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1.2

1	BIO.3.1.02.022 Identify examples of chemical reactions that support main functions of living organisms where reactants and products rearrange to form ATP, ADP and inorganic phosphate	Information from text	11

- **A chemical reaction:** is the process by which atoms or groups of atoms in substances are reorganized into different substances.

Two types of changes







Physical change

occurs when matter changes its physical properties but not its chemical composition.



example: chopping wood

Chemical change

occurs whenever matter changes into an entirely new substance. The new substance has different chemical properties.

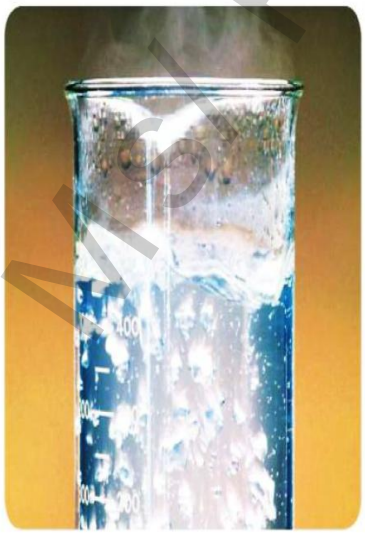


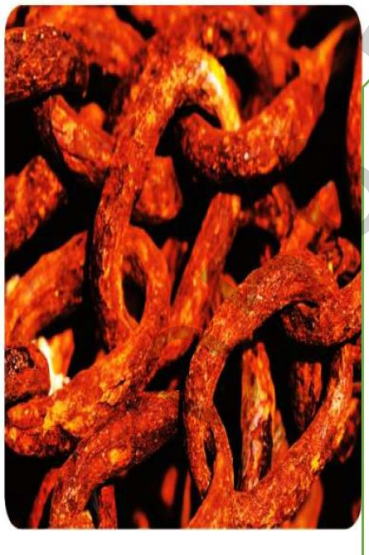
example: burning wood











Evidence that a chemical reaction occurred:

1/ Heat production.

2/ Light production.

3/ New gas.

4/ New liquid.

5/ A new solid.

2	BIO.3.1.02.022 Identify examples of chemical reactions that support main functions of living organisms where reactants and products rearrange to form ATP, ADP and inorganic phosphate	Information from text	12
		Demonstrate Undertanding: Question 1	17

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Chemical equations:-

- ***Reactants:*** are the starting substances, on the left side of the arrow.
- ***Products:*** are the substances formed during the reaction, on the right side of the arrow.

Chemical Equations: mass is conserved

Reactants ⟶ Products

$2\,Na + Cl_2 \longrightarrow 2\,NaCl$

Reactants → Products

$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$

➢ Glucose and oxygen react to form carbon dioxide and water.

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.

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

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Demonstrate Understanding

1. **Identify** the parts of this chemical reaction: $A + B \rightarrow AB$.

Reactants → Products

13	BIO.3.1.02.031 Collect data on the rates of reactions (catabolism and anabolism) with and without the presence of enzymes, and build charts and graphs to represent these data and compare the rates of reactions of different enzymes	"Get it?" question	13
		Figure 14	13

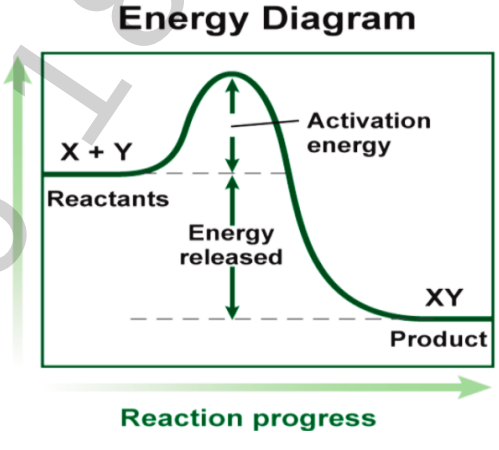
Get It?

Summarize the meaning of the term activation energy.

The activation energy

- ***The activation energy:*** **is the minimum amount of energy needed for reactants to form products in a chemical reaction.**
- ***Reason: Some interactions rarely occur.***

- Because it requires a very large amount of activation energy.



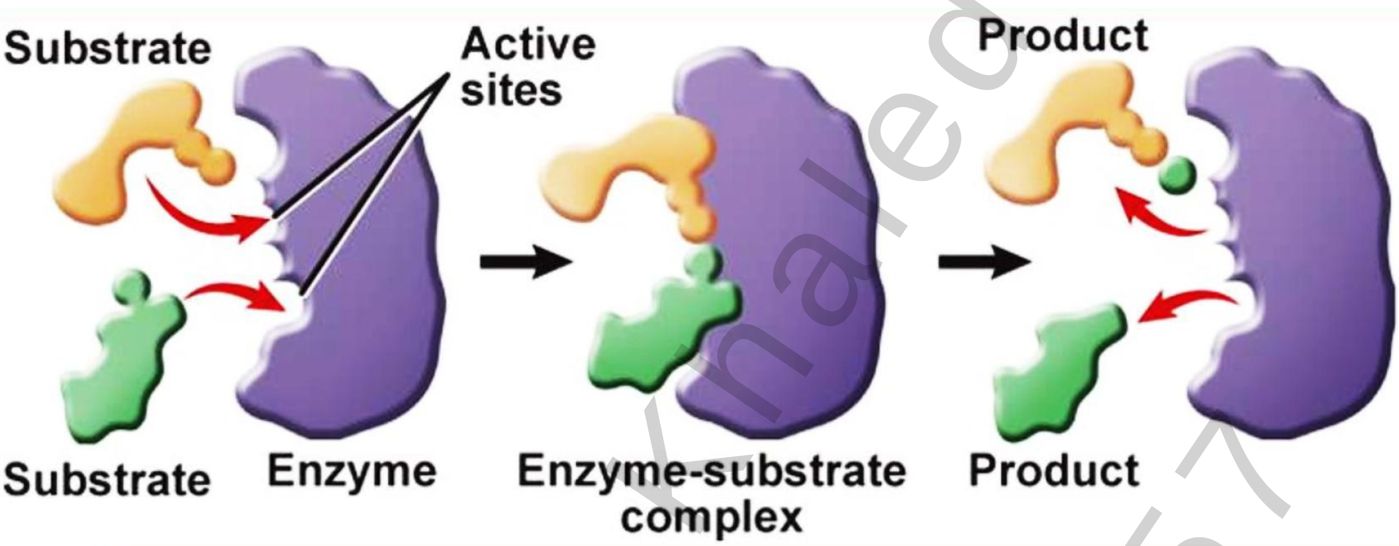
14	BIO.3.1.02.021 Identify examples of reactions catalyzed by enzymes that occur in living systems, describing their importance in living organism and explaining why an enzyme deficiency results in the inability to perform a specific function in life	Information from text	16
		Figure 18	16

Enzyme mechanism of action:

- ***Substrate:*** **reactant that binds to an enzyme.**
- ***Active site:*** **location where a substrate binds on an enzyme.**

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✓ **The enzyme only binds to a reactant that is the same size and shape as the active site.**

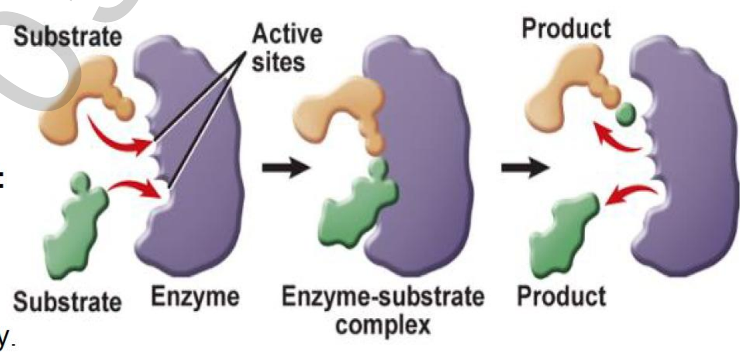
Enzyme action steps:

1 -The reactant binds to the active site.

2- The shape of the active site changes and it becomes the enzyme dimer (the reactant).

3- Chemical bonds in the reactants are broken and new bonds are formed.

4-Products are formed and then released by the enzyme.



1- A specific location where substrates bind on an enzyme:
A. Reactant　　B. Active site
C. Reaction site　　D. Products

2- The reactants that bind to the enzyme:
A. Products　　B. Active site
C. Reaction site　　D. Substrates

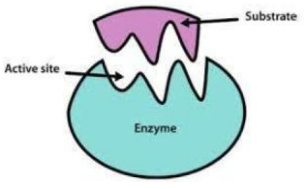
4- Enzymes are:
A. carbohydrates that store biological energy.
B. lipids that form biological membranes.
C. proteins that speed up biochemical reactions.
D. nucleic acids that have the information to make proteins.

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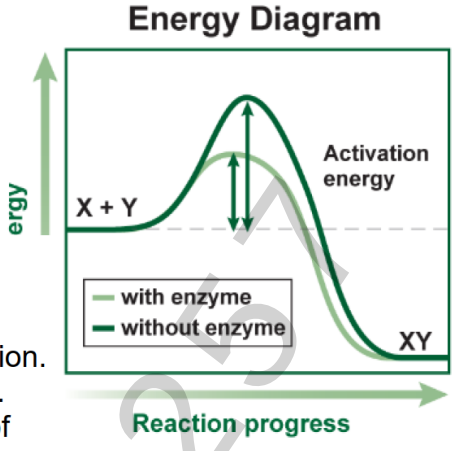
3- What occurs at the active site in the enzyme substrate complex?

A. An exothermic chemical reaction takes place.
B. Chemical bonds are broken, and new bonds are formed.
C. The enzyme gets used up in the reaction.
D. The substrates provide energy for the enzyme.



4- How do enzymes affect a chemical reaction, making it easier to occur?

A. They make the reaction endothermic.
B. They make the reaction exothermic.
C. They reduce the activation energy.
D. They raise the activation energy.



5- The action of enzymes is crucial to life. Enzymes act by:

A. lowering the activation energy needed to start the reaction.
B. reducing the amount of energy absorbed during a biochemical reaction.
C. reducing the amount of heat released during a biochemical reaction.
D. conserving matter in a biochemical reaction, such that the number of

Q14	The specific location where a substrate binds on an enzyme is called the ____.
A	active site
B	enzyme-substrate complex
C	binding point
D	catalyst

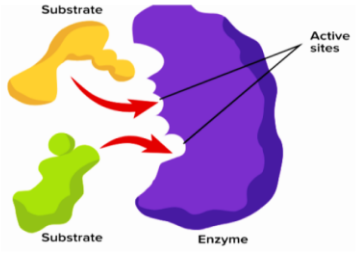
Q16	What is the function of the enzyme-substrate complex?
A	destroy the enzyme
B	prevent bondage at the active site
C	stop chemical reactions
D	break and forming chemical bonds

Which of the following BEST describes enzymes?

- Enzymes are proteins that act as biological catalysts.
- Enzymes are living things that act as biological catalysts.
- Enzymes are biological catalysts that slow down chemical reactions.
- Enzymes are carbohydrates that act as biological catalysts.

Q13	Which of the following are biological catalysts?
A	acids
B	enzymes
C	proteins
D	lipids

Q. Label the substrates, the enzyme, and the active sites.



The role of enzymes is to act as _____ in chemical reactions.

- reactants
- catalysts
- substrates
- activators

Q. Why is the active site of an enzyme important to enzyme activity?

A) It raises the activation energy of a reaction.
B) It allows the enzyme to interact with a large variety of substrates.
C) It allows the enzyme to catalyze very specific reactions.
D) It allows an endothermic reaction to run as an exothermic reaction.

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Q18	The minimum amount of energy needed for a chemical reaction is called ____.
A	product threshold
B	absorbent energy
C	principle mass
D	activation energy

1.3

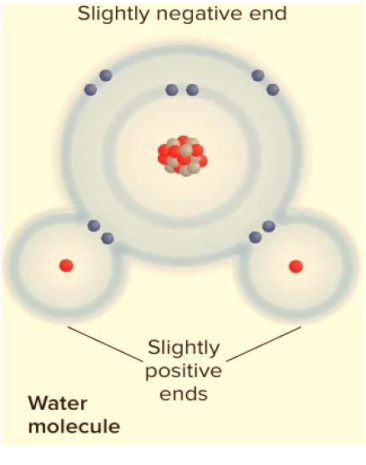
3	BIO.3.1.02.020 Identify the solubility as the ability of a solute to dissolve in a solvent and explain the properties of water that make it the universal solvent	Information from text	18
		Figure 19	18

Water's Polarity

Explain: Water is one of the most important molecules for sustaining life.

-Because its percentage is equal to about 70% of the cell mass.

- ***Polar Molecules***: are molecules that have an unequal distribution of charges.
- ***Polarity:*** is the property of having two opposite poles.
  - Water is a polar molecule it has a positive and a negative charge.
- **A hydrogen bond:** is a weak bond between a hydrogen and another element.
  - Ex: water to water.

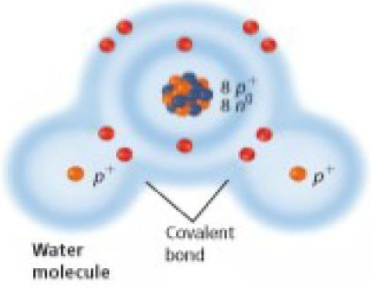


Q. Which of the following is not a property of water?

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

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In this water molecule, how many electrons does each hydrogen atom share with oxygen?



A)	two
B)	one
C)	four
D)	eight

15	BIO.3.1.02.020 Identify the solubility as the ability of a solute to dissolve in a solvent and explain the properties of water that make it the universal solvent	Figure 21	19
		Figure 23	21

Van der Waal forces

- Magnets have poles and that the poles of magnets exert forces on each other-opposite poles attract one other, while like poles of magnets repel one another.



- Similarly, when polar molecules are brought close together, they exert forces on each other, too. Regions of opposite charge cause weak electrostatic attractions between molecules.
- These attractions between the molecules are called van der Waals forces.
- These positive and negative charges create Van der Waal forces that cause molecules to stick together.

- The electrostatic attractions between different molecules are the cause of intermolecular forces.
- A compound's chemical properties are determined primarily by its chemical structure.
- Similarly, a compound's physical characteristics, such as its boiling point and melting point, are determined by its intermolecular forces.
- The strength of the electrostatic attraction depends on the size of the molecule, its shape, and its ability to attract electrons.

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- Although van der Waals forces are not as strong as covalent and ionic bonds, they play an important role in biological processes.
- Van der Waals forces are easier to break apart than covalent or ionic bonds .
- Making them ideal for short term interactions. Van der Walls forces act like a molecular "velcro*- unlike a covalent bond, which is more like a molecular "knot."
- In the example of a gecko, van der Waals forces between the hairlike structures on the gecko's toes and the surface it is climbing allow the animal to climb smooth surfaces.





Van der Waals forces in water

- *How van der Waals forces work in a common substance water?*
- The areas of slight positive and negative charges around the water molecule are attracted to the opposite charge of other nearby water molecules. These forces hold the water molecules together.
- Without van der Waals forces, water molecules would not form droplets, and droplets would not form a surface of water.

- Van der Waals forces are the attractive forces between the water molecules, not the forces between the atoms that make up water molecules.

""

Q. How are water molecules in a rain drop held together?

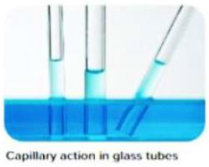
A) ionic bonds
B) attraction between positive charges
C) van der Waals forces
D) attraction between negative charges

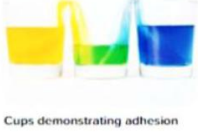
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some of the other special properties of water:

Adhesion

** Water is adhesive- it forms hydrogen bonds with molecules on other surfaces. Capillary action is the result of adhesion; it's why water can travel up the stems of plants. Water travels up the paper, and carries the dye to the middle glass via adhesion.


Capillary action in glass tubes


Cups demonstrating adhesion

Cohesion

** Water is cohesive--the molecules are attracted to each other because of hydrogen bonds. The positive polarity of the hydrogen atom is attracted to the negative polarity of the oxygen atoms.

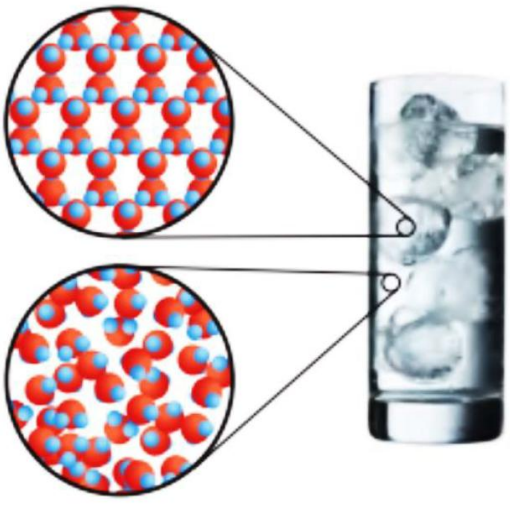

Water strider


Dew on grass

** This attraction creates surface tension, which causes water to form droplets and allows insects and leaves to rest on the surface of a body of water.

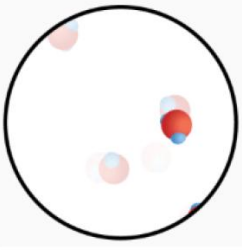
Ice Floats

Liquid water becomes more dense as it cools to 4°C. Yet, ice is less dense than liquid water. As a result, nutrients in bodies of water mi because of changes in water density during spring and fall. Also, fish can survive in winter because ice floats they continue to live and function in the water beneath the ice.



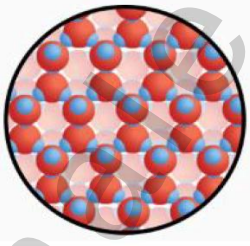
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The molecular view shown is best described by which state of water?



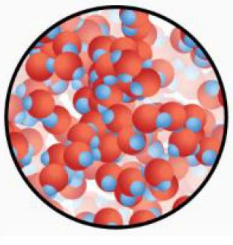
- A ice
- B steam
- C liquid water

The molecular view shown is best described by which state of water?



- A ice
- B steam
- C liquid water

The molecular view shown is best described by which state of water?



- A ice
- B steam
- C liquid water

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.

4	BIO.3.1.02.018 Distinguish between homogeneous mixtures (solutions) and heterogeneous mixtures	Information from text	22
		"Get it?" question	22

Get It?

Distinguish between solutions and suspensions.

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Mixture with water:

- A mixture is a combination of two or more substances in which each substance retains its individual characteristics and properties.

	Homogeneous mixtures	Heterogeneous
Definition	• A mixture with a uniform composition. • A **solution** is another name for a homogeneous mixture. • Solution contains of 1. **Solvent** 2. **Solute** ✓ **A solvent** is a substance in which another substance is dissolved. ✓ A **solute** is the substance that is dissolve in solvent.	• There are two types of heterogeneous: 1.Suspension 2. Collides • **Suspension:** the particles in a suspension settle to the bottom. • **Collides:** A colloid is a heterogeneous mixture in which the particles don't settle to the bottom.
Examples	1. In the powdered drink mix solution shown in the figure below, the drink mix is on top, in the middle and at the bottom.   2. A mixture of salt and water is another example of a solution because the solute (salt) dissolves completely in the solvent (water). 3. Saliva moistens your mouth and begins the digestion of some foods. It is a solution that containswater proteins, and salts. Air is a solution of gasses.	1. Sand and water form a suspension heterogeneous.  2. smoke, butter, milk, paint, ink, and blood are Collides heterogeneous.

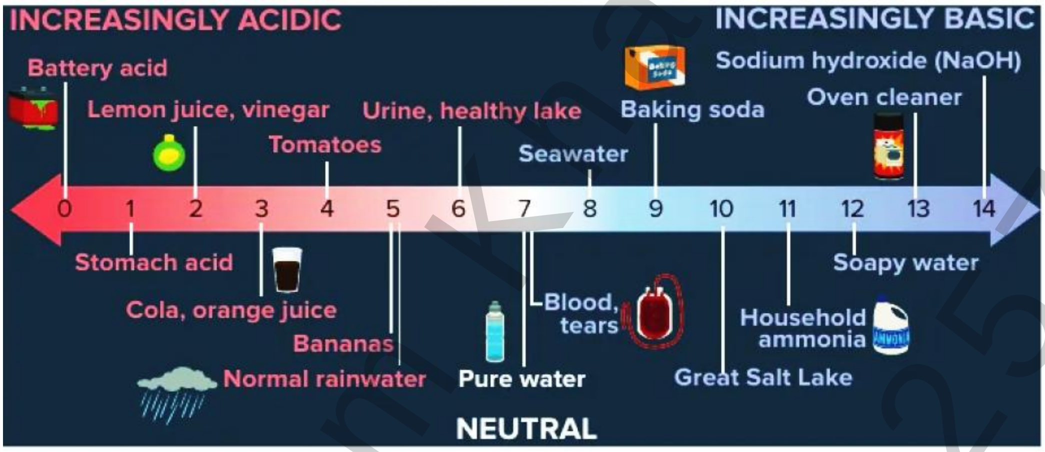
16	BIO.3.1.02.023 Use acid-base indicators or PH test strips to classify solutions as acidic, basic, or neutral	Information from text	24
		Figure 28	24

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PH and buffers:

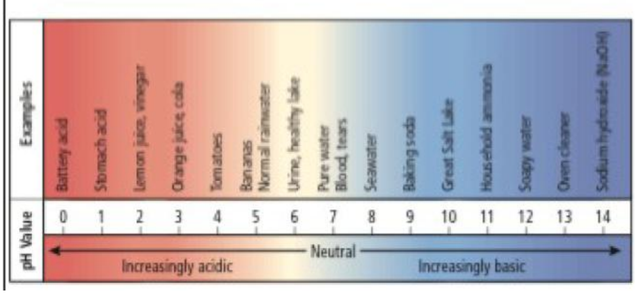
- Scientists have a method to measure how acidic or basic a solution is.
- The measure of concentration of H+ in a solution is called **"pH"**.



- Pure water is neutral; it has a pH value of 7.0.
- Acidic solutions have an abundance of H+ and have pH values lower than 7.
- Basics solutions have more OH- than H+ and have pH values higher than 7.
- **"Buffers"** are mixtures that can react with acids or base to keep the pH within a particular range.
- In cells, buffers keep the pH in a cell within the 6.5 to 7.5 pH range.

Q20	How do buffers help maintain homeostasis?
A	neutralize acids and bases
B	raise pH above 9
C	lower pH below 4
D	remove all hydrogen ions

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.

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1.4

5	BIO.3.1.02.019 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules	Information from text	26
		"Get it?" question	26
17	BIO.3.1.02.024 Explain that the hydrocarbon backbones of the sugars formed during photosynthesis are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules used, for example, to form new cells	Table 1	26

Get It?

Use an analogy to describe macromolecules.

Macromolecules

- Carbon atoms can be joined to form carbon molecules. Similarly, most cells store small carbon.
- ***Macromolecules:*** are large molecules formed by joining smaller organic molecules together.
- ***Polymers:*** are molecules made from repeating units of identical or nearly identical compounds linked together by a series of covalent bonds.

** Small molecules → Macromolecules

** Monomers → Polymers

Summary of biological macromolecules:

Group	Example	Function
Carbohydrate		** Store energy. ** Provide structural support.
Lipid		** Store energy providebarriers.
Proteins		**Transport substances. ** speed reactions. ** provide structural support. **control cell growth.
Nucleic Acids		** store and communicate genetic information.

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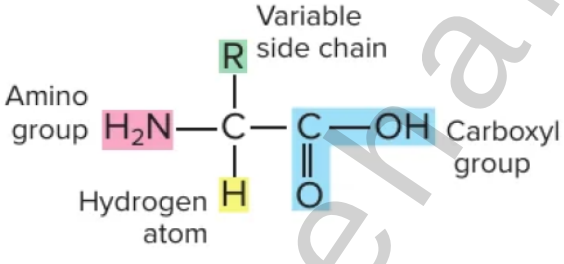
18	BIO.3.1.02.019 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules	Information from text	29
		Figure 33	29

3/ Proteins

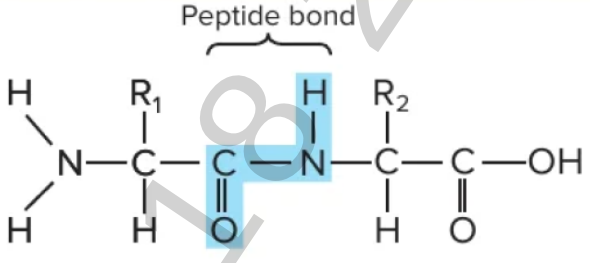
- ✓ ***A protein:*** **is a compound made of small carbon compounds called amino acids.**
- ✓ ***Amino acids:*** **are small compounds that are made of:**

1. carbon. 2. Nitrogen. 3. Oxygen. 4. Hydrogen. 5. and sometimes sulfur.

- ✓ **All amino acids share the same general structure.**



Amino acid



Dipeptide

Amino and acid structure:

** Amino acids have a central carbon atom, recall that carbon can form four covalent bonds, one of those bonds is with *hydrogen*, the other three bonds are with an *amino group(-NH2)*, a *carboxyl group(-COOH)*, and a *variable group(-R)*.

** The variable group makes each amino acid different, there are 20 different variable group, and proteins are made of different combinations of all 20 different amino acids.

** Several covalent bonds called peptide bonds, join amino acids together to form proteins.

** ***A peptide bond:*** **forms between the amino group of one amino acid and the carboxyl group together.**

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Protein function:

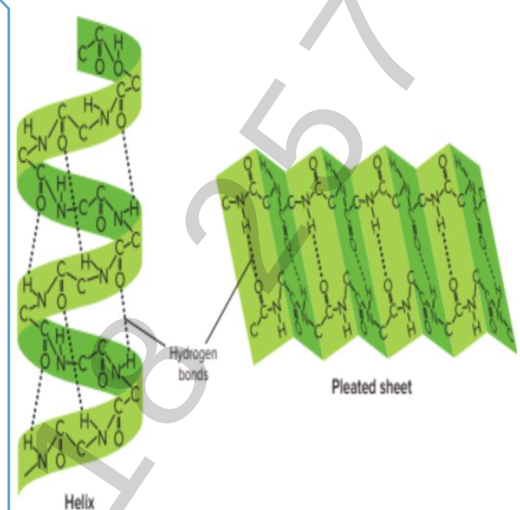
1) Proteins make up about 15 percent of your total body mass and are involved in nearly every function of your body, ***for example***: your muscles, skin, and hair are made of proteins.

2) Your cells contain about 10,000 different proteins that:

1. Provide structural support.
2. Transport substances inside the cell and between cells.
3. Communicate signals within a cell and between cells.
4. Speed up chemical reactions.
5. Control cell growth.

***** Three-dimensional protein structure:***

The number of amino acids in a chain, the order in which the amino acids are joined define the protein's primary structure.



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1- Which of the following functions of lipids:
a. Speed reaction b. Energy storage. c. Control cell growth d. Genetic information storage.



(A) Nucleic acids (B) Carbohydrates (C) Lipids (D) Proteins

2- Which of the following macromolecules is responsible for energy storage:
a. (C, D) b. (D, A) c. (C,B) d. (C,A)

3- Which of the following macromolecules is responsible for store and communicate genetic information:
a. (A) b. (B) c. (C) d. (D)

4- Which macromolecules is involved in nearly every function in the human body?
a. Carbohydrates b. Lipids c. Protein d. Nucleic acids

5- Molecules made from units of identical compounds linked by covalent bonds are called ____.
a. elements B. atoms C. Nucleic acids D. Polymers

Q19	Molecules made from units of identical compounds linked by covalent bonds are called ____.
A	polymers
B	nucleic acids
C	Elements
D	atoms

Q. What are the major classes of biological macromolecules? Select all that apply.

- ☐ A) acids
- ☐ B) proteins
- ☐ C) lipids
- ☐ D) chlorophylls
- ☐ E) organelles
- ☐ F) carbohydrates
- ☐ G) ribosomes
- ☐ H) nucleic acids

Q. Most biological macromolecules are polymers that are made up of many smaller subunits called monosaccharides.

- ○ True
- ○ False

62) Which macromolecule is involved in nearly every function in the human body?
- ○ lipid
- ○ protein
- ○ carbohydrate
- ○ nucleic acid

Correct Answer
protein

35) Which of the following functions can be attributed to carbohydrates?
- ○ structural support
- ○ signaling between cells
- ○ energy storage
- ○ all of the above

Correct Answer
all of the above

42) Match the type of lipid to its primary function.

fatty acids _____
phospholipids _____
steroids _____

structure of the cell membrane
building blocks for hormones
energy storage

Correct Answer

fatty acids ⟷ energy storage
phospholipids ⟷ structure of the cell membrane
steroids ⟷ building blocks for hormones

41) Which of the following functions can be attributed to lipids? Select all that apply.
- ☐ building blocks for cholesterol and other hormones
- ☐ membrane and barrier formation
- ☐ information storage
- ☐ catalyzing biological reactions
- ☐ energy storage

63) Which macromolecule stores genetic information for an organism?
- ○ carbohydrate
- ○ lipid
- ○ nucleic acid
- ○ protein

Correct Answer
nucleic acid

52) Which of the following functions can be attributed to nucleic acids and nucleotides?
- ○ long-term energy storage
- ○ chemical signaling between cells
- ○ genetic information storage and transmission
- ○ barrier in biological membranes

Correct Answer
genetic information storage and transmission

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64) Which macromolecule is responsible for the formation of a cell's membrane?

- nucleic acids
- carbohydrates
- proteins
- lipids

Correct Answer

lipids

Which of the following functions can be attributed to lipids?

- Speed reaction
- Control cell growth
- Energy storage
- Genetic information storage

You are analyzing a compound in a laboratory. You find that it is made up of carbon, hydrogen, and oxygen in a ratio of two hydrogen atoms for each carbon atom. How will you classify the compound?

A carbohydrate
B lipid
C protein
D nucleic acid

Which of the following macromolecules is matched with its correct role in the cell?

Nucleid acid – Transport substances

Lipids – Store genetic information

Proteins – Speed reactions

Carbohydrates – Make hormones

Which class of macromolecules store and communicate genetic information?

A carbohydrates
B lipids
C proteins
D nucleic acids

Which of the following is NOT a biological function of lipids?

A cushioning and insulation
B precursors to the synthesis of signaling molecules
C store energy
D speeding up reactions



Match the macromolecule to its functions. Note: Some functions may correspond to more than one type of biological molecule.

Structural support	Energy storage	Membrane and barrier formation	Catalysts of biological reactions
Structural support • Carbohydrates • Protein	Energy storage • Carbohydrates • Lipids	Membrane and barrier formation • Lipids	Catalysts of biological reactions • Protein

Genetic information storage	Chemical signaling
Genetic information storage • Nucleic acid	• Carbohydrates • Lipids • Protein

Which of the following functions can't be attributed to carbohydrates?

A- Structural support

B- Signalling between cells

C- Energy storage

D- Genetic information storage



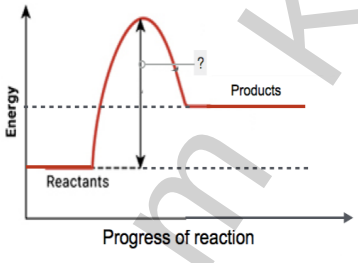
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Molecules made from units of identical compounds linked by covalent bonds are called _____.

A)	polymers
B)	nucleic acids
C)	elements
D)	atoms

What does the labeled arrow on the graph represent?



- the reactants
- the activation energy
- the time taken by the reaction
- the overall energy change

Which of the following scenarios DOES NOT require activation energy?

- cellular respiration
- combustion in a car engine
- adding milk to a cup of tea
- burning a piece of paper

During a test for hydrogen gas, a student lights a match at the opening of a test tube filled with hydrogen gas. Small explosive noise is observed and moisture forms at the top of the test tube.
Another student comments that the following reaction took place inside the test tube to form liquid water:

$H_2 + O_2$ → H_2O

What is the role of the burning match at the start of the reaction?

- To slow down the reaction.
- To convert the gases to liquids.
- To make the reaction endothermic.
- To provide activation energy for the reaction to occur. ✓

The minimum amount of energy needed for a chemical reaction to occur is called activation energy ✓ .

What is the substance dissolved in a solution?

- Solvent
- Solution

What is the substance in which another substance is dissolved?

- Acid
- Solute
- Solute
- Solution

- Mixture
- Solvent

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What is a measure of the concentration of hydrogen ions (H+) in a solution?

- ○ Solvent
- ○ Acid
- ○ Buffer
- ● pH

substance that produces hydroxide ions (OH-) when dissolved in water; a basic solution has a pH greater than 7

- ● base
- ○ acid
- ○ buffer
- ○ solution

4. MULTIPLE CHOICE

What is a molecule with oppositely charged regions?

- ○ Solute
- ○ Solution
- ○ Hydrogen bond
- ● Polar molecule

What is a homogeneous mixture formed when a substance (the solute) is dissolved in another substance (the solvent)?

- ○ Solute
- ● Solution
- ○ Mixture
- ○ Solvent

6. MULTIPLE CHOICE + Add

weak electrostatic bond formed by the attraction of opposite charges between a hydrogen atom and an oxygen, nitrogen, or fluorine atom

- ● hydrogen bond
- ○ covalent bond
- ○ ionic bond
- ○ polar bond

7. MULTIPLE CHOICE + Add

substance that releases hydrogen ions (H+) when dissolved in water; an acidic solution has a pH less than 7

- ○ buffer
- ○ base
- ● acid
- ○ solute

a mixture that can react with an acid or base to maintain the pH of a solution within a specific range

- ○ solvent
- ○ base
- ○ acid
- ● buffer

9. MULTIPLE CHOICE + Add

a combination of two or more different substances in which each substance keeps its individual characteristics; can have a uniform composition (homogeneous) or distinct areas of substance (heterogeneous)

- ○ solution
- ○ solute
- ○ solvent
- ● mixture

10. MULTIPLE CHOICE + Add

attractive forces between molecules

- ○ hydrogen bond
- ○ ionic bond
- ● van der waals forces
- ○ solvent

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2.1

6	BIO.3.1.01.075 Identify that all Living things are composed of cells	Information from text	37
		Figure 1	37

History of the Cell Theory



- **Robert Hooke:** made a simple microscope and looked at a piece of cork, the dead cells of oak bark.
- Hooke observed small, box-shaped structures.
- He called them cellulae .
- because the boxlike cells of cork .
- It is from Hooke's work that we have the term cell.
- **A cell :** is the basic structural and functional unit of all living organisms.

- During the late 1600s, Dutch scientist Anton van Leeuwenhoek designed his own microscope after he was inspired by a book written by Hooke.
- To his surprise, he saw living organisms in pond water, milk, and various other substances.

19	BIO.3.1.01.076 Assess the role of selected technologies in enhancing our understanding of cells and cellular processes	Information from text	40
		"Get it?" question	40

Get It?

Compare and contrast a TEM and a SEM.

Types of microscopes

- Non-optical microscopes
  - A Transmission electron microscope (TEM)
  - The Scanning electron microscope (SEM)
  - The scanning tunneling electron microscope (STM)
- Optical microscopes

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Non-optical microscopes (Electron Microscopes):

- As they began to study cells, scientists needed greater magnification to see the details of tiny parts of cells.
- In the early 1930s, Ernst Ruska developed the electron microscope.

A transmission electron microscope (TEM)

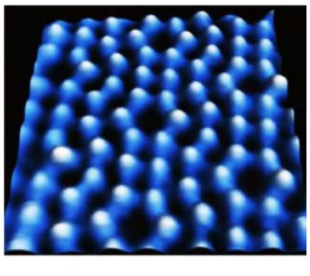
- This type of electron microscope uses magnets to aim a beam of electrons at thin slices of cells.
- because electrons are transmitted through a specimen to a fluorescent screen.
- Thick parts of the specimen absorb more electrons than thin parts, forming a black-and-white shaded image of the specimen.
- Transmission electron microscopes have advantages and disadvantages.
- They can magnify up to 500,000x, but the specimen must be dead, sliced very thin, and stained with heavy metals.

The scanning electron microscope (SEM)

- The directs electrons over the surface of the specimen, producing a three-dimensional image.
- One disadvantage of using a SEM is that only non-living cells and tissues can be observed.

The scanning tunneling electron microscope (STM)

- Involves bringing the charged tip of a probe extremely close to the specimen so that the electrons "tunnel" through the small gap between the specimen and the tip.



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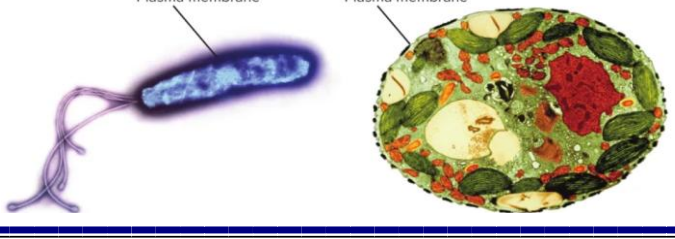
- This instrument has enabled scientists to create three-dimensional computer images of objects as small as atoms.
- In contrast to TEM and SEM, STM can be used with live specimens.
- Figure 3 shows an STM of a silicon chip surface.
- Each protrusion is a single silicon atom.

Q1.	If a microscope has a series of three lenses that magnify individually 5×, 5×, and 7×, what is the total magnification of the microscope?
a.	25x
b.	35x
c.	17x
d.	175x

20	BIO.3.1.01.075 Identify that all Living things are composed of cells	Information from text	41, 42
		"Get it?" question	42

Basic Cell Types

- All cells have a ***plasma membrane***: a special boundary that helps control what enters and leaves the cell.
- Most cells must exist in various shapes and sizes.
- Most cells contain genetic material in some form.
- Most cells break down molecules to generate energy.
- There are two basic kinds of cells: eukaryotic and prokaryotic .



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Get It?

Compare and contrast eukaryotic and prokaryotic cells.

Eukaryotic cells

- contain a nucleus and other organelles.
- *Organelles:* are specialized structures that perform specific cell functions.
- *The nucleus:* is the distinct central organelle that contains the cell's genetic material.
- Eukaryotic cells are generally much larger than prokaryotic cells.

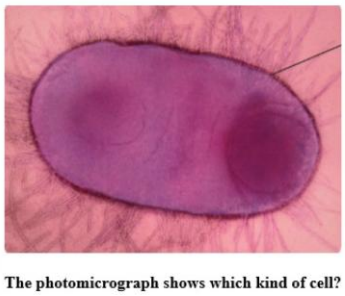
Prokaryotic cells

- do not have a nucleus or other membrane-bound organelles.
- They are smaller and simpler than eukaryotic cells.
- Most unicellular organisms, such as bacteria, are prokaryotic cells.
- Prokaryotic organisms are probably similar to the first organisms that lived on Earth.

Origin of cell diversity:

- **The endosymbiont theory proposes that a symbiotic relationship formed between two prokaryotic cells, one of which lived inside the other.**
- **Eventually the symbiotic relationship led to the two cells becoming one.**
- **Because eukaryotic cells are larger and more complex, they developed specific functions.**
- **These specific functions led to cell diversity, and thus, to organismal diversity.**

Use the photo to answer question 3.



The photomicrograph shows which kind of cell?

a.	prokaryotic cell
b.	eukaryotic cell
c.	animal cell
d.	plant cell

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2.2

7	BIO.3.1.01.050 Identify structures and organelles in cells, including the nucleus, cell membrane, cell wall, chloroplasts, vacuole, mitochondria, and cytoplasm, and explain the basic functions of each	Information from text	43
		Demonstrate Undertanding: Question 1	46

Structure of the Plasma

- Most of the molecules in the plasma membrane are **lipids**.
- ***Lipids:*** are large molecules that are composed of glycerol and three fatty acids.
- If a **phosphate** group **replaces** a **fatty** acid, a **phospholipid** forms.
- ***A phospholipid :*** is a molecule that has a glycerol backbone, two fatty acid chains, and a phosphate-containing group.
- ***The plasma membrane:*** is composed of a **phospholipid bilayer**, in which two layers of phospholipids are arranged tail-to-tail.
- In the plasma membrane, phospholipids arrange themselves in a way that allows the plasma membrane to **exist in the watery environment.**

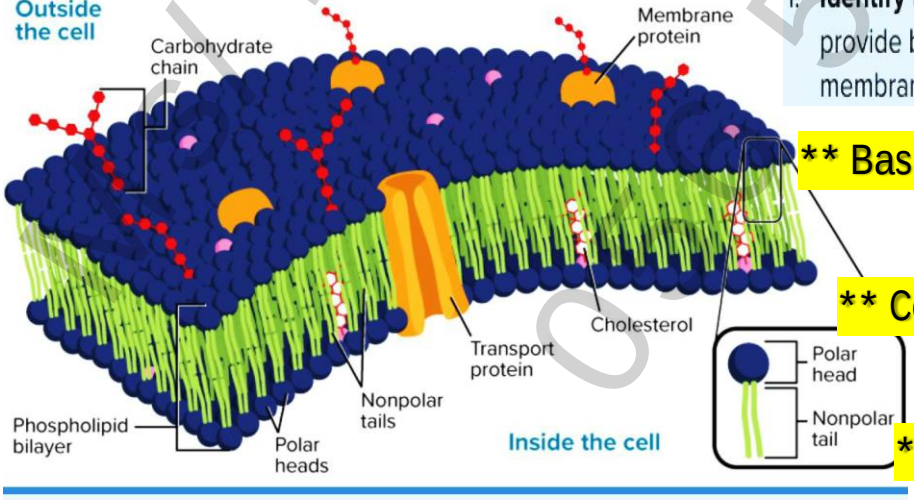


Figure 5 The phospholipid bilayer looks like a sandwich, with the polar heads facing the outside and the nonpolar tails facing the inside.

Demonstrate Understanding

1. **Identify** the molecules in the plasma membrane that provide basic membrane structure, cell identity, and membrane fluidity.

** Basic membrane composition: phospholipids.

** Cell identity: proteins and carbohydrates.

** Membrane fluidity: Cholesterol.

21	BIO.3.1.01.050 Identify structures and organelles in cells, including the nucleus, cell membrane, cell wall, chloroplasts, vacuole, mitochondria, and cytoplasm, and explain the basic functions of each	Information from text	45, 46
		Figure 7	46

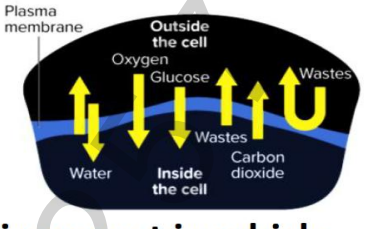
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Function of the Plasma Membrane

** The process of maintaining balance in an organism's internal environment is called homeostasis.

1) The plasma membrane is responsible for homeostasis.



2) The plasma membrane that allows nutrients into the cell and allows waste and other products to leave the cell.

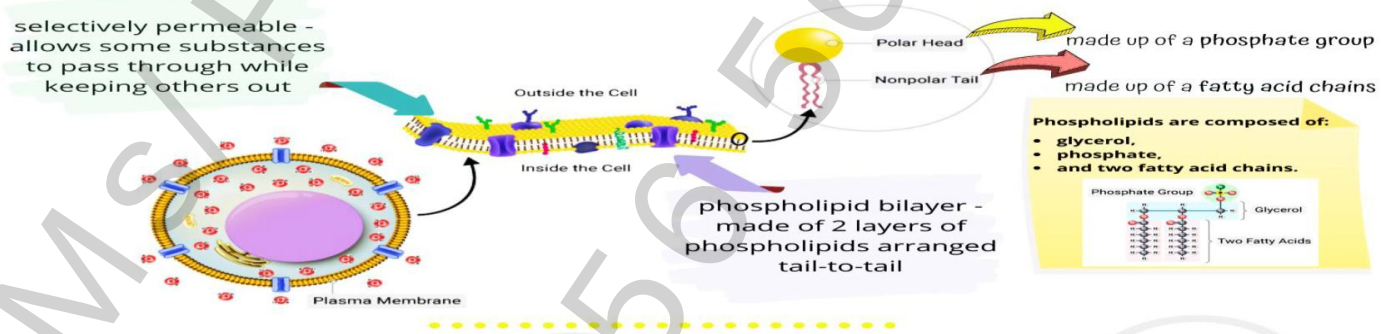
3) At prokaryotic cells and eukaryotic cells have a plasma membrane to separate them from the watery environment in which they exist.

4) A key property of the plasma membrane is selective permeability, by which a membrane allows some substances to pass through while keeping others out.

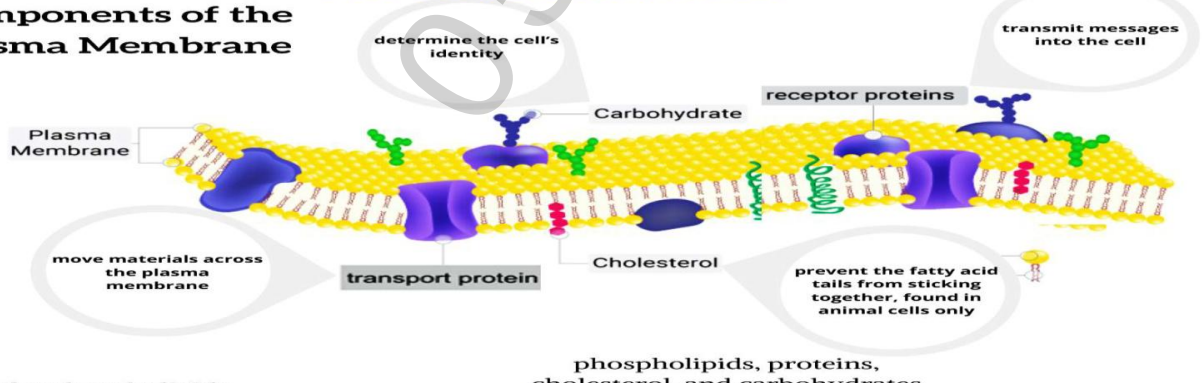
The Plasma Membrane

is a thin, flexible boundary between a cell and its environment that allows nutrients into the cell and allows waste and other products to leave the cell.

Properties of the Plasma Membrane



Components of the Plasma Membrane



the phospholipids move sideways within the membrane

phospholipids, proteins, cholesterol, and carbohydrates within the membrane create a mosaic of substances

The fluid mosaic model describes the plasma membrane.

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13) Fill in the blanks using the available answer choices.

Match each of the following structures with its function.

Function	Structure
a molecule that has a glycerol backbone, two fatty acid chains, and a phosphate-containing group	
molecules are arranged tail to tail, allowing it to exist in the watery environment	
transmits signals to the inside of the cell	
gives the cell its shape by anchoring to the cell's inner support structure	
moves needed substances or waste materials through the plasma membrane	
contributes to the fluidity of the plasma membrane by preventing it from sticking together	
defines the cell's characteristics and helps cells identify chemical signals	(Blank 2)

Correct Answer

phospholipid
phospholipid bilayer
receptor proteins
inner membrane proteins
transport proteins
cholesterol
carbohydrates

89) Fill in the blanks using the available answer choices.

A _____ (Blank 1) **is the basic structure that makes up the plasma membrane.**

Blank 1 options
- cholesterol bilayer
- carbohydrate bilayer
- phospholipid bilayer
- receptor protein

Correct Answer

phospholipid bilayer

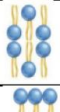
What critical function does cholesterol serve in the body?

A)	destroys the plasma membrane
B)	binds fatty acid tails to water
C)	disrupts homeostasis
D)	increases fluidity of plasma membrane

Q4. Which of the following orientations of phospholipids best represents the phospholipid bilayer of the plasma membrane?

a. 

b. 

c. 

d. 

A ____ contains polar and nonpolar ends, forming the plasma membrane.

A)	microtubule
B)	transport protein
C)	cytoskeleton
D)	phospholipid bilayer

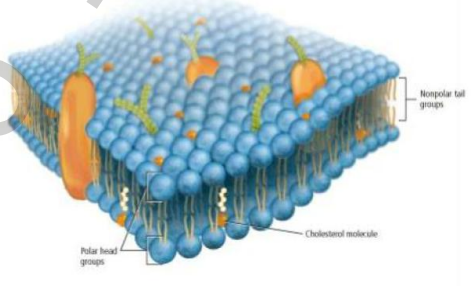
Which cellular structure helps control what enters and leaves the cell'

A)	cytoplasm
B)	cytoskeleton
C)	plasma membrane
D)	nucleus

Q5. Which situation would increase the fluidity of a phospholipid bilayer?

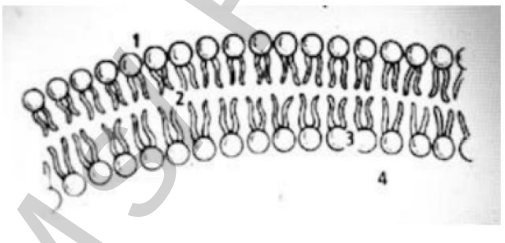
a.	decreasing the temperature
b.	increasing the number of proteins
c.	increasing the number of cholesterol molecules
d.	increasing the number of unsaturated fatty acids

This picture shows a phospholipid bylayer. What crucial function do the nonpolar tails of the phospholipids have?



A)	speed chemical reactions with enzymes
B)	keep water-soluble substances from passing easily into the cell
C)	allow water-soluble substances to pass easily into the cell
D)	help encode genetic material

Use the illustration below to answer questions 6 and 7.



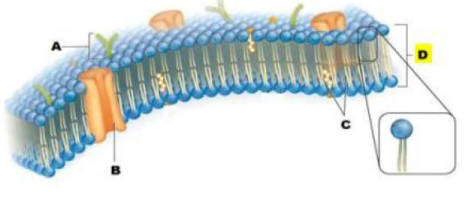
Q6. Which number in the illustration represents the location where you would expect to find water-insoluble substances?

a.	1
b.	2
c.	3
d.	4

Q14. How many layers of phospholipid molecules make up the plasma membrane?

a.	3
b.	2
c.	4
d.	1

Which of the following represents the phospholipid bilayer of the plasma membrane?



Q7. Which is the effect of having the polar and nonpolar ends of phospholipid molecules oriented as they are in the illustration?

a.	It allows transport proteins to move easily through the membrane.
b.	It controls the movement of substances across the membrane.
c.	It helps the cell to maintain its characteristic shape.
d.	It makes more room inside the phospholipid bilayer.

Why is the phospholipid bilayer critical to cell function?

A)	It forms a shell around the cell nucleus.
B)	Phospholipids allows water-soluble substances to pass easily into cell.
C)	Transport proteins are blocked from entering plasma membrane.
D)	Arrangement of phospholipids enables selective permeability.

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What is the name of this structure? What is its function?



- ✓ A carbohydrate; defines a cell's characteristics and helps identify chemical signals
- B cholesterol; helps prevent the fatty-acid tails of the phospholipid bilayer from sticking together
- C transport protein; moves needed substances or waste materials through the plasma membrane
- D phospholipid; creates separation from polar and non-polar molecules
- E receptor protein; transmits signals to inside the cell

What is the name of this structure? What is its function?



- A carbohydrate; defines a cell's characteristics and helps identify chemical signals
- ✓ B cholesterol; helps prevent the fatty-acid tails of the phospholipid bilayer from sticking together
- C transport protein; moves needed substances or waste materials through the plasma membrane
- D phospholipid; creates separation from polar and non-polar molecules
- E receptor protein; transmits signals to inside the cell

What is the function of a selectively permeable membrane?

A)	provides alternative to phospholipid bilayer
B)	prevents transport proteins from harming cell
C)	controls what enters and leaves cell
D)	blocks all water from entering cell

What is the name of this structure? What is its function?



- A carbohydrate; defines a cell's characteristics and helps identify chemical signals
- B cholesterol; helps prevent the fatty-acid tails of the phospholipid bilayer from sticking together
- ✓ C transport protein; moves needed substances or waste materials through the plasma membrane
- D phospholipid; creates separation from polar and non-polar molecules
- E receptor protein; transmits signals to inside the cell

Where would you find the nonpolar region on the phospholipid?



- ✓ A the fatty acid tails
- B the glycerol backbone
- C the head
- D entire molecule is nonpolar

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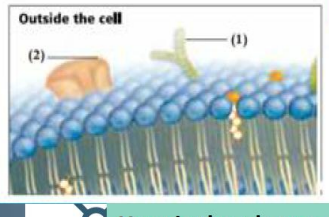
How many phospholipid layers are there in the plasma membrane?

- A 1
- B 2
- C 3
- D 4

Which one of these is not part of the phospholipid structure?

- A carbohydrate
- B glycerol
- C fatty acid chain
- D phosphate group

Which of the following represents the structures (1) and (2) shown in the below figure?



- Carbohydrate chain and membrane protein
- Vitamin chain and membrane protein
- Nonpolar Tails and membrane protein
- Cilia and Transport protein

A molecule necessary for cell functioning cannot diffuse through the plasma membrane but needs a protein that can open and close to allow the molecule to diffuse. What is this protein called?

- Carrier protein
- Motor protein
- Receptor protein
- Channel protein

How is the plasma membrane of a cell organized?

A one layer of phospholipids, through which proteins freely move

B one layer of phospholipids, which are laid out end-to-end, with a hydrophobic tail touching a hydrophilic head

C two layers of phospholipids, each of which has its hydrophilic side turned inward

D two layers of phospholipids, with their polar hydrophilic heads facing away from each other

The image below shows the structure of the phospholipid bilayer. Each component of the bilayer has an important role in supporting cellular activities. What is the importance of cholesterol in this case?

It contributes to the fluidity of the plasma membrane
by preventing the fatty acid tails of the phospholipid
bilayer from sticking together.
It gives the cell its shape by anchoring to the cell's inner support structure.
It defines the cell's characteristics and helps cells identify chemical signals.
It moves needed substances or waste materials through the plasma membrane.

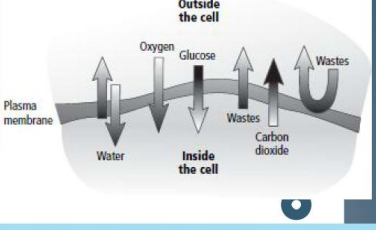
What characteristics of the plasma membrane is illustrated in this drawing?

A selective permeability

B phospholipid bilayer

C fluid mosaic construction

D impermeability to water



The plasma membrane has certain functions that help maintain the homeostasis of a cell.

i. It provides protection to the cell by prohibiting the entry of toxic or unwanted substances.

ii. The partially permeable nature of the membrane only allows specific ions and molecules to enter the cell.

iii. It prevents the exit of important or useful substances.

Which of these functions supports this claim?

i and ii only

i and iii only

ii and iii only

i, ii, iii

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2.3

8	BIO.3.1.01.057 Explain the processes of diffusion and osmosis and their roles within a cell	Figure 8(C)	47
		Information from text	48

Diffusion

- Substances dissolved in water move constantly in random motion called **Brownian motion**.
- This random motion causes **diffusion**.
- ***Diffusion***: which is the net movement of particles from an area where there are many particles of a substance to an area where there are fewer particles of the substance.
- The amount of a substance in a particular area is called **concentration**.
- Therefore, substances diffuse from areas of **high** concentration to **low** concentration.
- Additional energy input is not required for diffusion **because** the particles already are in motion.

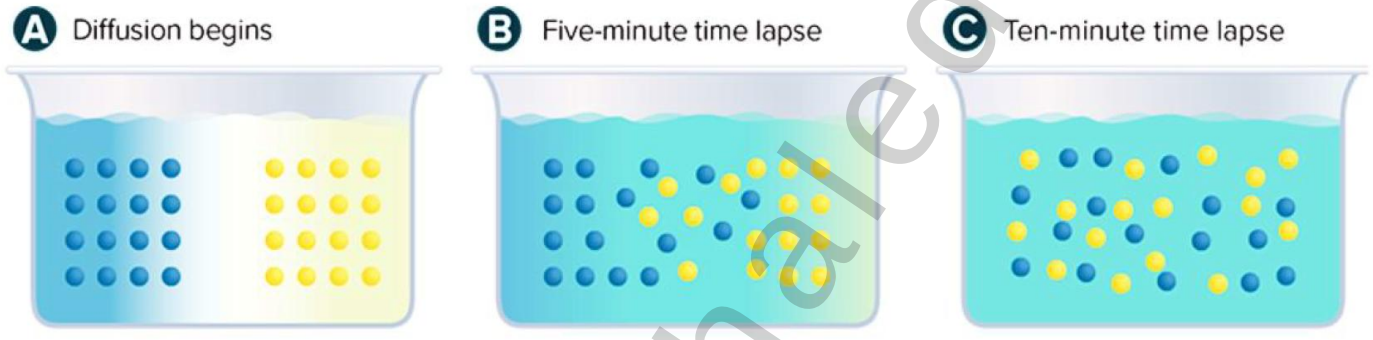
An experiment

- If you drop blue and yellow ink into a container of water at opposite ends of the container, which is similar to the watery environment of a cell, the process of diffusion begins, as shown in **Figure 8(A).**
- In a short period of time, the ink particles have mixed as a result of diffusion to the point where a green-colored blended area is visible. **Figure 8(B)** shows the initial result of this diffusion.
- Given more time, the ink particles continue to mix and, in this case, continue to form the uniform mixture shown in **Figure 8(C).**

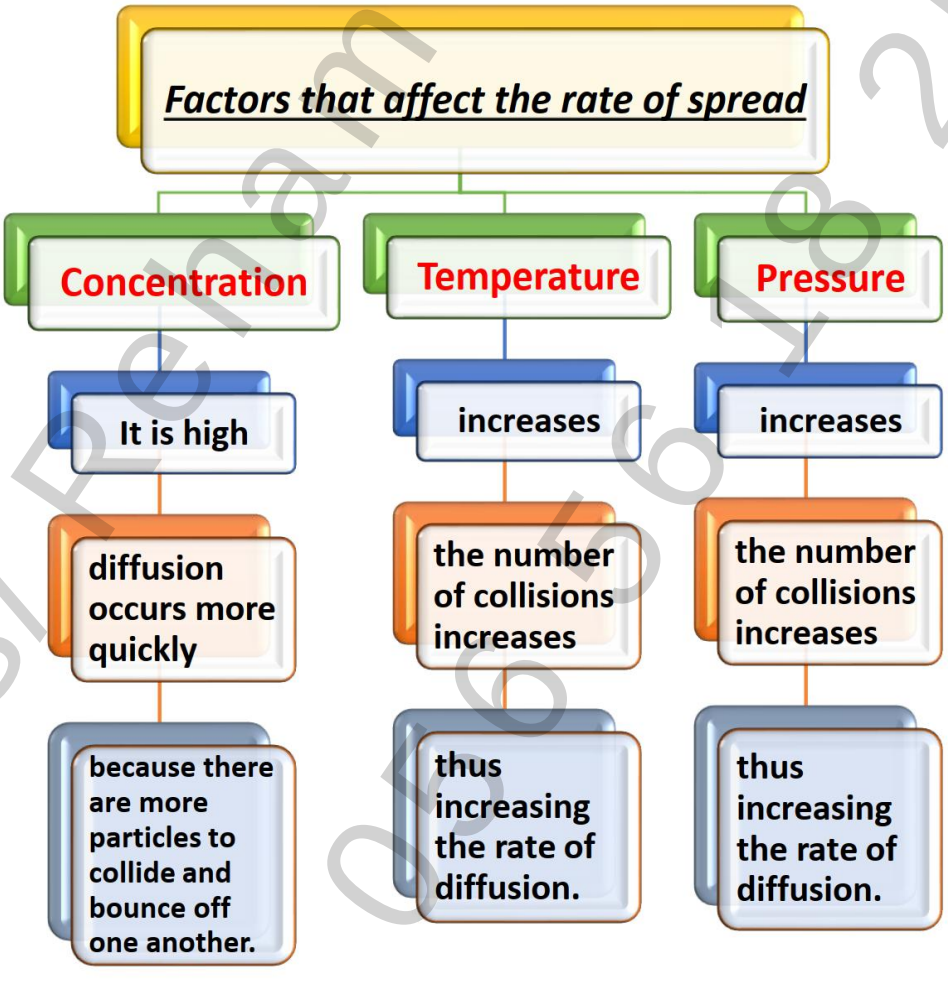
- This condition, in which there is continuous movement but no overall change, is called **dynamic equilibrium**.

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** One of the key characteristics of diffusion is the rate at which diffusion takes place.



** At higher temperatures particles move faster, and at higher pressure the particles are closer together.

** In both cases, more collisions occur, and diffusion is faster.

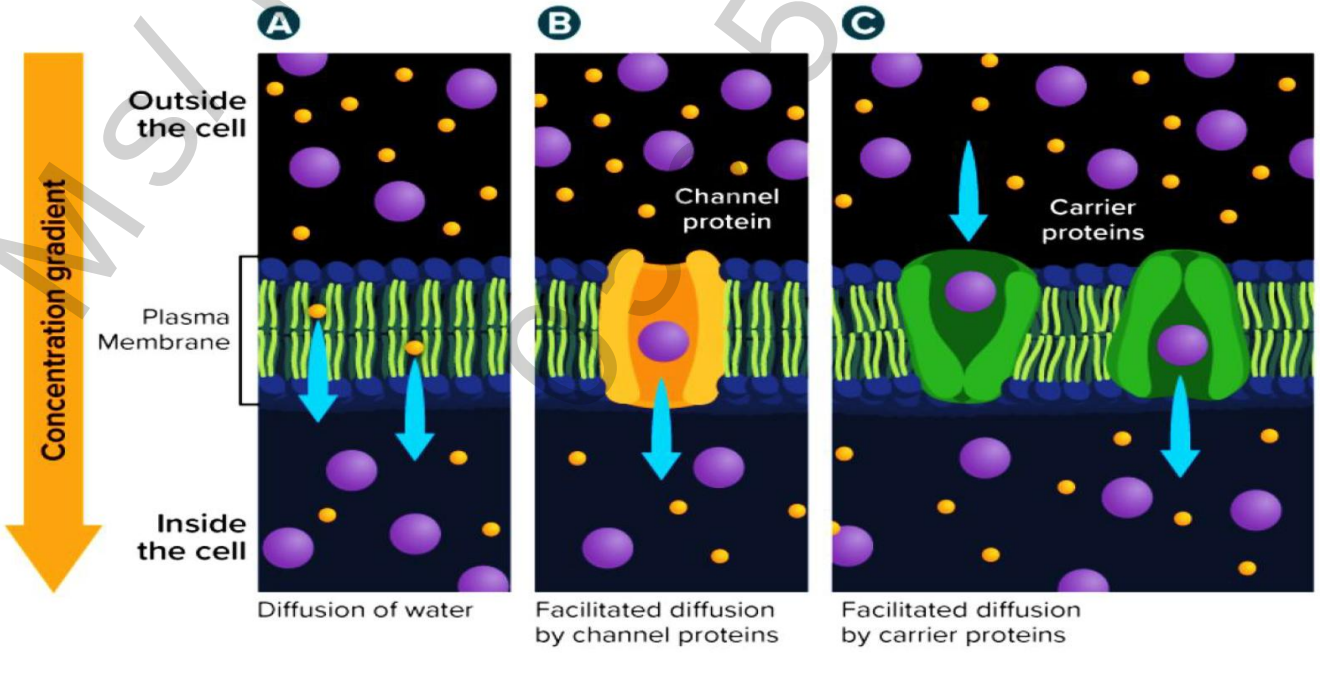
** The size and charge of a substance also affects the rate of diffusion.

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29	BIO.3.1.01.057 Explain the processes of diffusion and osmosis and their roles within a cell	Information from text	48
		Figure 9	48

Diffusion across the plasma membrane

- In addition to **water**, cells need certain ions and small molecules, such as **chloride** ions and **sugars**, to **perform cellular functions**.
- Water can diffuse across the plasma membrane, as shown in Figure 9(A), but most other substances cannot.
- Another form of transport, called **facilitated diffusion**, uses transport proteins to move other ions and small molecules across the plasma membrane.
- By this method, substances move into the cell through a water-filled transport protein, called **a channel protein**, that opens and closes to allow the substance to diffuse through the plasma membrane, as shown in Figure 9(B).
- Another type of transport protein, called a **carrier protein**, also can help substances diffuse across the plasma membrane.
- Carrier proteins change shape as the diffusion process continues to help move the particle through the membrane, as illustrated in Figure 9(C).



- Diffusion of water and facilitated diffusion of other substances require no additional input of energy .

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- Because the particles are moving from an area of high concentration to an area of lower concentration.
- This is also known as passive transport.

9	BIO.3.1.01.057 Explain the processes of diffusion and osmosis and their roles within a cell	Information from text	49
		Figure 10	49

Osmosis: Diffusion of Water

- ***Osmosis:*** is the diffusion of water across a selectively permeable membrane.
- Water molecules pass freely into and out of a cell through aquaporins.
- ***Aquaporins:*** are channel proteins embedded in the plasma membrane composed of tiny holes that selectively allow small uncharged molecules, such as water, to pass through.
- Regulating the movement of water across the plasma membrane is an important factor in maintaining homeostasis within the cell.

How osmosis works

- In a solution, a substance called the solute is dissolved in a solvent.
- Water is the solvent in a cell and its environment.
- ***Concentration***: is a measure of the amount of solute dissolved in a solvent.
- The concentration of a solution decreases when the amount of solvent increases.
- In other words, a more concentrated solution has more solute than a less concentrated solution.
- Examine Figure 10, which shows a U-shaped tube containing solutions with different sugar concentrations separated by a selectively permeable membrane.
- Water molecules diffuse toward the side with the greater sugar concentration—the right side.
- As water moves to the right, the concentration of the sugar solution decreases.
- The water continues to diffuse until dynamic equilibrium occurs—the concentration of the solutions is the same on both sides.

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- Notice in Figure 10 that the result is an increase in solution level on the right side.
- During dynamic equilibrium, water molecules continue to diffuse back and forth across the membrane. But, the concentrations on each side no longer change.

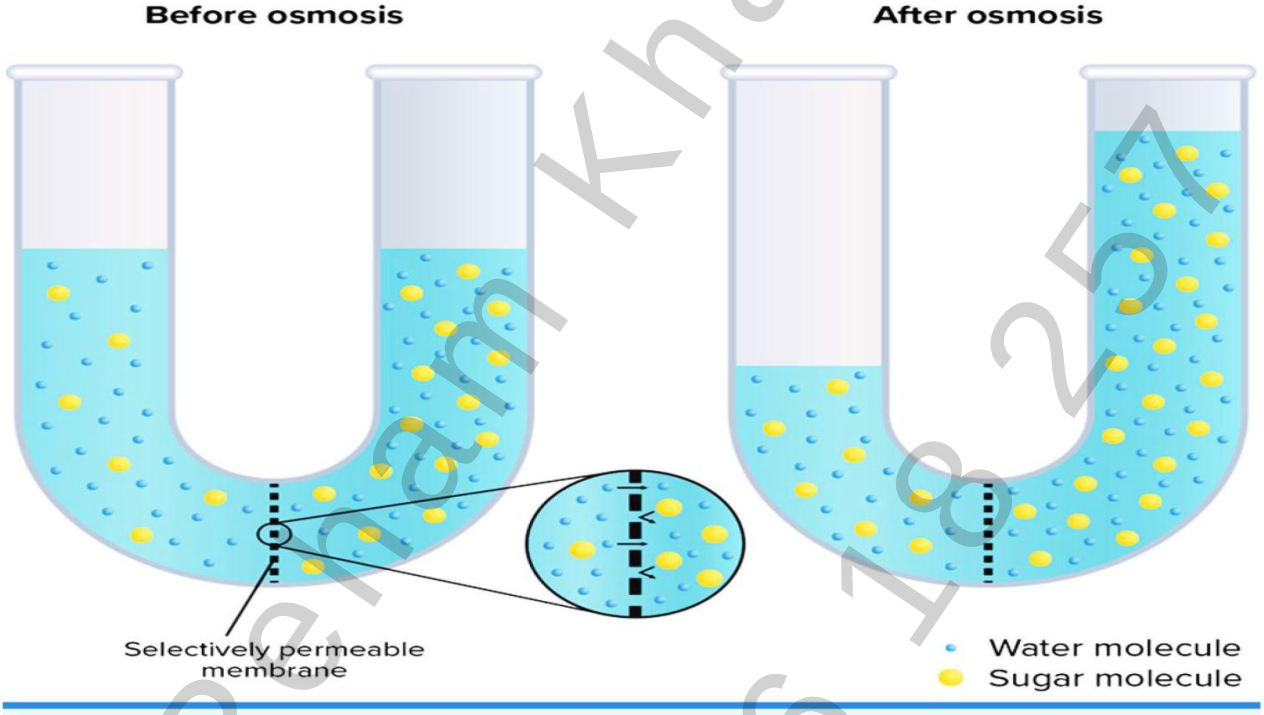


Figure 10 Before osmosis, the sugar concentration is greater on the right side. After osmosis, the concentrations are the same on both sides. Water molecules continue to move across the membrane.

28	BIO.3.1.01.071 Explain the swelling of the cells of the living organisms when put in water and its shrinking when put in salt solution, and generalize the phenomenon on all living organisms	Information from text	49, 50
		Figure 11 A, B, C	51

22	BIO.3.1.01.071 Explain the swelling of the cells of the living organisms when put in water and its shrinking when put in salt solution, and generalize the phenomenon on all living organisms	Information from text	50

Cells in an isotonic solution

- ✓ When a cell is in a solution that has the same concentration of water and solutes—ions, sugars, proteins, and other substances—as its cytoplasm, the cell is said to be in an isotonic solution.
- ✓ Water still moves through the plasma membrane, but water enters and leaves the cell at the same rate.
- ✓ The cell is at equilibrium with the solution, and there is no net movement of water.
- ✓ The cells retain their normal shape, as shown in Figure 11(A).
- ✓ Most cells in organisms are in isotonic solutions, such as blood.

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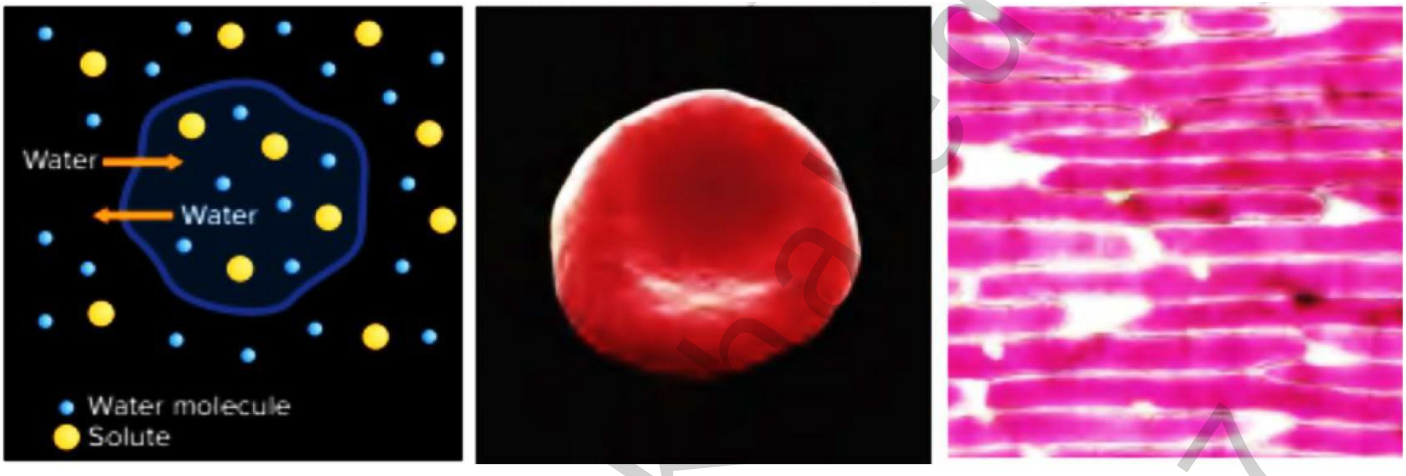


Figure 11(A) In an isotonic solution, water molecules move into and out of the cell at the same rate, and cells retain their normal shape. The animal cell and the plant cells have their normal shapes in an isotonic solution.

Cells in a hypotonic solution

- If a cell is in a solution that has a lower concentration of solute, the cell is said to be in a hypotonic solution.
- There is more water outside of the cell than inside.
- As a result of osmosis, the net movement of water through the plasma membrane is into the cell, as illustrated in Figure 11(B).
- ***Osmotic pressure:*** is a pressure generated as water flows through the plasma membrane.
- ***In an animal cell***, as water moves into the cell, the pressure increases, and the plasma membrane swells.
- If the solution is extremely hypotonic, the plasma membrane might be unable to withstand this pressure, and the cell might burst.
- Because they have a rigid cell wall that supports them, plant cells do not burst when they are placed in a hypotonic solution.
- As the pressure inside a cell increases, the plant's central vacuole fills with water, pushing the plasma membrane against the cell wall, shown in the plant cells in Figure 11(B).
- Instead of bursting, the plant cell becomes firmer.

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- **Grocers use this process to keep produce looking fresh by misting fruits and vegetables with water.**



Figure 11(B) In a hypotonic solution, water enters a cell by osmosis, causing the cell to swell. Animal cells may continue to swell until they burst. Plant cells swell beyond their normal size as internal pressure increases.

Cells in a hypertonic solution

- **When a cell is placed in a hypertonic solution, the concentration of the solute outside of the cell is higher than it is inside.**
- **During osmosis, the net movement of water is out of the cell, as illustrated in Figure 11(C).**
- **Animal cells in a hypertonic solution shrivel because of decreased pressure in the cells.**
- **Plant cells in a hypertonic solution lose water, mainly from the central vacuole.**
- **The plasma membrane shrinks away from the cell wall.**
- **Loss of water in a plant cell causes wilting.**

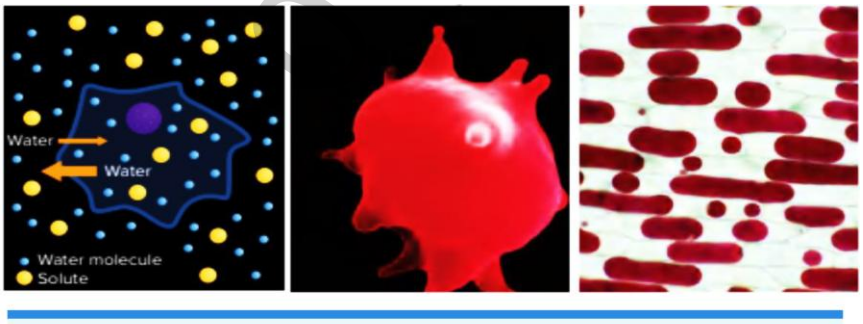


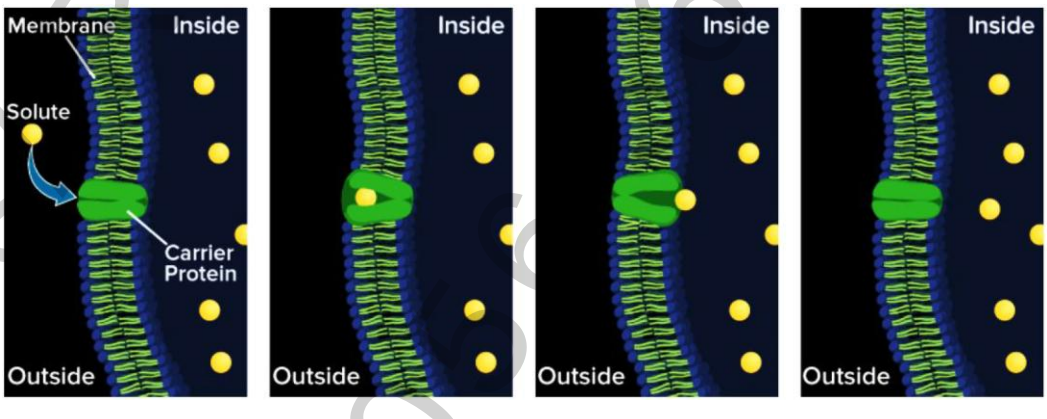
Figure 11(C) In a hypertonic solution, water leaves a cell by osmosis, causing the cell to shrink. Animal cells shrivel up as they lose water. As plant cells lose internal pressure, the plasma membrane shrinks away from the cell wall.

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24	BIO.3.1.01.043 Build a model of the cell membrane indicating the active and passive transport in terms of the difference in concentration, the required energy, and the movement direction of the particle and explain how the movement of a particle affects the cell and as a result, affects the living organisms also	Information from text	52, 53
		Figure 13, 14	52, 53

Active Transport

- Sometimes substances must move from a region of lower concentration to a region of higher concentration.
- This movement of substances across the plasma membrane against a concentration gradient requires energy. therefore, it is called active transport.
- Figure 12 illustrates how active transport occurs with the aid of carrier proteins, commonly called pumps.
- Some pumps move one type of substance in only one direction.
- while others move two substances either across the membrane in the same direction or in opposite directions.
- Because of active transport, the cell maintains the proper balance of substances it needs.
- Active transport helps maintain homeostasis.



Na^+/K^+ ATPase pump

** The sodium-potassium ATPase pump, shown in Figure 13, is an active transport pump found in the plasma membrane of animal cells.

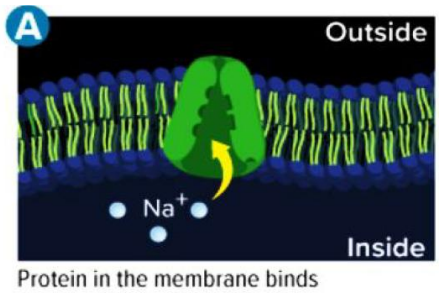
** The pump maintains the level of sodium ions (Na^+) and potassium ions (K^+) inside and outside the cell.

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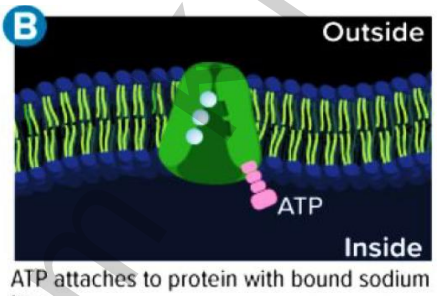
** ***The protein pump:*** **is an enzyme that catalyzes the breakdown of an energy-storing molecule.**

****The pump uses the energy to transport three sodium ions out of the cell while moving two potassium ions into the cell.**

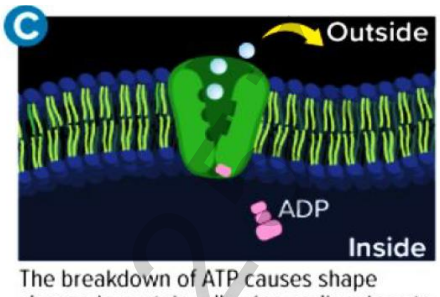
** **The high level of sodium on the outside of the cell creates a concentration gradient.**



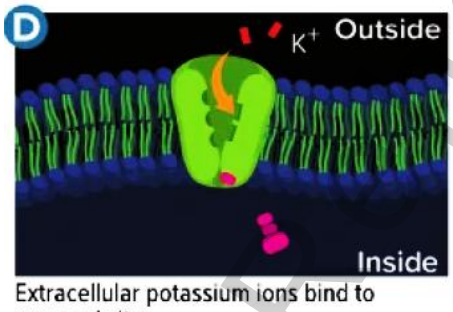
Protein in the membrane binds intracellular sodium ions.



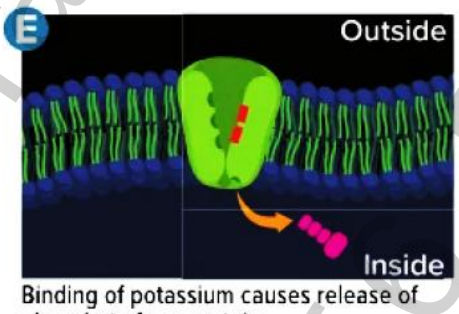
ATP attaches to protein with bound sodium ions.



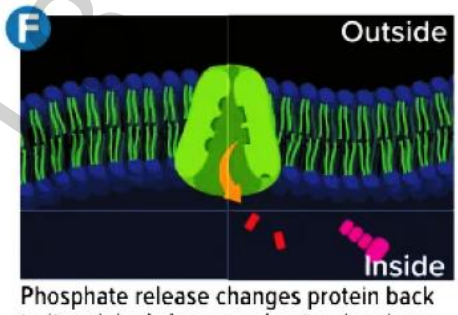
The breakdown of ATP causes shape change in protein, allowing sodium ions to leave.



Extracellular potassium ions bind to exposed sites.



Binding of potassium causes release of phosphate from protein.



Phosphate release changes protein back to its original shape, and potassium ions move back into the cell.

** **The activity of the** ***Na^+/K^+*** **ATPase pump can result in yet another form of cellular transport.**

** **Substances, such as sugar molecules, must come into the cell from the outside, where the concentration of the substance is lower than it is inside. This requires energy.**

** **Recall, that the** ***Na^+/K^+*** **ATPase pump moves** ***Na^+*** **out of the cell, creating a low concentration of** ***Na^+*** **inside the cell.**

** **In a process called** ***coupled transport*****, the** ***Na^+*** **ions that have been pumped out of the cell can couple with sugar molecules and be transported into the cell through a membrane protein called** ***a coupled channel*****.**

** **The sugar molecule, coupled to a** ***Na^+*** **ion, enters the cell by facilitated diffusion of the sodium, as shown in Figure 14.**

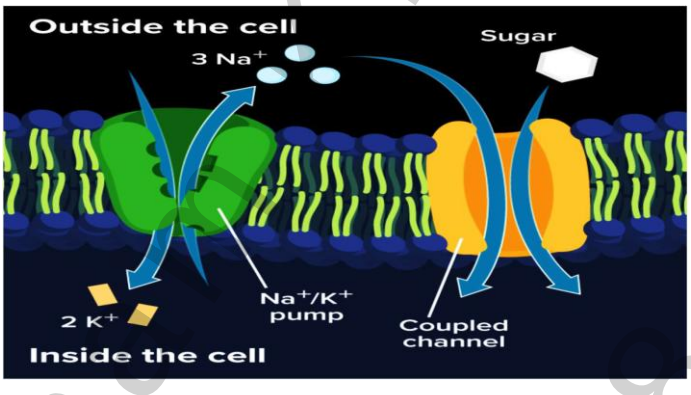
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** As a result, sugar enters the cell without spending any additional cellular energy.

** The type of transport shown in Figure 14 occurs in some plant tissues

** Sugar moves by coupled transport into plant tissues.

** These tissues carry the sugar to parts of the plant where it is stored until needed.



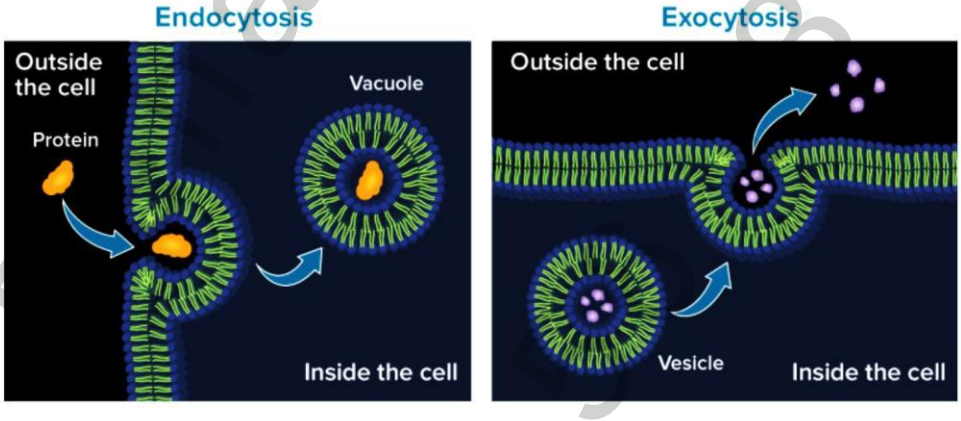
23	BIO.3.1.01.043 Build a model of the cell membrane indicating the active and passive transport in terms of the difference in concentration, the required energy, and the movement direction of the particle and explain how the movement of a particle affects the cell and as a result, affects the living organisms also	Information from text	54
		Figure 15	54

Transport of Large Particles

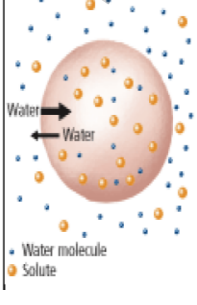
- Some substances are too large to move through the plasma membrane by diffusion or transport proteins and must get inside the cell by a different process.
- ***Endocytosis:*** is the process by which a cell surrounds a substance in the outside environment, enclosing the substance in a portion of the plasma membrane.
- The membrane then pinches off and leaves the substance inside the cell.
- ***Exocytosis:*** is the secretion of materials at the plasma membrane.

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- The substance shown on the left in Figure 15 is engulfed and enclosed by a portion of the cell's plasma membrane.
- The membrane then pinches off inside of the cell, and the resulting vacuole, with its contents, moves to the inside of the cell.
- Figure 15 shows that exocytosis is the reverse of endocytosis.
- Cells use exocytosis to expel wastes and to secrete substances, such as hormones, produced by the cell.
- Both endocytosis and exocytosis require the input of energy.
- Cells maintain homeostasis by moving substances into and out of the cell. Some transport processes require additional energy input, while others do not.
- Together, the different types of transport allow a cell to interact with its environment while maintaining homeostasis.



The animal cells below were placed in a hypotonic solution. What happened to the damaged cell?



A)	Osmosis was prevented in the cell.
B)	Osmosis caused the cell to shrivel.
C)	Osmotic pressure caused the cell to rupture.
D)	The cell was damaged by bacteria.

Which of the following is not true of exocytosis?

A)	results in hormone secretion
B)	does not require energy input
C)	allows waste matter to be expelled
D)	occurs at the plasma membrane

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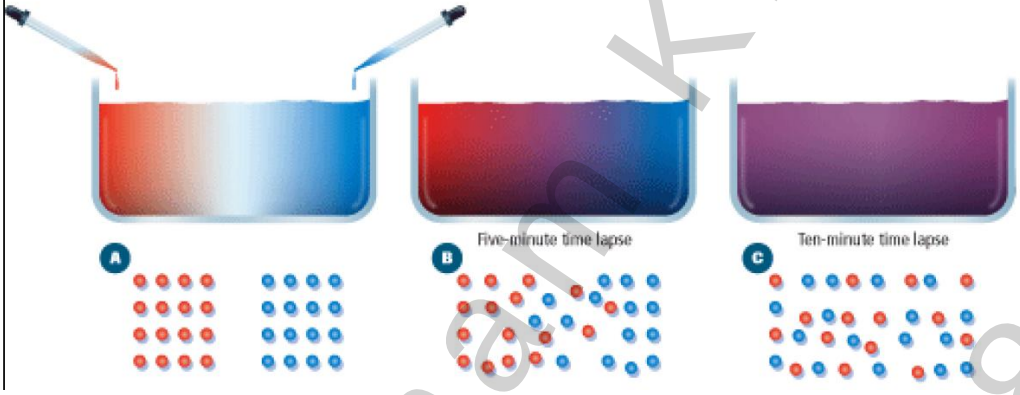
Which of these describes continuous particle movement with no overall change in concentration?

A)	selective permeability
B)	facilitated diffusion
C)	osmosis
D)	dynamic equilibrium

Why does misting fruits and vegetables with water help them look fresh?

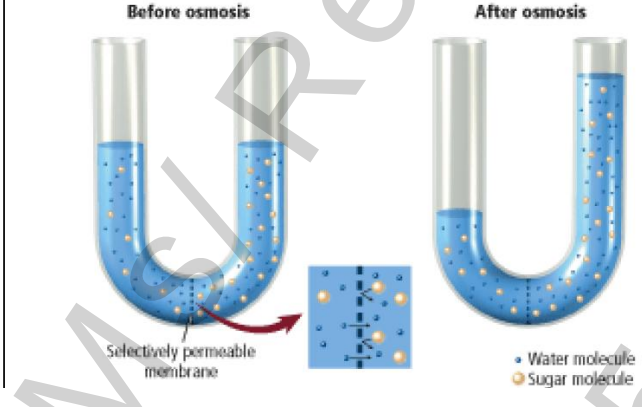
A)	Vacuoles fill with water due to osmosis.
B)	Plant cells in a hypotonic solution lose water.
C)	Plants do not have a rigid cell wall.
D)	Water cannot move through the cell membrane.

The picture shows the movement of ink molecules in water. Which of the following processes has occurred?



A)	endocytosis
B)	osmosis
C)	diffusion
D)	exocytosis

This shows a sugar solution with a selectively permeable membrane. What has occurred?



A)	water diffused toward higher sugar concentration
B)	sugar molecules crossed the membrane
C)	water diffused toward lower sugar concentration
D)	water did not cross the membrane

How could you prevent cells from bursting in an extremely hypotonic solution?

A)	Allow water to increase osmotic pressure.
B)	Decrease the concentration of solute outside cell.
C)	Increase the concentration of solute outside the cell.
D)	Wait for diffusion to reach equilibrium.

How do carrier proteins facilitate active transport?

A)	block the plasma membrane
B)	move substances against a concentration gradient
C)	prevent homeostasis
D)	create an isotonic solution

What is a significant difference of endocytosis and exocytosis?

A)	Exocytosis does not require energy input.
B)	Endocytosis does not involve waste secretion.
C)	Endocytosis does not require energy input.
D)	Exocytosis does not maintain homeostasis.

77) The spread of a drop of food dye throughout a glass of milk is called _____.

Correct Answer

Blank 1: diffusion

78) A pump located in a cell's plasma membrane transports sodium and _____.

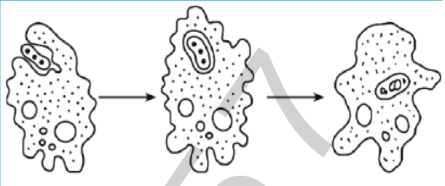
Correct Answer

Blank 1: potassium or K

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Different transport processes are used by organisms to carry materials
into and out of their cells. Which transport mechanism is shown in the
diagram above?

Exocytosis: bulk transport in which materials are transported out of the cell.
Facilitated diffusion: molecules moving along their concentration gradient with the help of transport proteins.
Endocytosis: bulk transport in which materials move into the cell.
Passive transport: molecules simply move along their concentration gradient.



24) A molecule that is important for cell functioning cannot diffuse through the plasma membrane, but needs a protein that can open and close to allow the molecule to diffuse. What is this protein called?

- ○ motor protein
- ○ channel protein
- ○ receptor protein
- ○ carrier protein

Correct Answer
channel protein

25) Fill in the blanks using the available answer choices.

A molecule needs to enter into the cell but cannot go through the plasma membrane because of its polarity. However, the molecule can bind to a _____ (Blank 1) protein and the protein changes shape to allow the particle to move through the membrane.

Blank 1 options
- carrier
- receptor
- channel
- motor

Correct Answer
carrier

67) How do carrier proteins facilitate active transport?

- ○ Carrier proteins block the plasma membrane.
- ○ Carrier proteins create an isotonic solution.
- ○ Carrier proteins move substances from a high to low concentration.
- ○ Carrier proteins move substances from a low to high concentration.

Correct Answer
Carrier proteins move substances from a low to high concentration.

23) Fill in the blanks using the available answer choices.

After some important cellular processes, there is an abundance of carbon dioxide (CO_2) molecules inside the cell, but not enough molecules outside the cell.
CO_2 molecules would _____ (Blank 1) because there is a _____ (Blank 2) concentration outside the cell than inside the cell.

Blank 1 options
- remain in the cell
- move into the cell
- move out of the cell

Blank 2 options
- lower
- higher
- stable

Correct Answer
move out of the cell
lower

76) Diffusion occurs when there is a net movement of particles from an area of _____ concentration to an area of _____ concentration.

Correct Answer
Blank 1: high **or** higher
Blank 2: low **or** lower

68) Predict how oxygen crosses the plasma membrane if the concentration of oxygen is lower inside the cell than it is outside the cell.

- ○ Oxygen enters the cell through channel proteins.
- ○ Oxygen leaves the cell through channel proteins.
- ○ Oxygen enters the cell through the plasma membrane.
- ○ Oxygen leaves the cell through the plasma membrane.

Correct Answer
Oxygen enters the cell through the plasma membrane.

Which type of transport uses transport proteins and does not require external energy?

Active transport | Facilitated diffusion | Osmosis | Simple diffusion

73) Substances would have more difficulty moving across the plasma membrane without a substance called _____ _____.

Correct Answer
Blank 1: transport
Blank 2: proteins **or** protein

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91) The diffusion of water across the selectively permeable membrane of an alga cell is called _____.

Correct Answer

Blank 1: osmosis

What moves needed substances or waste materials through the plasma membrane?

A)	transport proteins
B)	polar heads
C)	DNA
D)	water molecules

94) The condition of continuous, random movement of particles but no overall change in concentration of materials is called __.

- diffusion
- osmosis
- passive transport
- dynamic equilibrium

Correct Answer

dynamic equilibrium

Some cells use elaborate pumping systems, such as the Na^+/K^+ ATPase pump shown below. Which of the following shows how this pump works to maintain the level of sodium ions (Na^+) and potassium ions (K^+) inside and outside the cell?

Transports 2(Na^+) out of the cell and moves 3 (K^+) into the cell

Transports 3 (Na^+) into the cell and moves 2 (K^+) out of the cell

Transports 3 (Na^+) out of the cell and moves 2 (K^+) into the cell

Transports 2 (Na^+) into the cell and moves 3 (K^+) out of the cell

Which type of transport requires energy input from the cell?

Active transport

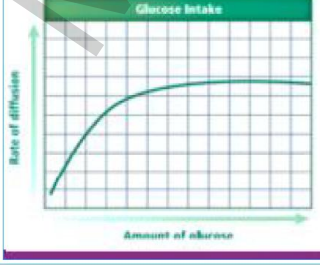
Osmosis

Simple diffusion

Facilitated diffusion

The graph below describes the relationship between the amount of glucose entering a cell and the rate at which the glucose enters the cell with the help of carrier proteins. The graph line shows that as the amount of glucose increases, the diffusion rate increases until a maximum rate is reached.

Which of the following is the correct reason for the stability of diffusion rate when higher amounts of glucose are reached?



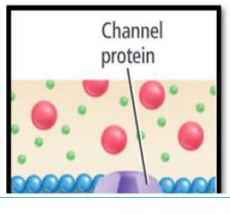
Because there is no more carrier proteins to transport the glucose

Because the cell is unable to produce more energy required for diffusion

Because the cell cannot handle more glucose

Because the carrier proteins change their shapes

Which of the following indicates the process shown in the figure below?



Diffusion

Exocytosis

Active transport

Facilitated diffusion

A cell's plasma membrane pump transports sodium and .....

a. Mn

b. K

c. Cl

d. Mg

Which is not a factor that affects the rate of diffusion?

a. Concentration

b. Pressure

c. Temperature

d. Conductivity

Which movement of substances through a Cell membrane against a concentration Gradient requires energy?

A osmosis

B diffusion

C active transport

D facilitated diffusion

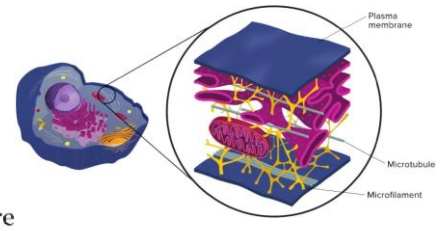
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2.4

25	BIO.3.1.01.050 Identify structures and organelles in cells, including the nucleus, cell membrane, cell wall, chloroplasts, vacuole, mitochondria, and cytoplasm, and explain the basic functions of each	Figure 18	57
		"Get it?" question	57

Get It?

Summarize the structure and function of the cytoskeleton.



Components of the cytoskeleton

At one time, scientists thought that cell organelles floated in a sea of cytoplasm. More recently, cell biologists have discovered that organelles do not float freely in a cell. Instead, the organelles are supported by a structure within the cytoplasm similar to the structure shown in **Figure 18**. The **cytoskeleton** is a supporting network of long, thin protein fibers that form a framework for the cell and provide an anchor for the organelles inside the cell. The cytoskeleton also has a function in cell movement and other cellular activities.

Microtubules and microfilaments

The cytoskeleton is composed of substructures called microtubules and microfilaments. Microtubules are long, hollow protein cylinders that form a rigid skeleton for the cell and assist in moving substances within the cell. Microfilaments are thin protein threads that help give the cell shape and enable the entire cell or parts of the cell to move. Microtubules and microfilaments rapidly assemble and disassemble and slide past one another. This allows cells and organelles to move.

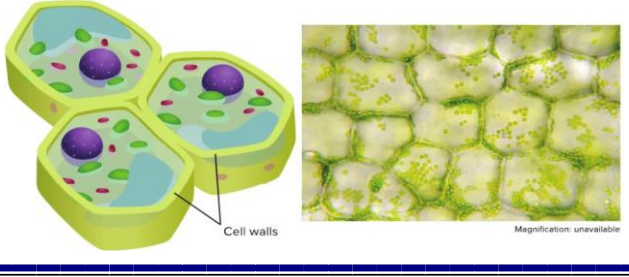
10	BIO.3.1.01.073 Compare the structure and function of plant and animal cells and that of eukaryote and prokaryote cell	Information from text	59
		"Get it?" question	59

Get It?

Compare and contrast the cells walls of prokaryotic and eukaryotic cells.

Cell wall

Plant cell wall A structure associated with plant cells is the **cell wall,** shown in **Figure 21**. The cell wall is a thick, rigid, mesh of fibers that surrounds the outside of the plasma membrane, protects the cell, and gives it support. Rigid cell walls allow plants to stand at various heights—from blades of grass to California redwood trees. Plant cell walls are made of a carbohydrate called cellulose, which gives the cell walls their inflexible characteristic.



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Prokaryote cell wall Prokaryotes, such as bacteria, also have a cell wall surrounding the cell. The functions of a prokaryotic cell wall are similar to the functions of the plant cell wall. A prokaryotic cell wall protects the cell, helps to maintain the cell's shape, and gives the cell support.

However, prokaryotic cell walls are not made of cellulose, like plant cells are. The prokaryotic cell wall is made of a material called peptidoglycan, which is a combination of disaccharides and peptide fragments. All prokaryotes have peptidoglycan in their cell walls.

30	BIO.3.1.01.050 Identify structures and organelles in cells, including the nucleus, cell membrane, cell wall, chloroplasts, vacuole, mitochondria, and cytoplasm, and explain the basic functions of each	Information from text	62
		Demonstrate Undertanding: Question 2	66

2. **Summarize** the role of the endoplasmic reticulum.

Ribosomes

One of the functions of a cell is to produce proteins. The organelle that help manufacture proteins is called the **ribosome.** Ribosomes are made of two components—RNA and protein—and are not bound by a membrane like other organelles are. The nucleolus is the site of ribosome production.

Cells have many ribosomes that produce a variety of proteins that are used by the cell or are moved out and used by other cells. Some ribosomes float freely in the cytoplasm, while others are bound to another organelle called the endoplasmic reticulum. Free-floating ribosomes produce proteins for use within the cytoplasm of the cell. Bound ribosomes produce proteins that will be bound within membranes or used by other cells.

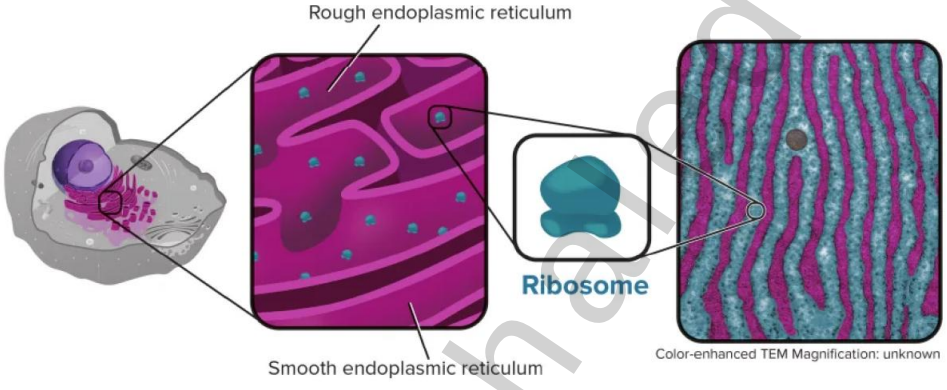
Endoplasmic reticulum

The **endoplasmic reticulum** (en duh PLAZ mihk • rih TIHK yuh lum), also called ER, is a membrane system of folded sacs and interconnected channels that serves as the site for protein and lipid synthesis. The structure of the ER, with many pleats and folds, provides a large amount of surface area where cellular functions can take place.

Rough endoplasmic reticulum The area of ER where ribosomes are attached is called rough endoplasmic reticulum. Notice in **Figure 25** that the rough ER appears to have bumps on it. These bumps are the attached ribosomes that will produce proteins for export to other cells.

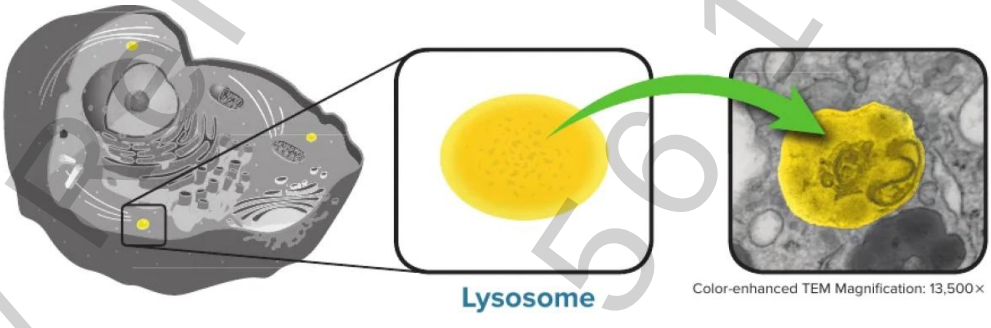
Smooth endoplasmic reticulum Notice that **Figure 25** also shows that there are areas of the ER that do not have ribosomes attached. The area of ER where no ribosomes are attached is called smooth endoplasmic reticulum. Although the smooth ER has no ribosomes, it does perform important functions for the cell. For example, the smooth ER provides a membrane surface where a variety of complex carbohydrates and lipids, including phospholipids, are synthesized. Smooth ER in the liver detoxifies harmful substances.

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11	BIO.3.1.01.050 Identify structures and organelles in cells, including the nucleus, cell membrane, cell wall, chloroplasts, vacuole, mitochondria, and cytoplasm, and explain the basic functions of each	Information from text	64
		Figure 28	64

Lysosomes Factories and cells also need cleanup crews. In a cell, there are **lysosomes**, shown in **Figure 28**, which are vesicles that contain substances that digest excess or worn-out organelles and food particles. Lysosomes also digest bacteria and viruses that have entered the cell. The membrane surrounding a lysosome prevents the digestive enzymes inside from destroying the cell. Lysosomes can fuse with vacuoles and dispense their enzymes into the vacuoles. These enzymes digest the wastes inside.



27	BIO.3.1.01.050 Identify structures and organelles in cells, including the nucleus, cell membrane, cell wall, chloroplasts, vacuole, mitochondria, and cytoplasm, and explain the basic functions of each	Table 1	65

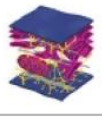
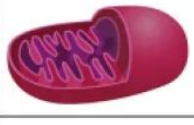
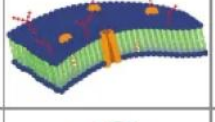
Comparing cells

Table 1, on the next page, summarizes, compares, and contrasts the general structures of plant cells and animal cells. Notice that plant cells contain chlorophyll; they can capture and transform energy from the Sun into a usable form of chemical energy. This is one of the main distinctions between plant cells and animal cells. In addition, recall that animal cells usually do not contain vacuoles. If they do, vacuoles in animal cells are much smaller than vacuoles in plant cells. Also, animal cells do not have cell walls. Cell walls give plant cells protection and support.

There are many structures found in both plant and animal cells. For example, the nucleus controls the activities of both plant and animal cells. The plasma membrane plays a vital role in maintaining homeostasis in both plant and animal cells, and the ribosomes are the site of protein synthesis for both types of cells.

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Table 1 Summary of Cell Structures

Cell Structure	Example	Function	Cell Type
Cell wall		An inflexible barrier that provides support and protects the plant cell	Plant cells, fungi cells, and some prokaryotes
Centrioles		Organelles that occur in pairs and are important for cell division	Animal cells and most protist cells
Chloroplasts		A double-membrane organelle with thylakoids containing chlorophyll; where photosynthesis takes place	Plant cells and some protist cells
Cilia		Projections from cell surfaces that aid in locomotion and feeding; also used to sweep substances along surfaces	Some animal cells, protist cells, and prokaryotes
Cytoskeleton		A framework for the cell within the cytoplasm	All eukaryotic cells
Endoplasmic reticulum		A highly folded membrane that is the site of protein synthesis	All eukaryotic cells
Flagella		Projections that aid in locomotion and feeding	Some animal cells, prokaryotes, and some plant cells
Golgi apparatus		A flattened stack of tubular membranes that modifies proteins and packages them for distribution outside the cell	All eukaryotic cells
Lysosome		A vesicle that contains digestive enzymes for the breakdown of excess or worn-out cellular substances	Animal cells and rare in plant cells
Mitochondria		A membrane-bound organelle that makes energy available to the rest of the cell	All eukaryotic cells
Nucleus		The control center of the cell that contains coded directions for the production of proteins and cell division	All eukaryotic cells
Plasma membrane		A flexible boundary that controls the movement of substances into and out of the cell	All cells
Ribosome		Organelle that is the site of protein synthesis	All cells
Vacuole		A membrane-bound vesicle for the temporary storage of materials	Plant cells–one large; rarely animal cells–a few small

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26	BIO.3.1.01.050 Identify structures and organelles in cells, including the nucleus, cell membrane, cell wall, chloroplasts, vacuole, mitochondria, and cytoplasm, and explain the basic functions of each	Information from text	66

Organelles at work

With a basic understanding of the structures found within a cell, it becomes easier to envision how those structures work together to perform cell functions. Take, for example, the synthesis of proteins. Protein synthesis begins in the nucleus with the information contained in the DNA. Genetic information is copied and transferred to another genetic molecule called RNA. Then RNA and ribosomes, which have been manufactured in the nucleolus, leave the nucleus through the pores of the nuclear membrane. Together, RNA and ribosomes manufacture proteins. Each protein made on the rough ER has a particular function; it might become a protein that forms a part of the plasma membrane, a protein that is released from the cell, or a protein transported to other organelles. Other ribosomes will float freely in the cytoplasm and also make proteins.

Most of the proteins made on the surface of the ER are sent to the Golgi apparatus. The Golgi apparatus packages the proteins in vesicles. It then transports the proteins to other organelles or out of the cell. Other organelles use these proteins as they carry out cell processes. For example, lysosomes use proteins, enzymes in particular, to digest food and waste. Mitochondria use enzymes as they produce a usable form of energy for the cell.

After reading about the structures and organelles in a cell and how they work together, it becomes clear why people often equate the cell to a factory. Like the parts of a factory, each organelle has a specific job to do. Different structures are involved in completing different tasks. The health of the cell depends on all of the components working together.

Cells arise only from previously existing cells with cells passing copies of their genetic material on to their daughter cells.

Organisms that break down molecules to generate energy	Both
Organisms that have cells lacking internal membrane-bound organelles	Prokaryotic cell
Organisms whose cells do not have nuclei	Prokaryotic cell
Organisms that are either unicellular or multicellular	Eukaryotic cell
Organisms that are generally unicellular	Prokaryotic cell
Organisms that have cells containing organelles	Eukaryotic cell
Organisms that have plasma membranes	Both

Categorize the following characteristics as either prokaryotic cells, eukaryotic cells, or both.

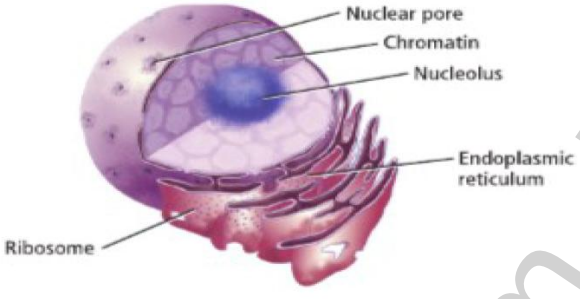
Prokaryotic cells	Eukaryotic cells	Both
smaller cell	nucleus	ribosomes
examples are bacteria	larger cell	plasma membrane
	membrane-bound organelles	DNA
	examples are yeast and algae	

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Q7.	Which is the effect of having the polar and nonpolar ends of phospholipid molecules oriented as they are in the illustration?
a.	It allows transport proteins to move easily through the membrane.
b.	It controls the movement of substances across the membrane.
c.	It helps the cell to maintain its characteristic shape.
d.	It makes more room inside the phospholipid bilayer.

Use the diagram below to answer questions 8 and 9.



Q8.	Which structure synthesizes proteins that will be used by the cel
a.	Chromatin
b.	ribosome
c.	nucleus
d.	Endoplasmic reticulum

Q9.	Which is the site of protein synthesis?
a.	Nuclear pore
b.	Endoplasmic reticulum
c.	chromatin
d.	nucleolus

Q10.	In which structure would you expect to find a cell wall?
a.	Human skin cell
b.	Cell from an oak tree
c.	Blood cell from a cat
d.	Liver cell from a mouse

Q11.	Which is not a factor that effects the rate of diffusion?
a.	conductivity
b.	concentration
c.	pressure
d.	temperature

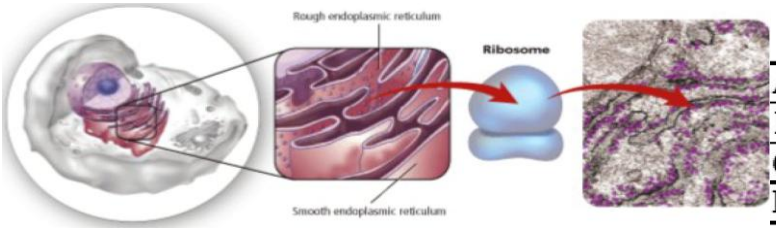
Q12.	In which type of cell would you find a chloroplast?
a.	prokaryote
b.	animal
c.	plant
d.	fungus

Q13.	Which of the following are called the powerhouses of cells?
a.	Ribosomes
b.	cytoplasm
c.	mitochondria
d.	centrioles

Q14.	How many layers of phospholipid molecules make up the plasma membrane?
a.	3
b.	2
c.	4
d.	1

Q15.	Which set of conditions effect the rate of diffusion?
a.	Mass, temperature, and volume
b.	Weight, volume, and pressure
c.	Mass, volume, and concentration
d.	Concentration, temperature, and pressure

This shows an example of endoplasmic reticulum. What is the significance of its structure?



A)	provides a location for DNA production
B)	helps decrease surface area
C)	allows selective permeability of cell membrane
D)	facilitates breakdown of chemical bonds

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Vesicles that digest worn-out organelles or food particles are called _____.

A)	lysosomes
B)	centrioles
C)	ribosomes
D)	plasma membranes

What critical function does cholesterol serve in the body?

A)	destroys the plasma membrane
B)	binds fatty acid tails to water
C)	disrupts homeostasis
D)	increases fluidity of plasma membrane

What effect has eukaryotic evolution had on cells?

A)	more simplified structures
B)	greater adaptability
C)	eliminated organelles
D)	decreased cell diversity

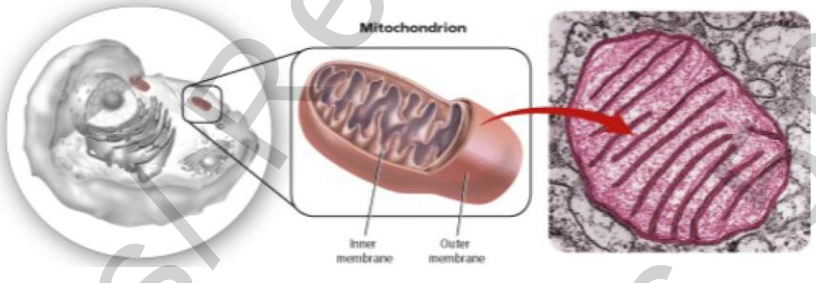
Which of the following is not a function of the Golgi apparatus?

A)	modifies proteins
B)	produces proteins
C)	organizes where proteins are sent
D)	packages proteins into vesicles

The ___ is a network of fibers that form a framework and anchor organelles.

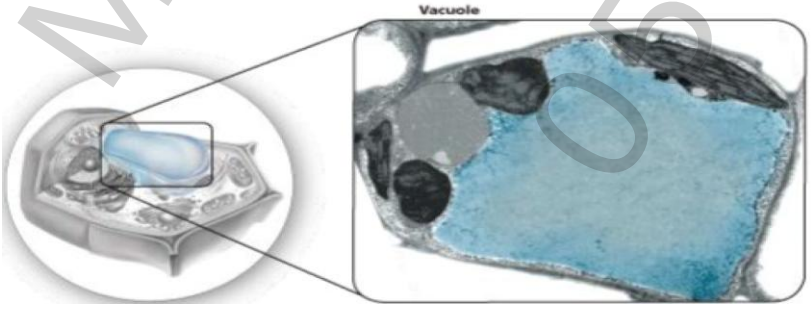
A)	endoplasmic reticulum
B)	cytoplasm
C)	cytoskeleton
D)	golgi apparatus

Observe the structure of this mitochondrion. Why is its inner membrane crucial for cell functioning?



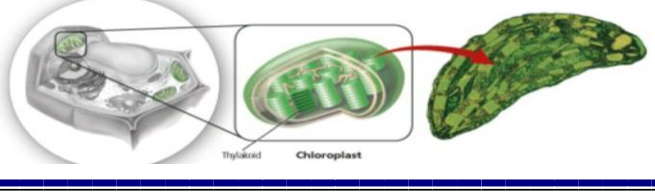
A)	provides a large surface area
B)	keeps sunlight from damaging cell
C)	provides inflexible barrier on cell surface
D)	promotes photosynthesis

The large compartment shown in the detailed image of this plant cell is a ____.



A)	nucleus
B)	vacuole
C)	ribosome
D)	plasma membrane

What is the function of the small, disk-shaped thylakoids in this plant cell?



A)	digest enzymes
B)	assist cell movement
C)	store food and enzymes
D)	contain chlorophyll for trapping sunlight

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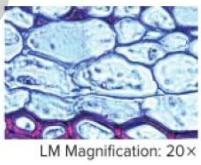
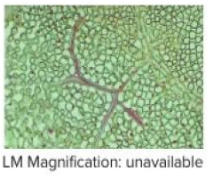
3.2

12	BIO.3.1.01.078 Identify, and draw biological diagrams of, the specialized plant tissues in roots, stems, and leaves, using a microscope and models	Information from text	81
		Table 4	81

Plant Cells

You can identify a typical plant cell by the presence of a cell wall, a large central vacuole, and chloroplasts. However, there are many different types of plant cells—each with one or more adaptations that enable it to carry out a specific function. Three types of plant cells form most plant tissues. **Table 4** shows each of these cells and their functions.

Table 4 Plant Cells and Functions

Cell Type	Examples	Functions
Parenchyma	 LM Magnification: 20×	• Storage • Photosynthesis • Gas exchange • Protection • Tissue repair and replacement
Collenchyma	 LM Magnification: 20×	• Support • Transport of materials
Sclerenchyma	 LM Magnification: unavailable	• Support for surrounding tissues • Provides flexibility for plant • Tissue repair and replacement

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✨ *Work hard — the future belongs to those with great determination* 💪

🌟 *Wishing you continued success and excellence in your studies* 📚 💫

With best wishes,

Ms. Riham Khaled 👩‍🏫

📞 *0565618257*

🕊️ *Please remember me in your kind prayers* 🤍