BIO.A.1 Basic Biological Principles

BIO.A.1.2 Describe the relationships between structure and function at biological levels of organization.

BIO.A.1.2.1 Compare cellular structures and their functions in prokaryotic and eukaryotic cells.

NOTES

Cytoplasm-

Jelly like substance that contains dissolved molecular building block – such as proteins, nucleic acids, minerals, and ions.

Organelles –

Structures specialized to perform distict processes within a cell. A nucleus is an organelle.

Cytoskeleton –

Network of proteins that is constantly changing to meet the needs of a cell.

Composed of microtubules, microfilaments, and intermediate filaments that give the cell shape, support, internal and external motility.

All cells contain cytosol, dna, plasma membrane, ribosomes.

NOTES

Prokaryotic cells –

Do NOT have a nucleus or other membrane bound organelles.

Instead, the cell's DNA is suspended in the cytoplasm.

All prokaryotes are microscopic single celled organisms.

Bacteria is an example of a prokaryote cell.

NOTES

Eukaryotic cells –

Contain membrane bound organelles that perform specific cellular processes, divide certain molecules into compartments, help regulate timing of key events.

Not a random jumble of suspended organelles. Certain organelles and molecules are anchored to specific sites, which vary based on cell type.

The nucleus, the largest organelle, encloses the genetic information.

Eukaryotes may be multi-cellular or single-celled organisms.

“U” have a nucleus. Eukaryotic cells include animul plant and fungi.

Eukaryotic cells larger than prokaryotic cells because have nucleus.

NOTES

Prokaryotic vs Eukaryotic Cells

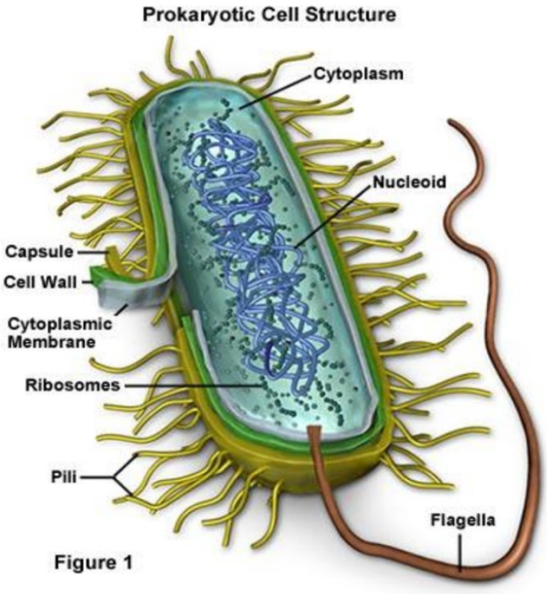
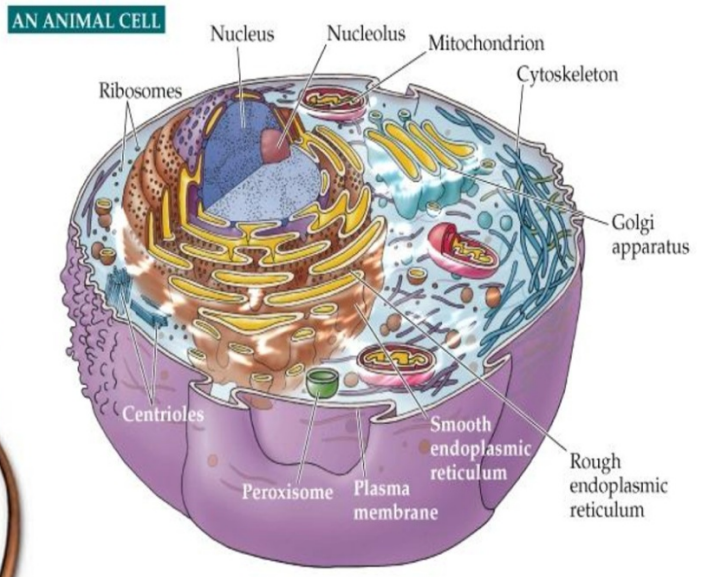


Figure 1

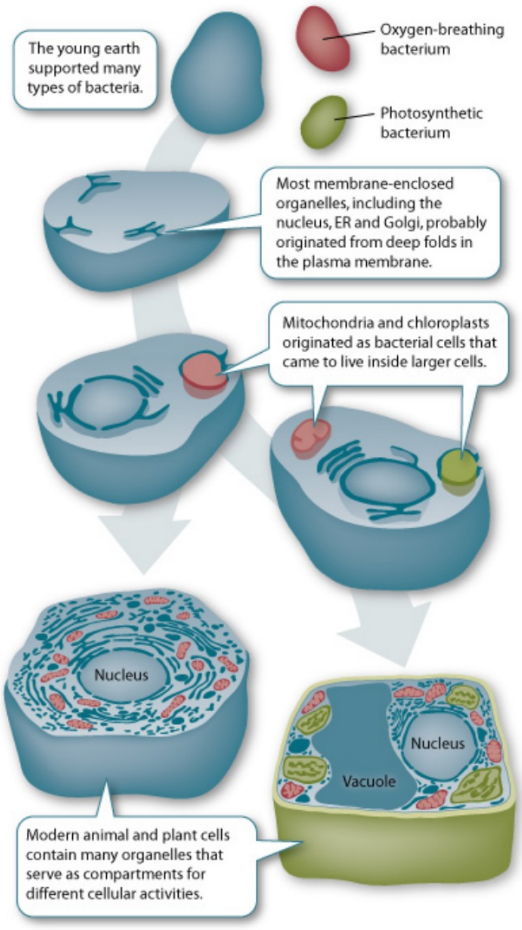


NOT TO SCALE

Size of cells app

NOTES

Evolution of organelles in eukayotes



Keystone Prep Questions - Biology

Which characteristic is shared by **all** prokaryotes and eukaryotes?

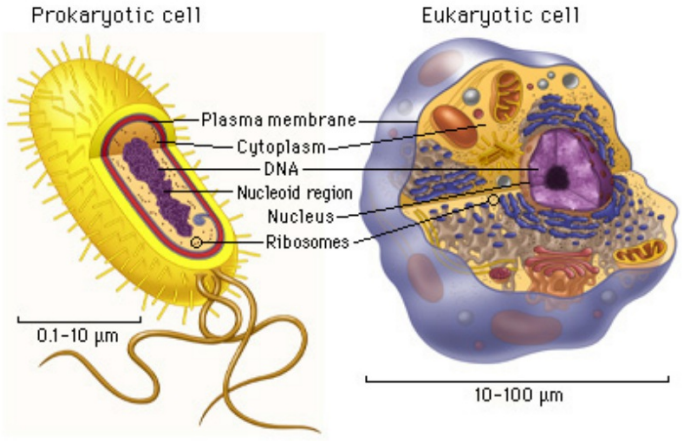
A) ability to store heredity information

B) use of organelles to control cell processes

C) use of cellular respiration for energy release

D) ability to move in response to environmental stimuli

Answer



Keystone Prep Questions - Biology

Living organisms can be classified as prokaryotes or eukaryotes. Which two structures are common to both prokaryotic and eukaryotic cells?

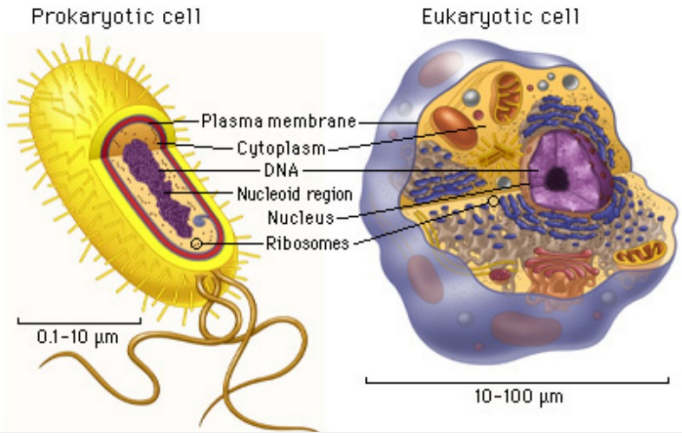
A) cell wall and nucleus

B) cell wall and chloroplast

C) plasma membrane and nucleus

D) plasma membrane and cytoplasm

Answer



Keystone Prep Questions- Biology

Alveoli are microscopic air sacs in the lungs of mammals. Which statement best describes how the structure of the alveoli allows the lungs to function properly?

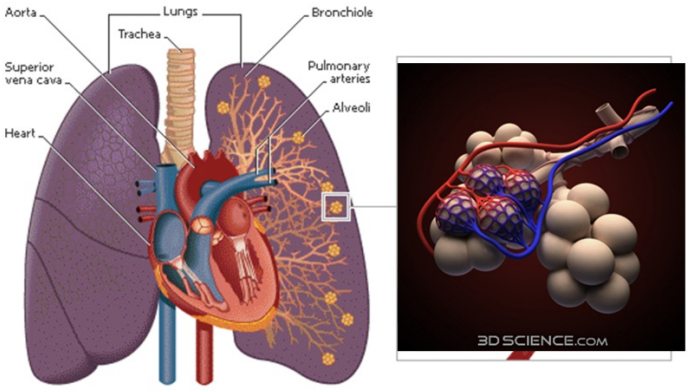
A) They increase the amount of energy transferred from the lungs to the blood.

B) They increase the flexibility of the lungs as they expand during inhalation.

C) They increase the volume of the lungs, allowing more oxygen to be inhaled.

D) They increase the surface area of the lungs, allowing efficient gas exchange.

Answer



Corrected Responses from Homework

Prokaryotic cells are generally much smaller than eukaryotic cells.

Identify a structural difference between prokaryotic cells and eukaryotic cells that is directly related to their difference in size.

Eukaryotic cells have a nucleus and other organelles while a prokaryotic cell does not.

Based on the structural difference, explain why prokaryotic cells can be much smaller than eukaryotic cells.

Prokaryotic cells can be much smaller simply because they do not have a nucleus. The nucleus takes up space in the Eukaryotic cells.

Describe one similarity between prokaryotic cells and eukaryotic cells that is independent of size.

Both types of cells have cell membranes, genes, and ribosomes.

BIO.A.2 The Chemical Basis for Life

BIO.A.2.2 Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e.,atoms, molecules, and macromolecules).

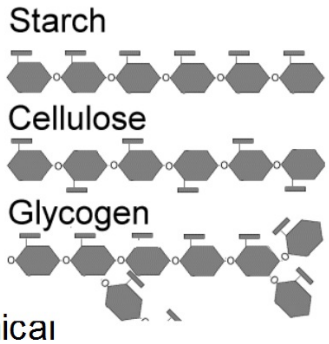
BIO.A.2.2.3 Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms.

NOTES

*monomer – each subunit in a complete molecule

*polymer – large molecules made of many monomers bonded together.

Carbohydrates –

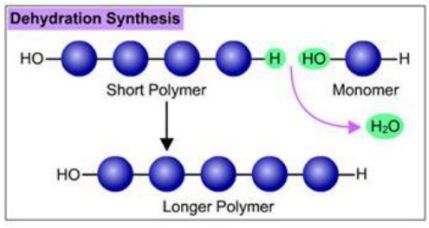


Molecules composed of carbon, hydrogen, and oxygen.

Include sugars (monosaccharide) and starches.

Can be broken down to provide a source of usable chemical energy for cells.

Link together by glyscosidic linkages (dehydration reaction) between the carbons of the monosaccharides.



Responsible for the storage and transport of energy and structural components

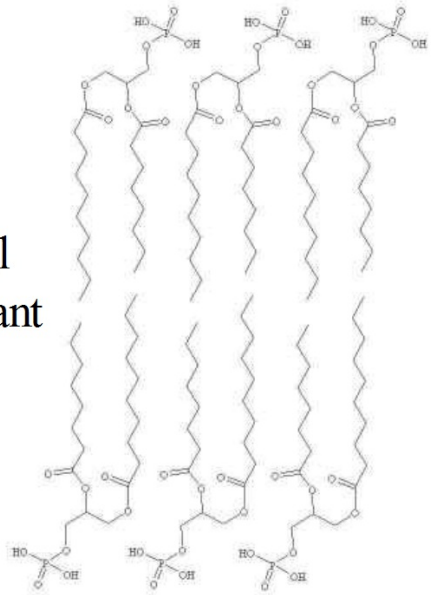
NOTES

Lipids –

Nonpolar molecules that include fats, oils, and cholesterol.

Most contain chains of carbon atoms bonded to oxygen and hydrogen atoms.

Have many functions in living organisms including nutrients, energy storage, structural components of cell membranes, and important signaling molecules.



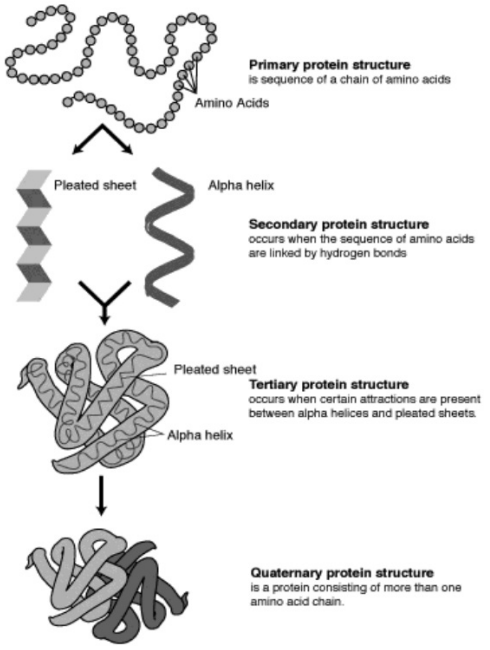
NOTES

Proteins –

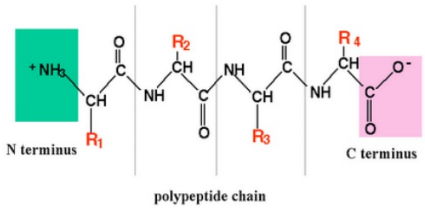
Polymer made of monomers called amino acids.

Amino acids are molecules that contain carbon, hydrogen, oxygen, nitrogen and sometimes sulfer.

Amino acids link together by peptide linkages (dehydration reaction) between the amine group and the carboxylic acid to form a polypeptide chain.



Peptide = chain of amino acids



NOTES

Many proteins are enzymes that catalyze biochemical reactions, and are vital to metabolism.

Protein is also necessary in animals' diets, since they cannot synthesize all the amino acids and must obtain essential amino acids from food.

Protein types

Type	Function	Examples
Structural	Give shape and structure to cell or organelles	Actin Tubulin
Enzymes	Catalyse biological reactions	Trypsin Adenylate cyclase
Receptors	Bind to other molecules and transmit signal	Glutamate R. Steroid R.
Other functional proteins	Have specific functions	Antibodies Nuclear factors Neuropeptides

NOTES

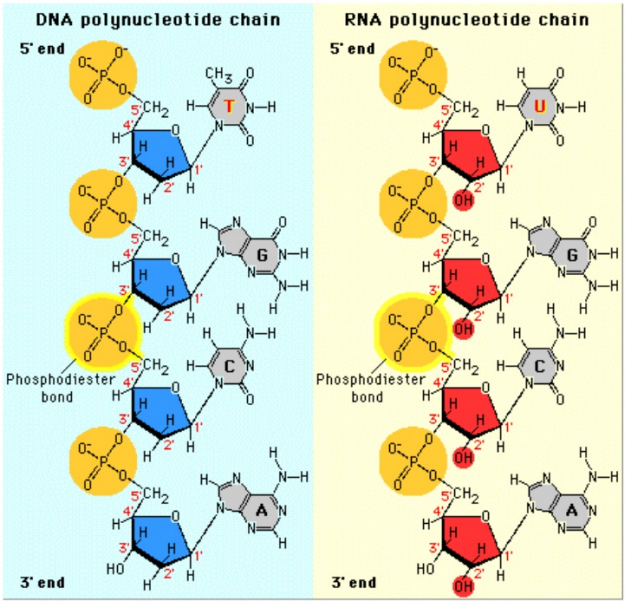
Nucleic acids –

Polymers made up of monomers called nucleotides.

Composed of a sugar, phosphate group, and nitrogen-containing molecule called a base.

Two general types of nucleic acids include RNA and DNA.

Carry genetic information or form structures within cells.



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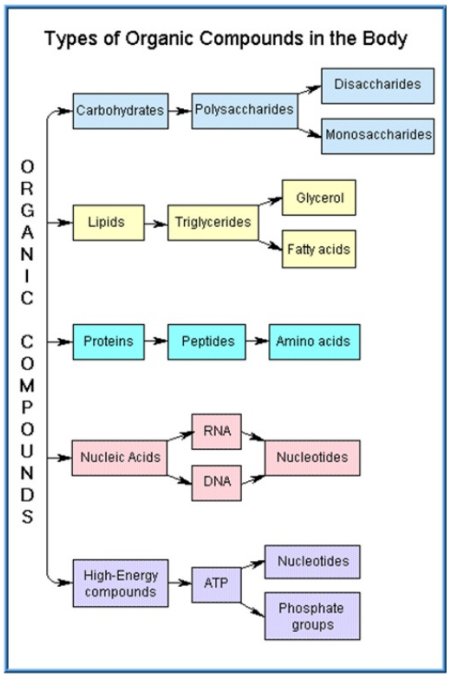


Carbohydrates are the energy.

Lipids are the insulation.

Proteins are the muscle.

Nucleic acids are the blue print.

Carbohydrates, lipids, and proteins have large number of structures and functions. Nucleic acids have one function – to make proteins. DNA stores info for putting amino acids together to make proteins. RNA helps to build proteins.

Keystone Prep Questions- Biology

Which statement best describes an effect of the low density of frozen water in a lake?

A) When water freezes, it contracts, decreasing the water level in a lake.

B) Water in a lake freezes from the bottom up, killing most aquatic organisms.

C) When water in a lake freezes, it floats, providing insulation for organisms below.

D) Water removes thermal energy from the land around a lake, causing the lake to freeze.

Answer

Keystone Prep Questions- Biology

Which statement correctly describes how carbon's ability to form four bonds makes it uniquely suited to form macromolecules?

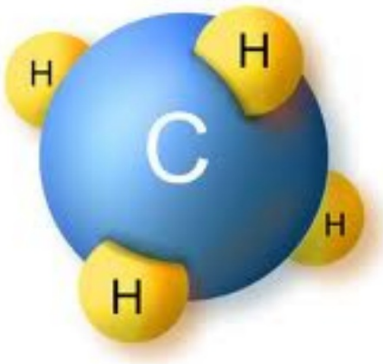
A) It forms short, simple carbon chains.

B) It forms large, complex, diverse molecules.

C) It forms covalent bonds with other carbon atoms.

D) It forms covalent bonds that can exist in a single plane.

Answer



Keystone Prep Questions- Biology

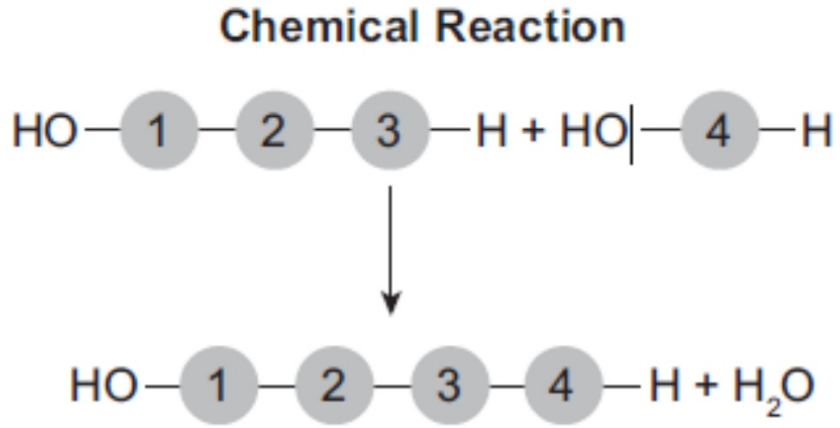
The diagram shows a reaction that forms a polymer from two monomers. What is this type of reaction called?

A) Glycolysis

B) Hydrolysis

C) Photosynthesis

D) Dehydration synthesis



Answer

Keystone Prep Questions- Biology

Carbohydrates and proteins are two types of macromolecules. Which functional characteristic of proteins distinguishes them from carbohydrates?

A) large amount of stored information

B) ability to catalyze biochemical reactions

C) efficient storage of usable chemical energy

D) tendency to make cell membranes hydrophobic

Answer

Keystone Prep Questions- Biology

Substance A is converted to Substance B in a metabolic reaction. Which statement best describes the role of an enzyme during this reaction?

A) It adjusts the pH of the reaction medium

B) It provides energy to carry out the reaction

C) It dissolves substance A in the reaction medium

D) It speeds up the reaction without being consumed

Answer

Keystone Prep Questions- Biology

A scientist observes that, when the pH of the environment surrounding an enzyme is changed, the rate the enzyme catalyzes a reaction greatly decreases. Which statement best describes how a change in pH can affect and enzyme

A) A pH change can cause the enzyme to change its shape

B) A pH change can remove energy necessary to activate an enzyme

C) A pH change can add new molecules to the structure of an enzyme

D) A pH change can cause an enzyme to react with a different substrate

Answer

Corrected Responses from Homework

Proteins are a major part of every living cell and have many different functions within each cell. Carbohydrates also perform numerous roles in living things.

Describe the general composition of a protein molecule.

A protein is a sequence (polymer) of amino acids (monomer). The amino acids are joined by peptide linkages.

Describe how the structures of proteins differ from the structures of carbohydrates.

Proteins are amino acids while carbohydrates are monocaccharides. Carbohydrates are linked via glycosidic linkages while proteins are linked by peptide linkages.

Describe how the functions of proteins differ from the functions of carbohydrates.

Proteins provide structure and function and are the catalyst for biological reactions while carbohydrates provide energy.

BIO.A.4 Homeostasis and Transport

BIO.A.4.1: Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell.

BIO.A.4.1.2 Compare the mechanisms that transport materials across the plasma membrane (i.e., passive transport-diffusion, osmosis, facilitated diffusion; and active transport-pumps, endocytosis, excocytosis).

NOTES

Cell Membrane -

Forms a boundary between a cell and the outside environment and controls the passage of materials into and out of the cell.

Consists of a double layer of phospholipids interspersed with a variety of other molecules.

A phospolipid is a molcule composed of three basic parts: a charged phoshate group, glycerol, and two fatty acid chains.

Has property of selective permeability which means it allows some but not all material to cross.

Concentration Gradient -

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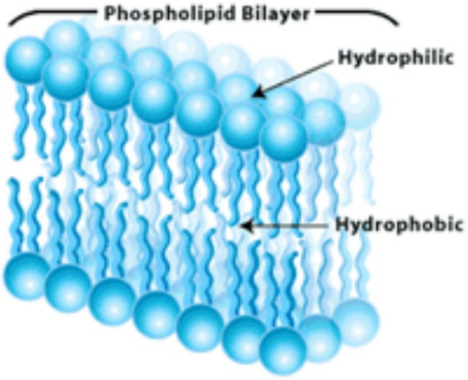


NOTES

Passive transport –

Movement of molecules across a cell membrane without energy input from the cell.

Diffusion -

The movement of molecules in a fluid or gas from a region of higher concentration to a region of lower concentration.

Osmosis –

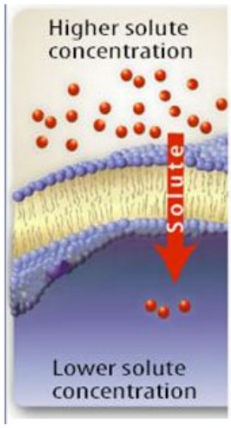
Water moves from higher water concentration to an area of lower water concentration.

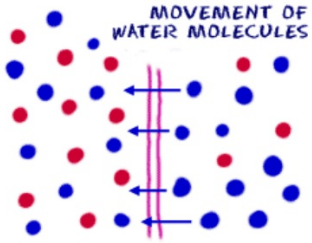
Facilitated diffusion –

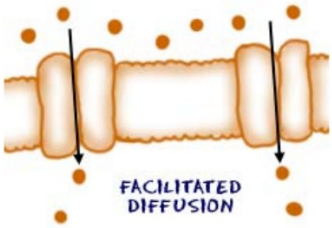
Some molecules cannot easily diffuse across membrane.

They cross more easily through transport proteins – openings formed by proteins that pierce the membrane.

Transport proteins make it easier to molecules to enter or exit a cell.


Higher solute concentration
Solute
Lower solute concentration


MOVEMENT OF WATER MOLECULES


FACILITATED DIFFUSION

NOTES

Active transport pumps –

Drives molecules across a membrane from a region of lower concentration to a region of higher concentration. Needs energy (ATP).

Uses transport proteins powered by chemical energy.

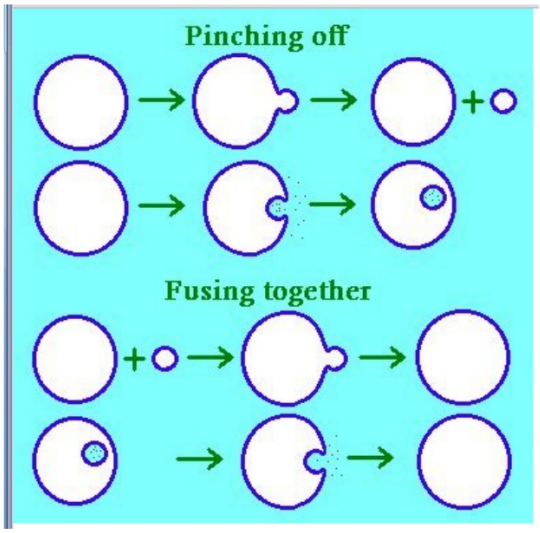
Cells use active transport to get needed molecules regardless of the concentration gradient and to maintain homeostasis.

Endocytosis –

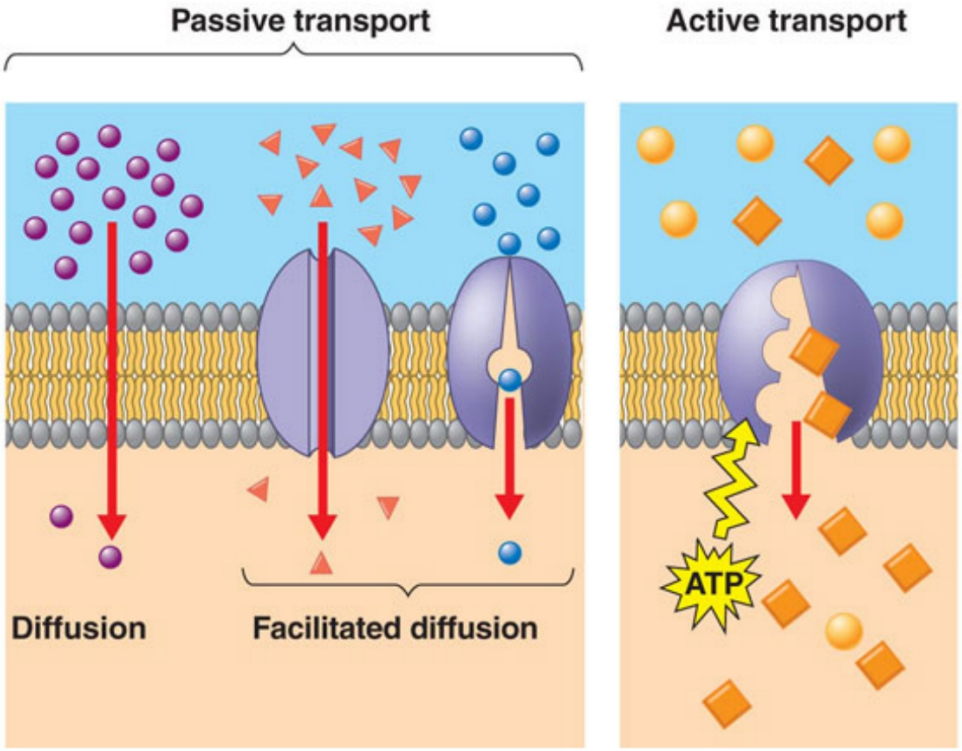
The process of taking liquids or fairly large molecules into a cell by engulfing them in a membrane.

Exocytosis –

The opposite of endocytosis, is the release of substances out of a cell by the fusion of a vesicle with the membrane.



Active Transport vs Passive Transport



Keystone Prep Questions- Biology

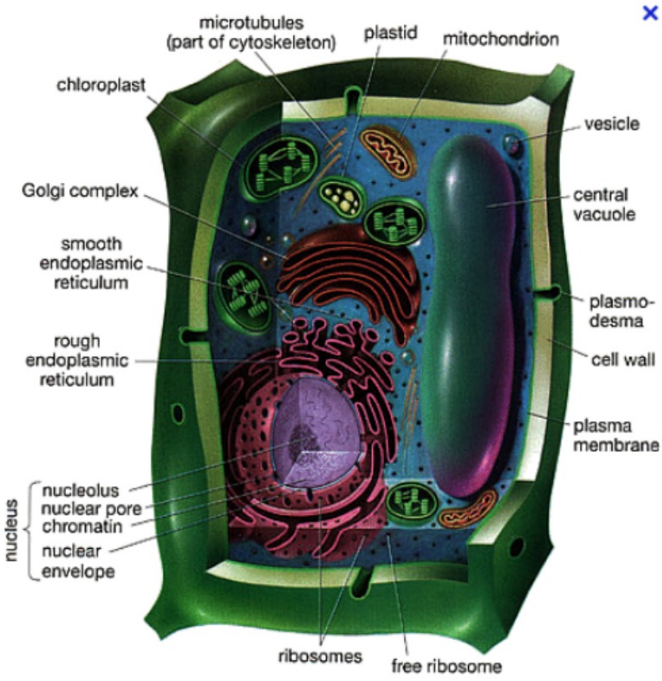
Using a microscope, a student observes a small, green organelle in a plant cell. Which energy transformation most likely occurs first within the observed organelle?

A) ATP to light

B) light to chemical

C) heat to electrical

D) chemical to chemical



Answer

Keystone Prep Questions- Biology

Photosynthesis and cellular respiration are two major processes of carbon cycling in living organisms. Which statement correctly describes one similarity between photosynthesis and cellular respiration?

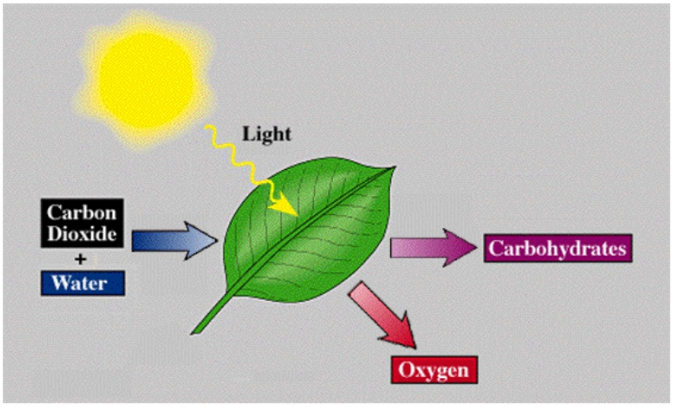
A) Both occur in animal and plant cells.

B) Both include reactions that transform energy.

C) Both convert light energy into chemical energy.

D) Both synthesize organic molecules as end products.

Answer



Keystone Prep Questions- Biology

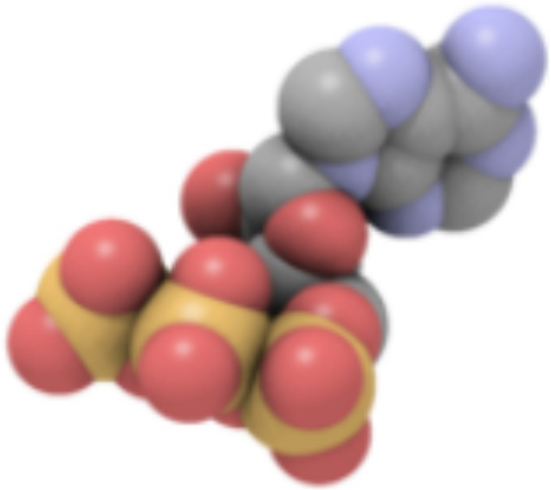
A protein in a cell membrane changed its shape to move sodium and potassium ions against their concentration gradients. Which molecule was most likely used by the protein as an energy source?

A) ATP

B) ADP

C) catalase

D) amylase



Answer

Corrected Responses from Homework

Some animals can produce a potassium ion concentration inside their cells that is twenty times greater than that of their environment. The ion concentration gradient is maintained by the plasma membrane.

Identify the process in the cell membrane that produces this difference in concentration.

Active transport increases the concentration.

Explain the process that occurs as the cell produces the ion concentration gradient.

Active transport uses ATP (energy) to increase the concentration.

Compare the process of potassium ion transport to another mechanism that moves material across the plasma membrane.

Another method is passive transport such as facilitated diffusion. Facilitated diffusions allows molecules to move across the membrane through transport proteins without using energy.

BIO.A.3 Bioenergies

BIO.A.3.2 Identify and describe how organisms obtain and tranform energy for their life processes.

BIO.A.3.2.1 Compare the basic transformation of energy during photosynthesis and cellular respiration.

NOTES

Photosynthesis -

A process that captures energy from sunlight to make sugars that store chemical energy.

Directly or indirectly, the energy for almost all organisms begins as sunlight.

Chlorophyll -

A molecule in chloroplasts that absorbs some of the energy in visible light.

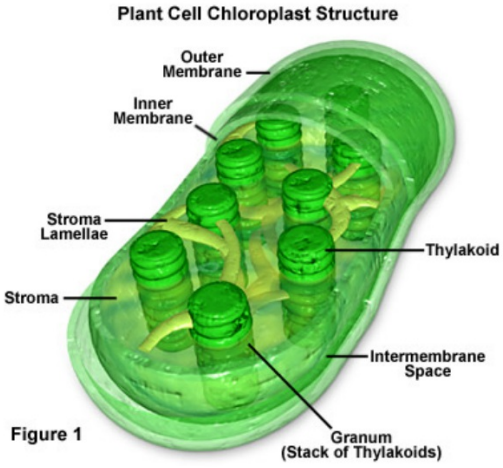


Figure 1

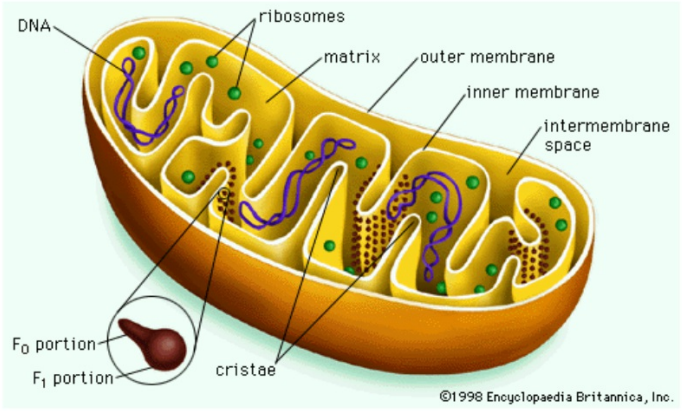
NOTES

Cellular Respiration -

Releases chemical energy from sugars to make ATP when oxygen is present.

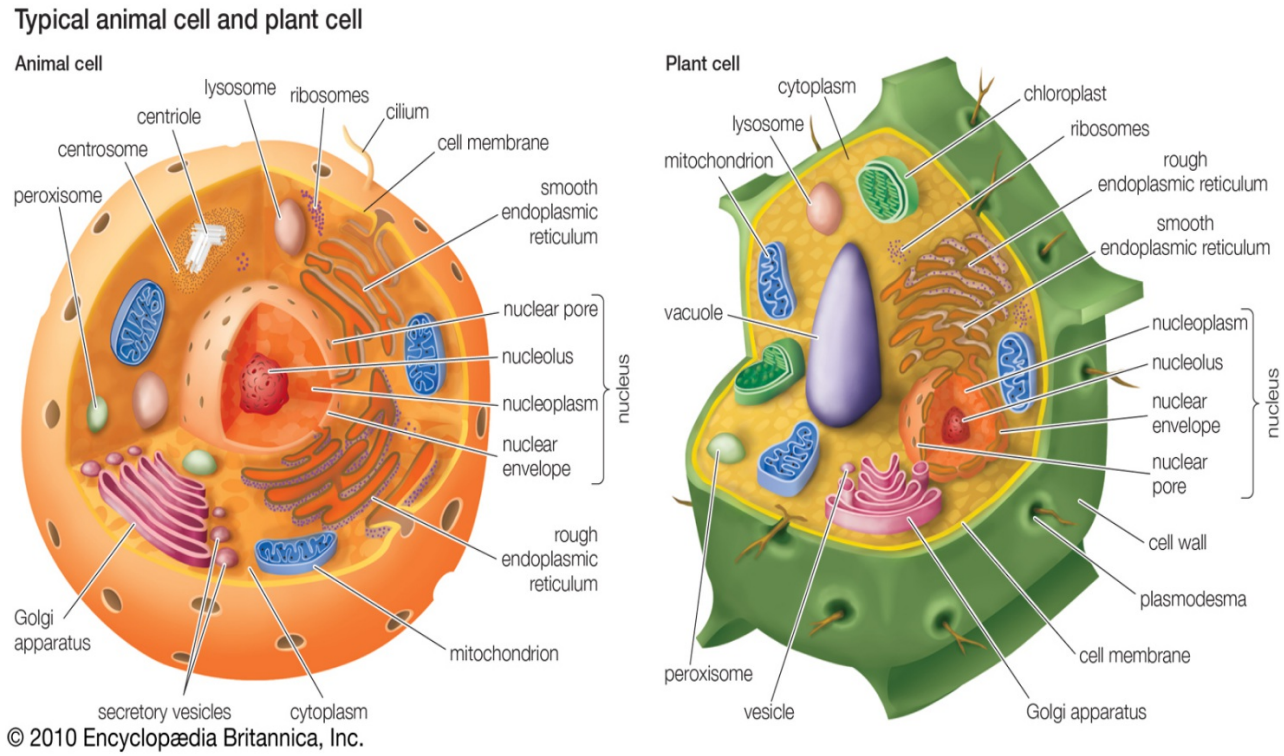
Mitochondria -

The organelle in an animal cell where cellular respiration takes place.

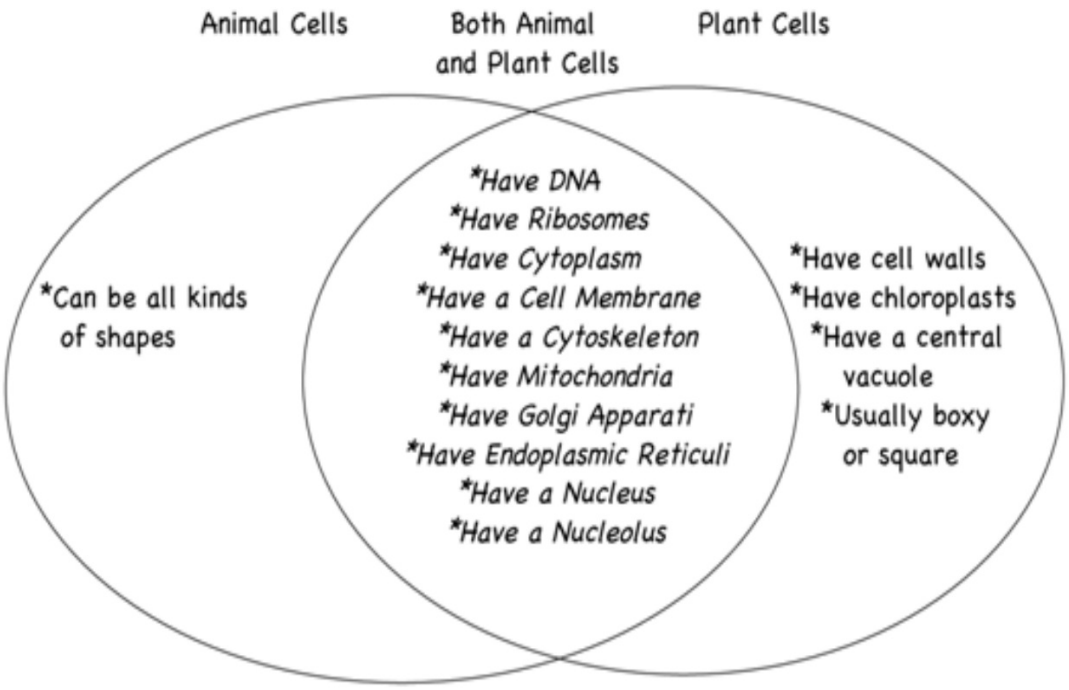


Cellular Respiration is like the mirror image of Photosynthesis.

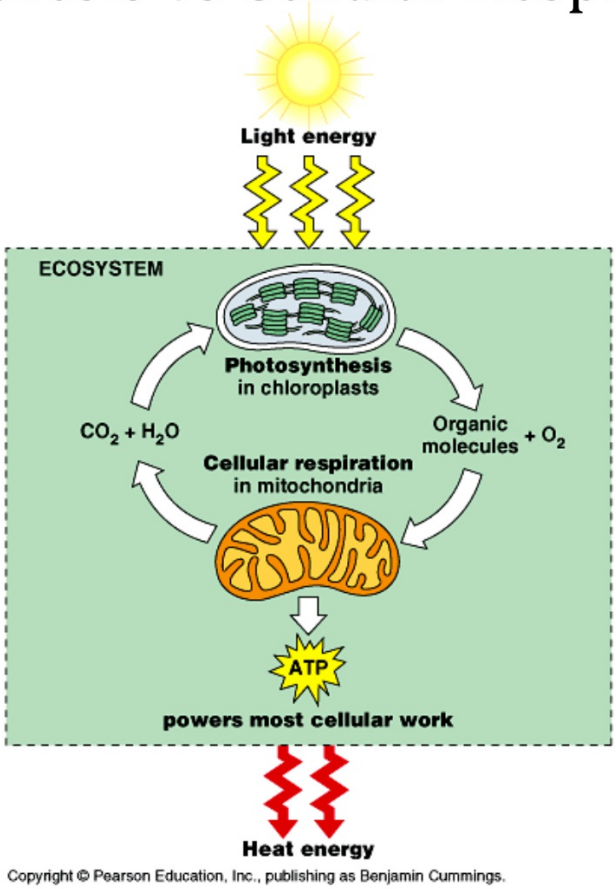
Plant vs Animal Cell



Animal Cell and Plant Cell Venn Diagram



Photosynthesis vs Cellular Respiration



Keystone Prep Questions- Biology

Carbon dioxide and oxygen are molecules that can move freely across a plasma membrane. What determines the direction that carbon dioxide and oxygen molecules move?

A) orientation of cholesterol in the plasma membrane

B) concentration gradient across the plasma membrane

C) configuration of phospholipids in the plasma membrane

D) location of receptors on the surface of the plasma membrane

Answer

Keystone Prep Questions- Biology

A sodium-potassium pump within a cell membrane requires energy to move sodium and potassium ions into or out of a cell. The movement of glucose into or out of a cell does not require energy. Which statement best describes the movement of these materials across a cell membrane?

A) Sodium and potassium ions move by active transport, and glucose moves by osmosis.

B) Sodium and potassium ions move by active transport, and glucose moves by facilitated diffusion.

C) Sodium and potassium ions move by facilitated diffusion, and glucose moves by osmosis.

D) Sodium and potassium ions move by facilitated diffusion, and glucose moves by active transport.

Answer

Keystone Prep Questions- Biology

The rough endoplasmic reticulum and Golgi apparatus work together in eukaryotic cells. What is one way that the rough endoplasmic reticulum assists the Golgi apparatus?

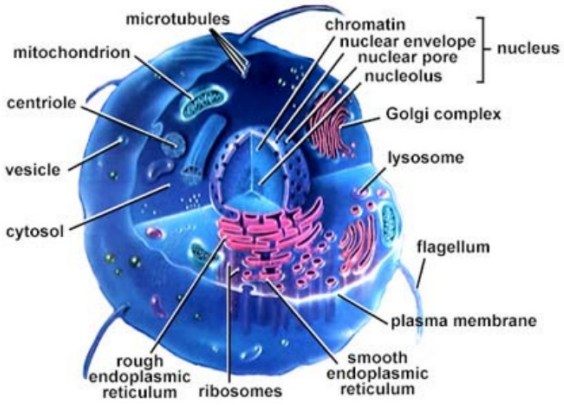
A) It assembles nucleic acids from monomers.

B) It breaks down old, damaged macromolecules.

C) It packages new protein molecules into vesicles.

D) It determines which protein molecules to synthesize.

Answer



Keystone Prep Questions- Biology

Which example is an activity that a fish most uses to maintain homeostasis within its body?

A) using camouflage to avoid predators

B) feeding at night to regulate body temperature

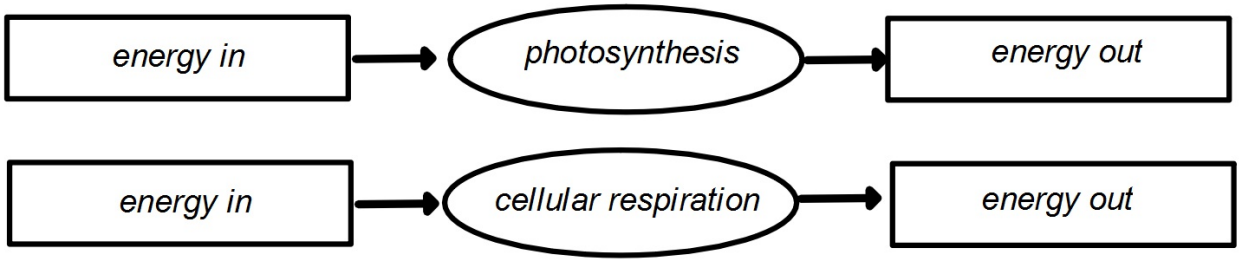
C) moving to deeper water to regulate metabolic wastes

D) exchanging gases through its gills to regulate oxygen levels

Answer

Corrected Responses from Homework

Use the diagrams below to answer the questions.



Complete the chart below by describing the energy transformations involved in each process.

Photosynthesis - sunlight is transformed into glucose.
light + CO_2 + H_2O converts to organic materials + O_2

Cellular Respiration - glucose is transformed into ATP.

Describe how energy transformations involved in photosynthesis are related to energy transformations involved in cellular respiration.

Photosynthesis and Cellular Respiration are mirror images of each other. The biproducts of one are the reactants of the other.