin C		10%		0%
Vitamin D		25%		30%
Calcium		30%		30%
Iron		0%		6%

When lactose is digested by the human body, each lactose molecule is broken down into smaller molecules. To which of the following categories of molecules do these smaller molecules belong?

- A. amino acids
- B. monosaccharides
- C. nucleic acids
- D. polypeptides

Unlike dairy milk, soymilk provides some of the body's daily requirement for iron. In which of the following functions of the human body does iron serve a primary role?

- A. conducting nerve impulses
- B. strengthening bone structure
- C. causing muscle fibers to contract
- D. helping transport oxygen in the blood

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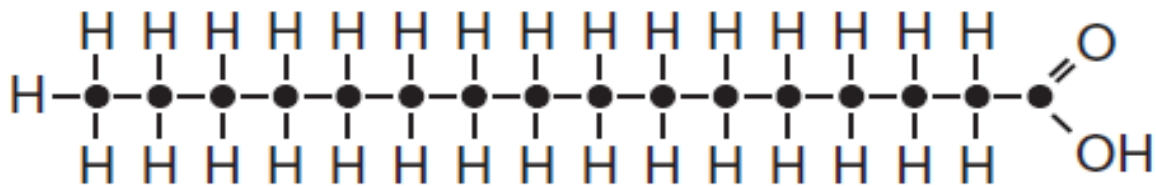
Which type of milk, per serving, will theoretically yield a greater amount of ATP in the human body, and what is the reason for this?

- A. dairy milk, because it contains vitamin C
- B. soymilk, because it contains no cholesterol
- C. dairy milk, because it has larger amounts of sugar and fat
- D. soymilk, because it has larger amounts of vitamins A and D

Individuals with one form of lactose intolerance do not produce the enzyme lactase because the gene coding for the production of lactase is shut off in their cells. This means that which of the following processes does **not** occur for the gene?

- A. hydrogenation
- B. mutation
- C. replication
- D. transcription

13 A diagram of an organic molecule is below.



Which element is found at the positions marked by the dots (●) in the molecule?




- A. carbon
- B. nitrogen
- C. phosphorus
- D. sulfur

Students in a biology laboratory are monitoring the rate at which hydrogen peroxide breaks down to produce water and oxygen gas. They begin monitoring a sample of hydrogen peroxide and then add catalase, an enzyme that speeds up its breakdown. Their data are shown in the table below.


Time (min)	Rate of Hydrogen Peroxide Breakdown (molecules per min)
0.0	0
0.5	0.030
1.0	0.032
1.5	4,970,000
2.0	5,001,000
2.5	4,985,300
3.0	5,021,700

Based on the data in this table, during which of the following time periods did the students add the catalase to the hydrogen peroxide?

- A. between 0.0 and 0.5 min
-  B. between 1.0 and 1.5 min
- C. between 2.0 and 2.5 min
- D. between 2.5 and 3.0 min

Some bacteria live in hot springs. Their cells contain enzymes that function best at temperatures of 70°C or higher.

At a temperature of 50°C , how will the enzymes in these bacterial cells **most likely** be affected?


- A. The enzymes will be destroyed by lysosomes.
- B. The enzymes will lose their bond structure and fall apart.
- C. The enzymes will require less energy to function than at 70°C .
-  D. The enzymes will not increase the rate of reactions as much as they would at 70°C .

The table below shows the elemental composition of three different types of organisms.

Elemental Composition of Selected Organisms (percent by weight)

Element	Human	Alfalfa	<i>E. coli</i> Bacterium
O	65.0	77.9	73.7
C	18.5	11.3	12.1
H	9.5	8.7	9.9
X	3.3	0.8	3.0
P	1.0	0.7	0.6
S	0.3	0.1	0.3
Total	97.6%	99.5%	99.6%

The X in the table represents which of the following elements?

- A. calcium (Ca)
- B. iron (Fe)
-  C. nitrogen (N)
- D. sodium (Na)

bromthymol blue (a chemical indicator that changes color from blue to yellow as the level of carbon dioxide in a solution increases)

The class sets up an experiment with the four flasks as shown.

Flask 1: 100 mL water, 1 mL bromthymol blue, plant

Flask 2: 100 mL water, 1 mL bromthymol blue, 2 small fish

Flask 3: 100 mL water, 1 mL bromthymol blue, 2 small fish, plant

Flask 4: 100 mL water, 1 mL bromthymol blue



Flask 1



Flask 2



Flask 3



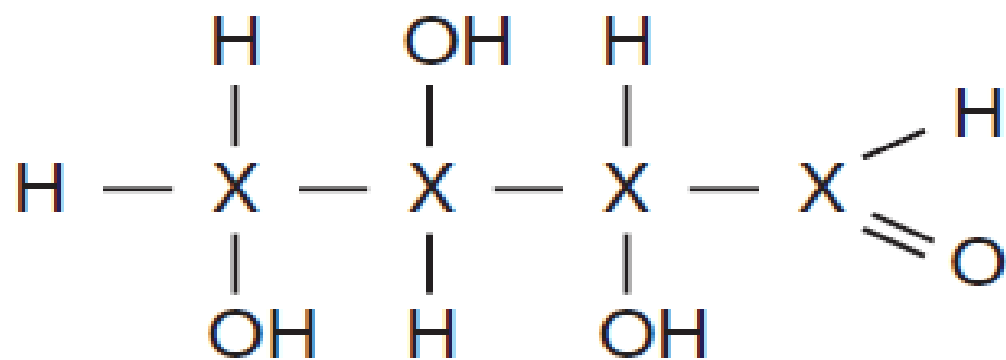
Flask 4

All four flasks are stoppered and placed under the floodlight.


a. What color would the solution in **each** flask be after a few hours?

b. Explain how the processes that have occurred in **each** flask result in the observed color of the bromthymol blue solutions.

The structure of an organic molecule is represented below.



In this organic molecule, which element is identified by each X?

- A. iron
-  B. carbon
- C. sodium
- D. phosphorus