



أكاديمية أجيال المستقبل

مرخصة من قبل دولة الإمارات العربية المتحدة

Grade 9 Advance **BIOLOGY**

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2026

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Revision

Lesson 1 Chemical Reactions:

1	Describe the function of enzymes as biological catalysts and their importance in living organisms	Figure (18)	16
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Activation energy: minimum amount of energy needed for reactants to form products in a chemical reaction

- **Exothermic reactions:** energy is released. As a result, the energy of the product is lower than the energy of the reactants.
- **Endothermic reactions:** energy is absorbed. As a result, the energy of the product is higher than the energy of the reactants

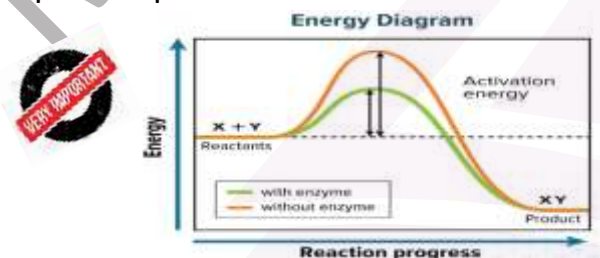


Catalyst: substance that Speeds up the chemical reaction

Enzyme: protein that speeds up a chemical reaction in a biological process (داخل الجسم)

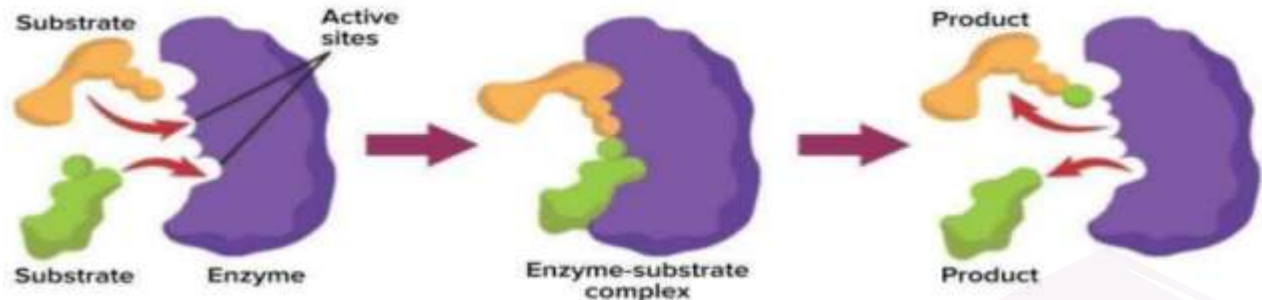
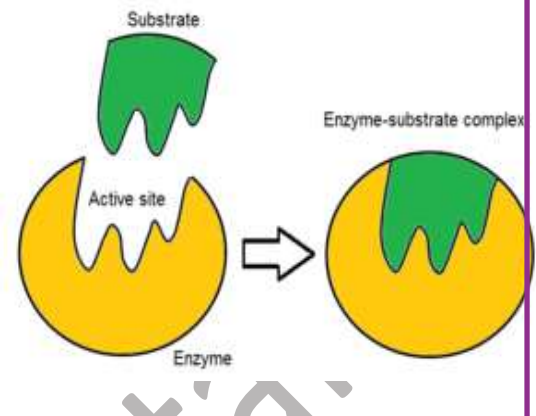
Catalyst & (Enzyme) Functions:

- 1- lowers the activation energy needed to start a chemical reaction
- 2- Speeds up the chemical reaction



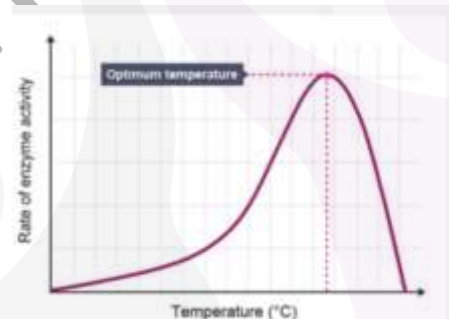
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- **Substrate:** reactant that binds to an enzyme
- **Active site:** location where a substrate binds on an enzyme
 - ✓ After Substrate-enzyme binding, Enzyme substrate complex is formed
 - ✓ Then Product is released



Remember that:

- ✓ **Inhibitors:** can bind to an enzyme's active site, preventing the substrate from binding to the enzyme, and slowing the rate of reaction
- ✓ Also temperature and PH can affect the enzyme Activity
(اقصى قدره للتحمل If they exceeded the optimum)



- As the temperature increases the rate of enzyme increase till it reaches optimum then if it increased more therefore denaturation occurs that decreases the activity of enzyme.
- While change in pH can alter the shape of enzyme activity

Importance in living Organism

Digestion of food begins in the mouth when **amylase** (enzyme) speeds the breakdown of amylose, one of the components of **starch**. **Lipase** breaks down **fats** and **protease** breaks down **proteins**. **Photosynthesis and cellular respiration** provide energy for the cell with the help of enzymes

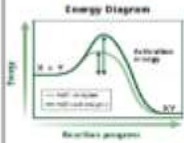
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Previous Exams Questions اسئلة الاعوام الماضية

The minimum amount of energy needed for a chemical reaction is called _____

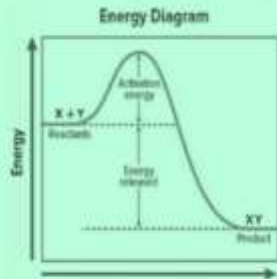
- A) product threshold
- B) absorbent energy
- C) principle mass
- D) **activation energy**

How can enzymes benefit chemical reactions, as shown in this energy diagram?



- A) **Lowering activation energy**
- B) raising activation energy
- C) slowing reactions
- D) increasing the amount of product

Which statement is true regarding this energy diagram?



- a. It shows an endothermic reaction
- b. **It shows an exothermic reaction.**
- c. Reactant and product energy are equal
- d. Product energy is higher than reactant energy

Based on the diagram below, which number represents the energy absorbed during the chemical reaction?



استناداً إلى المخطط أدناه، أي رقم يمثل الطاقة الممتصة خلال التفاعل الكيميائي؟



Explain the effect of extreme conditions on the activity of enzymes?
(Final writing Exam 2022)

Answer:

- As the temperature increases the rate of enzyme increase till it reaches optimum then if it increased more therefore denaturation occurs that decreases the activity of enzyme.
- While change in pH can alter the shape of enzyme activity

13) Why is the active site of an enzyme important to enzyme activity?

- ☐ It raises the activation energy of a reaction.
- ☐ It allows the enzyme to interact with a large variety of substrates.
- ☐ It allows the enzyme to catalyze very specific reactions.
- ☐ It allows an endothermic reaction to run as an exothermic reaction.

Correct Answer

It allows the enzyme to catalyze very specific reactions.

Q5. Which of the following is a substance that lowers the activation energy?

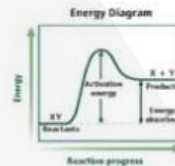
- a. An anion
- b. A reactant
- c. **A catalyst**
- d. A substrate

What is the function of the enzyme-substrate complex?

- A) Destroy the enzyme
- B) Prevent bondage at the active site
- C) Stop chemical reactions
- D) **Break and forming chemical bonds**

What kind of chemical reaction does this energy diagram show?

- A) Exothermic
- B) **Endothermic**
- C) Ionic
- D) Mass creating



Which is true about enzymes?

- a) They act on nonspecific, randomly chosen substrates.
- b) After a reaction, they cannot be reused.
- c) **They can speed up metabolic processes in the body.**
- d) They cannot change shape.

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Important:

Chemical reaction: process by which atoms or groups of atoms in substances are reorganized into different substances



Reactant Mass = Product Mass



LAW of Conservation of Mass:

The number of atoms of each element on the reactant side must equal the number of Atoms of the same element on the product side

Matter cannot be created or destroyed in chemical reactions.

• Therefore, mass must balance in all chemical equations.

Which statement is true of chemical equations?

Learning Objectives Covered

A 111

- المعادلة الكيميائية هي عبارة عن معادلة رياضية.
- Reactant are on the right side of the arrow and products are on the left side of the arrow.
- المعادلة الكيميائية هي عبارة عن معادلة رياضية.
- Products have fewer atoms than reactants.
- المعادلة الكيميائية هي عبارة عن معادلة رياضية.
- Reactants have fewer atoms than products.
- المعادلة الكيميائية هي عبارة عن معادلة رياضية.
- The number of atoms of each element on the reactant side is equal to the number of atoms of the same element on the product side.

Complete the following chemical equation so it is balanced.

أكمل المعادلة الكيميائية التالية بحيث تكون متوازنة.



- 6 H₂O
- 12 H₂O
- 3 H₂O
- H₂O

which of the following are bonds broken and new bonds formed?

أي من المعادلات التالية تنطبق على المعادلات الكيميائية؟

- المعادلة الكيميائية
- المعادلة
- المعادلة
- المعادلة الكيميائية

A chemical reaction is a process by which atoms or groups of atoms in substances are

المعادلة الكيميائية هي عملية تكون من خلالها التفاعل أو مجموعات الذرات الموجودة في المواد

- تتحد مع مواد أخرى
- Divided in other substances.
- تتحد مع مواد أخرى
- limited by the loss of protons
- تتحد مع مواد أخرى
- Mixed together with atoms in other substances
- تتحد مع مواد أخرى
- Recombined as different substances.

Which statement is true of chemical equations?

أي من العبارات التالية تنطبق على المعادلات الكيميائية؟

- عدد ذرات المتفاعلات أقل من عدد ذرات النواتج
- Reactants have fewer atoms than products
- عدد ذرات كل عنصر في المتفاعلات يساوي عدد ذرات العنصر نفسه في النواتج
- The number of atoms of each element on the reactant side is equal to the number of atoms of the same element on the product side
- المتفاعلات على يمين السهم والناتج على يسار السهم
- Reactants are on the right side of the arrow and products are on the left side of the arrow
- عدد ذرات النواتج أقل من عدد ذرات المتفاعلات
- Products have fewer atoms than reactants

Which statement is true of chemical equations?

أي من العبارات التالية تنطبق على المعادلات الكيميائية؟

- المتفاعلات على اليمين
- Reactants are on the right.
- الناتج على اليسار
- Products are on the right
- عدد ذرات النواتج أقل من عدد ذرات المتفاعلات
- Products have fewer atoms than reactants
- عدد ذرات المتفاعلات أقل من عدد النواتج
- Reactants have fewer atoms than products

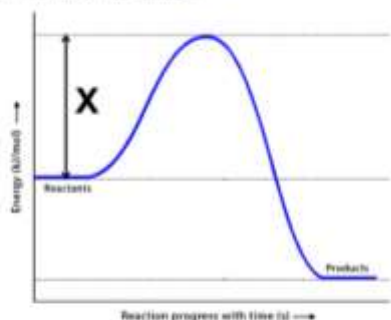
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Use the graph below to answer questions 1 and 2.



1. What does the arrow marked with the letter X show?

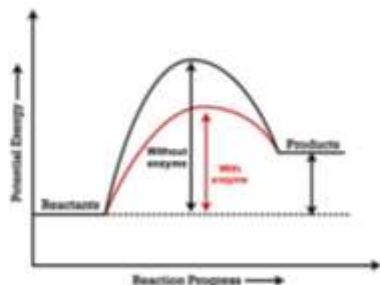
- ☒ A. The activation energy
- ☐ B. The free energy
- ☐ C. The lost energy
- ☐ D. The reactant energy

2. Which of the following is the correct definition of the energy labeled with the letter X?

- ☐ A. The free energy change, which determines the spontaneity of the reaction
- ☒ B. The minimum energy required to start the reaction
- ☐ C. The potential energy of the products
- ☐ D. The total energy change of the reaction

3. What is the main role of enzymes in living organisms?

- ☐ A. Enzymes build new cells by joining atoms together
- ☐ B. Enzymes provide energy for the cell to work
- ☒ C. Enzymes speed up chemical reactions without being used up
- ☐ D. Enzymes store information needed for growth



4. Which of the following correctly describes how the presence of the enzyme affects the reaction?

- ☐ A. The enzyme changes the equilibrium position of the reaction
- ☒ B. The enzyme decreases the activation energy required for the reaction to proceed
- ☐ C. The enzyme increases the overall energy change of the reaction
- ☐ D. The enzyme provides additional energy to the reactants, making the reaction more

5. The graph shows an _____ reaction since a net amount of energy is _____.

- ☒ A. endothermic absorbed
- ☐ B. endothermic released
- ☐ C. exothermic absorbed
- ☐ D. exothermic released

6. Which part of the enzyme binds with the substrate to help the reaction happen?

- ☒ A. The active site
- ☐ B. The energy site
- ☐ C. The product site
- ☐ D. The reaction center

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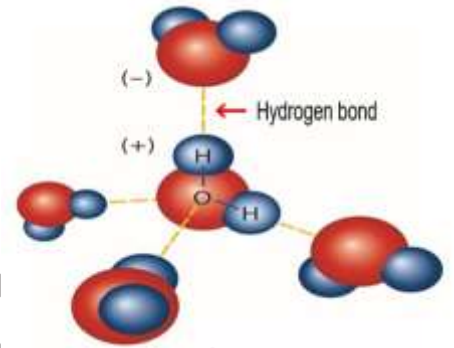
Lesson 3 Water

2

Compare the properties of water

Remember that:

- Water molecules are polar molecules
- Hydrogen bond attract water molecules together



Unique properties of water affects the biological process

- 1- Water are excellent solvents as water is polar.
- 2- Water is **cohesive** due to Hydrogen bond cause water to stay close to each other and be so it can be transported to all cells.
- 3- Water has high heat capacity due to hydrogen bond that help organism to maintain homeostasis (balance).
- 4- Buffer cells for high acidic and high basic substances to maintain homeostasis

- 1- **Buffers:** are mixtures that can react with acids or bases to keep the pH within a certain range (It is able to neutralize small amounts of added acid or base)

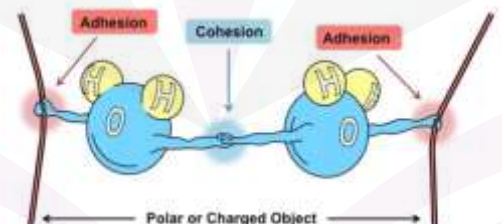
Note that: Water is Buffer

- **How antacids مضاد الحموضة work?**
By neutralizing the acid in the stomach.

Cohesion and Adhesion:

Cohesion: attraction between molecules of same Substance. (Water likes to stick to itself)

Adhesion: attraction between molecules of different Substance (water likes to stick to other things)



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الذي يربط جزيئات الماء مع بعضها

hydrogen bond الرابطة الهيدروجينية ✓

ionic bond الرابطة الأيونية

chemical reaction التفاعل الكيميائي

H⁺ البروتون

Q. Which statement is not true about pure water?

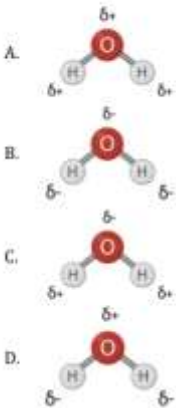
- ☐ A) It is adhesive and cohesive due to hydrogen bonds.
- ☐ B) It is a good solvent.
- ☐ C) It is composed of ionic bonds.
- ☐ D) It is composed of polar molecules.

Q. Identify which properties of water make it a compound necessary for life to exist on our planet. Select all that apply.

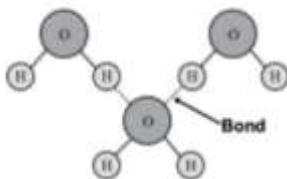
- ☐ A) It is adhesive and cohesive.
- ☐ B) It is composed of three atoms.
- ☐ C) It is a polar molecule capable of forming hydrogen bonds.

- ☐ D) Its molecular weight is 18.
- ☐ E) Its solid form is less dense than its liquid form, ice floats.
- ☐ F) It is an excellent solvent.

15. Which of the following models shows the correct polarity of water?



17. Which of the following is the name of the bond indicated by the arrow in the diagram below?



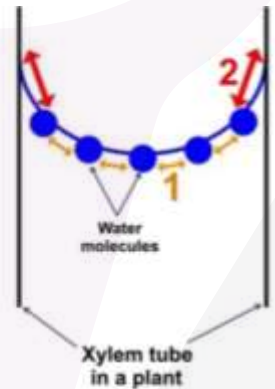
- ☐ A) Covalent bond
- ☐ B) Hydrogen bond
- ☐ C) Ionic bond
- ☐ D) Metallic bond

Q. Which of the following is not a property of water?

- ☐ A) It is adhesive.
- ☐ B) It is cohesive.
- ☐ C) It is a good solvent.
- ☐ D) It combusts.

19. A student places a drop of water on a clean glass slide and notices that the drop holds together in a dome shape but also spreads slightly along the surface. Which of the following **BEST** explains this observation

- ☒ A. Cohesion causes water molecules to stick to each other, while adhesion causes them to stick to the glass
- B. The cohesive forces pull water molecules apart, while adhesion keeps them from moving
- C. Water molecules repel each other due to their negative charges
- D. Water sticks to the glass because of cohesion and forms a dome shape because of adhesion



26. Identify the names of the two water properties labeled 1 and 2.

- 1 is cohesion.
- 2 is adhesion.

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Difference between Acids and Bases

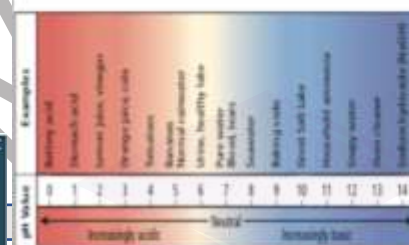
Acids	Bases
Acid gives off hydrogen ions when dissolved in water.	Bases give off hydroxyl ion when dissolved in water.
It turns blue colour litmus paper into red.	It turns red colour litmus paper into blue.
It has a sour taste.	It has bitter taste and soapy to touch.
Its pH value ranges from 1 to 7.	Its pH value ranges from 7 to 14.

Q. What is a base?

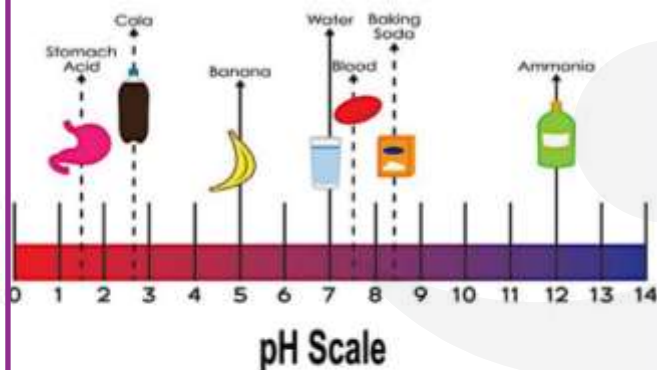
- ☐ A) a substance that releases hydroxide ions (OH^-) into solution
☐ B) a substance that quenches chemical reactions
☐ C) a substance that releases hydrogen ions (H^+) into solution
☐ D) a substance that decreases pH

A(n) **base** is a substance that produces hydroxide ions (OH^-) in water, while a(n) **acid** produces hydrogen ions (H^+) in water.

Which statement is true based on this scale?



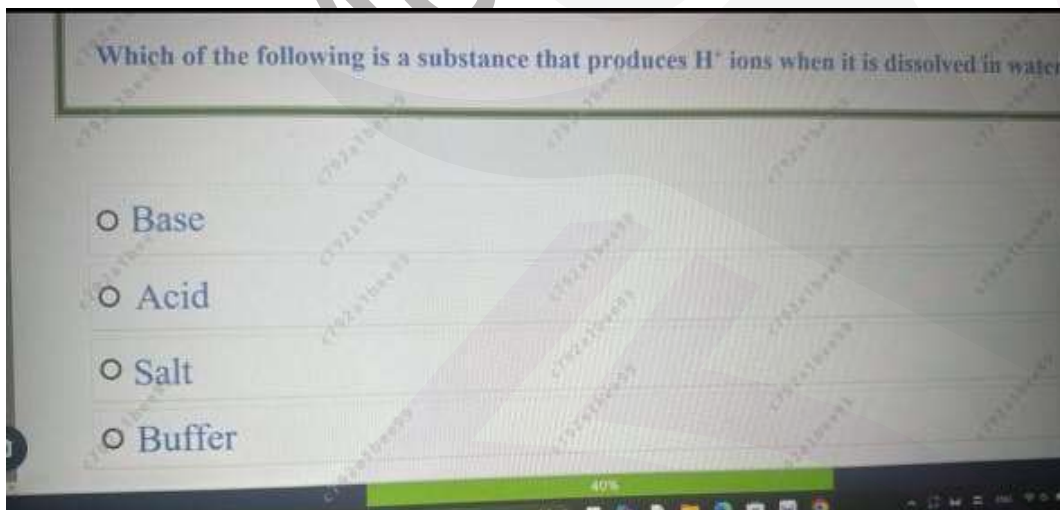
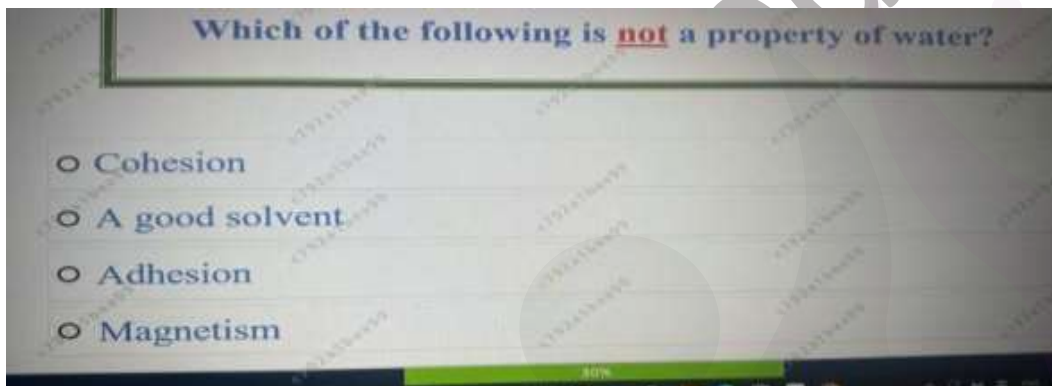
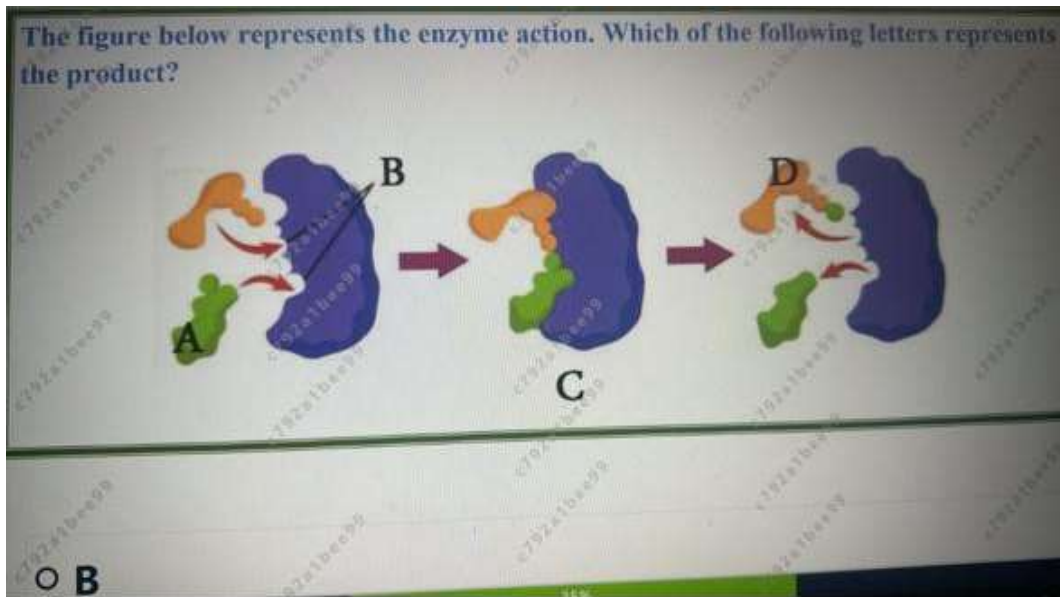
- A) Seawater has a higher concentration of hydrogen than tomatoes.
 B) Tomatoes have a higher concentration of hydrogen than seawater.
 C) Blood has no hydrogen ions.
 D) Household ammonia is neutral.



30. Complete the table below to identify the type of each listed substance. (KPI 1.2.6)

Substance	Type (acidic, basic, neutral)
Blood	Basic
Cola	Acidic
Banana	Acidic
Ammonia	Basic
Water	Neutral

Last year exam 2024



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