



# Keystone Review

## Module A

# BIO.A.1.1

- Explain the characteristics common to all organisms.
  - Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.



Which characteristic is shared by all prokaryotes and eukaryotes?

- A. Ability to store hereditary 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: A

- A. **Correct - All prokaryotes and eukaryotes contain nucleic acids, which store hereditary information.**
- B. Incorrect - Prokaryotes lack membrane-bound organelles.
- C. Incorrect – some organisms use fermentation as opposed to cellular respiration.
- D. Incorrect – not all organisms are capable of movement.

# BIO.A.1.2

- Describe the relationships between structure and function at biological levels of organization.
  - Compare cellular structures and their functions in prokaryotic and eukaryotic cells.
  - Describe and interpret relationships between structure and function at various levels of biological organization.



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: B

- A. Incorrect – prokaryotes lack nuclei
- B. Incorrect – Prokaryotes lack chloroplasts
- C. Incorrect –prokaryotes lack a nucleus.
- D. **Correct – Prokaryotes and Eukaryotes have cytoplasm and MAY have cell walls.**



Prokaryotic cells are generally much smaller than eukaryotic cells.

- A. Identify a structural difference between prokaryotic and eukaryotic cells that is directly related to their difference in size.
- B. Based on the structural difference, explain why prokaryotic cells can be much smaller than eukaryotic cells.
- C. Describe one similarity between prokaryotic and eukaryotic cells that is independent of size.



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

- **Prokaryotic cells contain less genetic material and lack nuclei.**



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

- Prokaryotic cells are smaller and less complex than eukaryotic cells. Therefore, they require less genetic material. This genetic material is packaged into a plasmid. Eukaryotic cells require more genetic material, which they store in multiple chromosomes. These chromosomes are stored in the nucleus.



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

- Prokaryotes and eukaryotes both contain ribosomes, cell walls, and cell membranes. None of these are a function of size.



Alveoli are microscopic air sacs in the lungs of mammals. Which statement BEST describes how the structure of alveoli allows 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 areas of the lungs, allowing efficient gas exchange.

# Answer - D

- A. Incorrect – energy transfer has nothing to do with the function of alveoli.
- B. Incorrect – not the primary function of alveoli.
- C. Incorrect – true, but not the best answer
- **D. Correct – the function of the lungs is in gas exchange, which occurs by diffusion. The more surface area between lungs and blood vessels, the greater the gas exchange.**

# Bio.A.2.1

- Describe how the unique properties of water support life on Earth.



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 land around the lake, causing the lake to freeze.

# Answer - C

- A. Incorrect – Water expands when it freezes, and this answer has nothing to do with density.
- B. Incorrect – water in a lake freezes from the top down. It would have to be more dense than liquid water to freeze at the bottom first.
- C. **Correct – water on the top of the lake freezes first, due to the low density of frozen water. This allows the water underneath to remain liquid. This allows aquatic organisms to live through the winter.**
- D. Incorrect – this has nothing to do with the



**BIO.A.2.2 – Describe and interpret relationships between structure and function at various levels of biochemical organization.**

- Explain how carbon is uniquely suited to form biological macromolecules.
- Describe how biological macromolecules form from monomers.
- Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms.



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 than can exist in a single plane.

# Answer - B

- A. Incorrect – macromolecules are large, this gives no insight into the ability of carbon to form large molecules.
- B. Incorrect – this is true, but doesn't describe how it forms large molecules.
- C. **Correct – the ability of carbon to bond with itself and other elements is what allows it to form macromolecules.**
- D. Incorrect – this has nothing to do with macromolecule formation



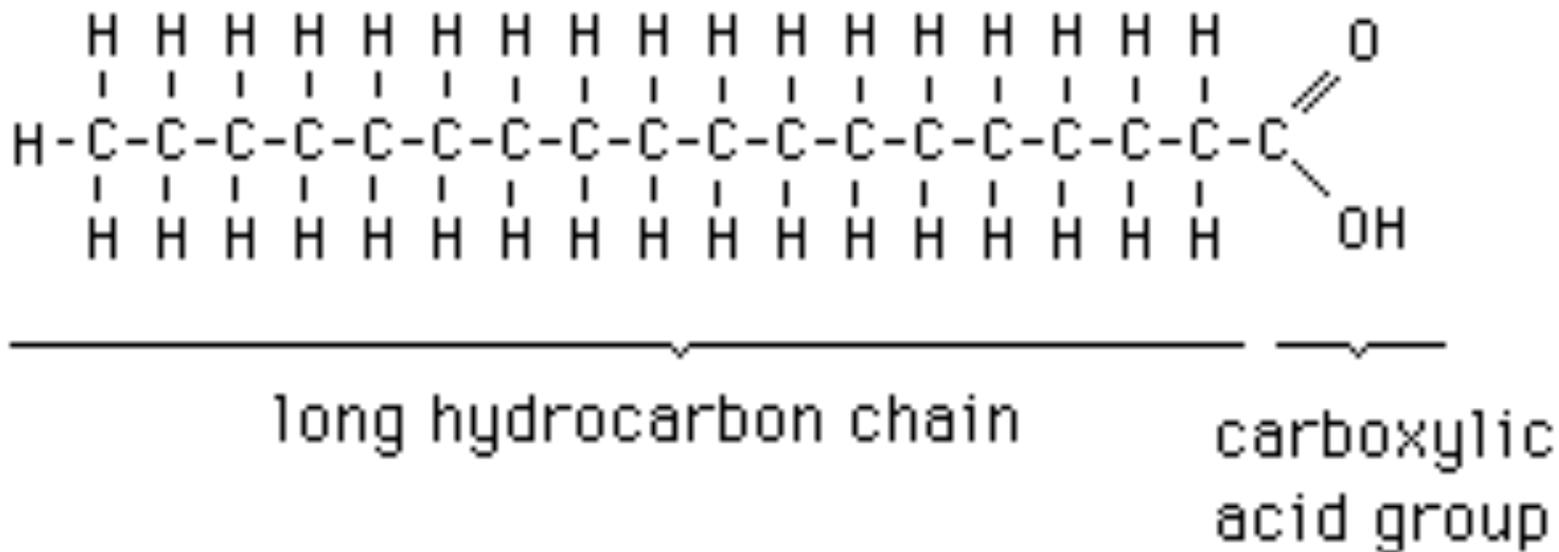
Carbohydrates and proteins are two types of macromolecules. Which functional characteristic of proteins distinguishes them from carbohydrates?

- 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 - B

- A. Incorrect – this is a characteristic of nucleic acids.
- B. **Correct – carbohydrates are unable to catalyze reactions.**
- C. Incorrect – carbohydrates have efficient storage of chemical energy
- D. Incorrect – this is a characteristic of lipids.

A scientist formed Chemical X in a laboratory. The material was then analyzed by other scientists. Analysis showed that the chemical was composed of long chains of repeated CH<sub>2</sub> molecules.





A researcher noticed that a similar  $\text{CH}_2$  molecular structure was also located in the plasma membrane of an animal cell. The  $\text{CH}_2$  molecular structure contained a negatively charged phosphate groups. Which statement BEST describes the primary function of the  $\text{CH}_2$  and phosphate molecular structure located in the plasma membrane?

- A. It contains the genetic information needed for protein production.
- B. It allows the energy that a cell needs to perform various life processes.
- C. It allows a cell to regulate the movement of materials into and out of a cell.
- D. It catalyzes specific chemical reactions in the cytoplasm of a cell.

# Answer - C

- A. Incorrect – The molecule describe does not indicate DNA.
- B. Incorrect – the molecule described does not indication an ATP molecule.
- C. **Correct – the molecule described is a phospholipid located in the plasma membrane that helps regulate the movement of materials into and out of a cell.**
- D. Incorrect - The molecule described does not indicate an enzyme.



Which type of organic molecule was MOST LIKELY formed by the scientist in the laboratory?

- A. Lipid
- B. Protein
- C. Carbohydrate
- D. Nucleic acid

# Answer - A

- A. Correct – most lipids have long hydrocarbon chains as the main component of their structures. The molecule describes also contains a phosphate group, indicating a phospholipid.**
- B. Incorrect – Proteins are made of amino acids**
- C. Incorrect – Nucleic acids are made of nucleotides**
- D. Incorrect – carbohydrate molecules are made of carbon, hydrogen, and oxygen atoms in a specific ratio.**



Proteins are a major part of every living cell and have many functions within each cell.

Carbohydrates also perform multiple roles in living things.

- Describe the general composition of a protein molecule.
- Describe how the structures of proteins differ from the structures of carbohydrates.
- Describe how the functions of proteins differ from the functions of carbohydrates.



# Describe the general composition of a protein molecule.

- Proteins consist of carbon, hydrogen, oxygen, and nitrogen. These elements are combined to form over 20 different amino acids. These amino acids are then manipulated into four different levels of protein structure.



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

- Proteins contain nitrogen, while carbohydrates do not. The elements in carbohydrates are used to create ring-shaped monosaccharides, which are then strung together into di- and polysaccharides. There are only three different monosaccharides. Proteins contain over 20 monomer units, the amino acid. Their four-level structure also makes them more complex.



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

- Due to their complex structure, proteins have a huge variety of function. Examples include: immune response, catalysts, clotting, membrane structure, transport, etc. Carbohydrates have a more simplistic structure and are used primarily for energy and structure.



## BIO A.2.3 - Explain how enzymes regulate biochemical reactions within a cell.

- Describe the roles of an enzyme as a catalyst in regulating a specific biochemical reaction.
- Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.



Substance A is converted to substance B in a metabolic reaction. Which statement BEST describes the roles 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 – D

- A. Incorrect – not relevant to converting the substance.
- B. Incorrect – enzymes do not actually provide energy for reactions.
- C. Incorrect – enzymes do not dissolve substances.
- D. **Correct – enzymes speed up the rate of chemical reactions by lowering the activation energy needed to start the reaction. Enzymes are not used up by this, and can be reused.**



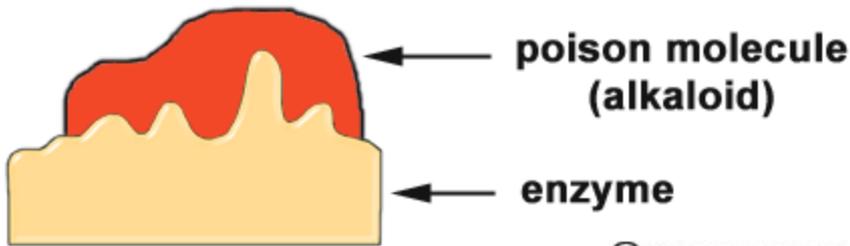
A scientist observes that, when the pH of the environment surrounding an enzyme is changed, the rate the enzyme catalyzes a reaction greatly decreases. Which statement BEST describes how a change in pH can affect an enzyme?

- 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 the enzyme.
- D. A pH change can cause an enzyme to react with a different substrate.

# Answer - A

- A. **Correct – enzymes are substrate-specific due to the shape of their active sites. Changes in pH, temperature causes the proteins that make-up the enzyme to denature. This changes their shape and prevents them from catalyzing reactions.**
- B. Incorrect – enzymes do not actually provide energy for the reaction.
- C. Incorrect – pH change does not add molecules to the enzyme
- D. Incorrect – a denatured enzyme will not react with anything.

The diagram models how a poison bonds to the active site of an enzyme. Which function is the enzyme MOST LIKELY usable to perform because of the attachment of the poison molecule?



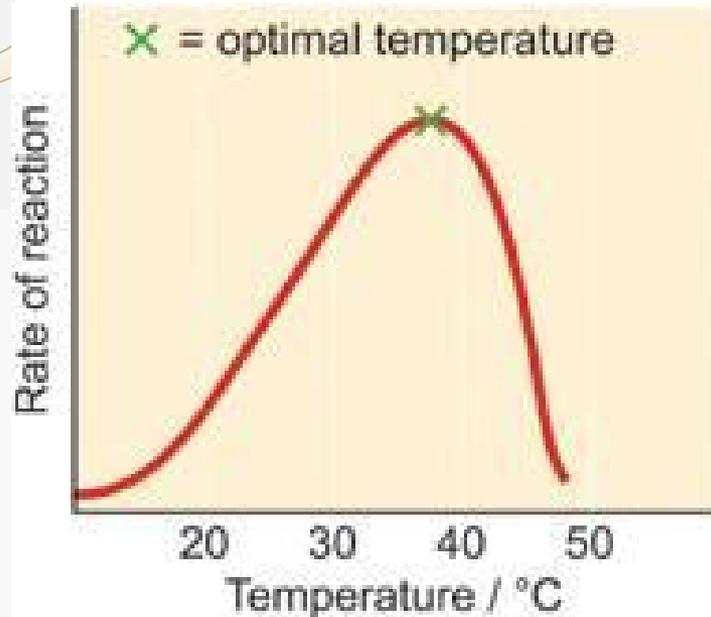
© W.P. Armstrong 2001

- A. The release of stored chemical energy.
- B. The donation of electrons to the substrate
- C. The supply of activation energy for a reaction.
- D. The catalysis of the reaction with the substrate.

# Answer - D

- A. Incorrect - Release of any chemical energy comes from the substrate and not from the enzyme.
- B. Incorrect - Enzymes do not donate electrons to the substrate.
- C. Incorrect – Enzymes lower the activation energy needed for the chemical reaction to occur.
- D. **Correct – Most enzymes react with only one reactant, so when a poison blocks the active site, the enzyme can no longer bond with the substrate, causing the chemical reaction to stop.**

The graph shows how the activity of an enzyme changes at different temperatures. Which statement BEST describes what happens to the enzyme when the temperature of the reaction increases to 45 degrees?



- A. The enzyme is used up and the reaction stops.
- The enzyme begins to decrease the rate of the reaction.
- The enzyme continues to increase the rate of the reaction.
- The enzyme changes shape and can no longer speed up the reaction.

# Answer - D

- A. Incorrect – an enzyme is not consumed during the chemical reaction.
- B. Incorrect – the enzyme does not have the ability to decrease the rate of a reactions; the rate of reaction is affected by temperature, pH, concentration, etc.
- C. Incorrect – The graph illustrates that enzyme activity decreases as the temperature increases beyond 40 degrees.
- D. **Correct – enzymes have an optimum temperature range at which they function; when the temperature exceeds that range, the enzyme will denature, causing it to change shape and no longer be able to bind to the substrate.**



## BIO.A.3.1 – Identify and describe the cell structures involved in processing energy.

- Describe the fundamental roles of plastids and mitochondria in energy transformations.



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 - B

- A. Incorrect – chloroplasts make ATP to use during photosynthesis using light energy
- B. Correct – chloroplasts use light energy to create chemical energy in the form of glucose.**
- C. Incorrect – heat energy is not a part of photosynthesis
- D. Incorrect – the energy coming in to photosynthesis is light energy.



**BIO.A.3.2 – Identify and describe how organisms obtain and transform energy for their life processes.**

- Compare the basic transformation of energy during photosynthesis and cellular respiration.
- Describe the role of ATP in biochemical reactions.



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 - B

- A. Incorrect - Photosynthesis does not occur in animals.
- B. Correct – Photosynthesis transforms the energy in sunlight into chemical energy in glucose. Cellular respiration transforms the energy in glucose into ATP.**
- C. Incorrect - Cellular respiration does not convert light energy into chemical energy.
- D. Incorrect – ATP is not an organic molecule.



BIO.A.3.2 – Identify and describe how organisms obtain and transform energy for their processes.

- Describe the roles of ATP in biochemical reactions
- Compare the basic transformation of energy during photosynthesis and cellular respiration.



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 - A

- A. **Correct - ATP is used to power active transport.**
- B. Incorrect - ADP is an de-energized molecule
- C. Incorrect – catalase catalyzes the reaction breaking down hydrogen peroxide into water and oxygen.
- D. Incorrect – amylase catalyzes the reaction breaking down amylase for digestion.



Energy in — PHOTOSYNTHESIS Energy out

Energy in → CELLULAR RESPIRATION → Energy out

- A. Describe the energy changes occurring in each process.
- B. Describe how energy transformations involved in photosynthesis are related to energy transformations involved in cellular respiration.



Describe the energy changes occurring in each process.

- Photosynthesis transforms light energy into chemical energy. Photosynthesis uses the energy of sunlight to make sugars.
- Cellular respiration transforms the chemical energy in glucose into chemical energy in ATP.



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

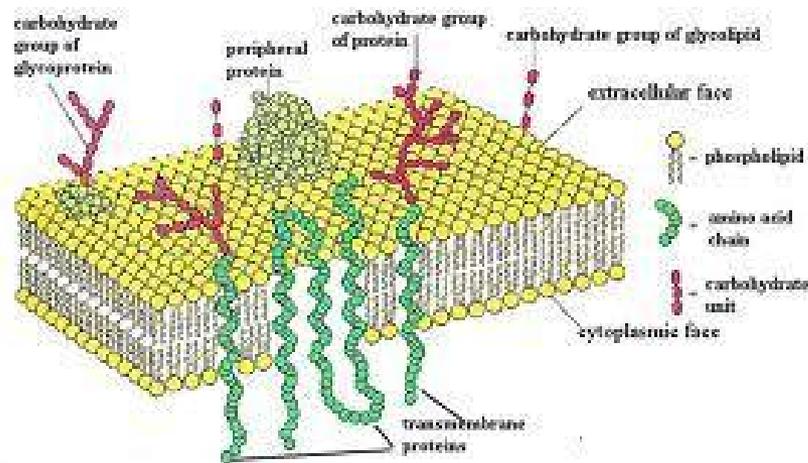
- Cellular respiration takes the energy stored in glucose and converts it into ATP. ATP is used to run cell activities. The glucose used in cellular respiration comes from photosynthesis. Photosynthesis converts the light energy into chemical energy; cellular respiration converts this chemical energy into a more usable form for the cell.



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

- Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell.
- Compare the mechanisms that transport materials across the plasma membrane.
- Describe how membrane-bound cellular organelles facilitate the transport of materials within a cell.

Which component of this membrane contains a hydrophobic region and acts as the primary barrier to MOST foreign substances?



- A. Protein
- B. Cholesterol
- C. Carbohydrate chain
- D. Phospholipid bilayer

# Answer - D

- A. Incorrect - The function of the proteins in a plasma membrane is transport.
- B. Incorrect – Cholesterol makes the membrane more rigid, decreasing permeability and preventing phase shifts.
- C. Incorrect – carbohydrate chains function as markers.
- D. **Correct – phospholipids are composed of hydrophobic tails, which makes the membrane impermeable to most hydrophilic molecules and ions.**



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: B

- A. Incorrect – cholesterol is not involved in transport
- B. **Correct – molecules diffuse down the concentration gradient, from high to low concentration.**
- C. Incorrect – The phospholipids in the membrane are configured in an identical fashion on both sides.
- D. Incorrect – Receptors are not involved in the transport of carbon dioxide and oxygen.



A sodium-potassium pump within a cell membrane requires energy to move a 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: B

- A. Incorrect – osmosis moves water
- B. **Correct – sodium and potassium require energy, which is active transport. Glucose moves without energy, which is a form of passive transport. Glucose is large, therefore requires facilitated diffusion.**
- C. Incorrect – facilitated diffusion does not require energy, osmosis is the diffusion of water.
- D. Incorrect – facilitated diffusion does not require energy, active transport does require energy.



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

- A. Identify the process in the cell membrane that produces this difference in concentration.
- B. Explain the process that occurs as the cell produces the ion concentration gradient.
- C. Compare the process of potassium ion transport to another mechanism that moves material across the plasma membrane.



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

- This difference is created by active transport. You can identify this because in passive transport, molecules move across the membrane until the concentration on each side of the membrane is equal.



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

- The cell uses the energy from ATP to pump potassium ions into their cells. Special pumps within the cell membrane are used to perform this process. The ATP provides the energy to open and close these pumps.



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

- Active transport can be compared to facilitated diffusion. Both processes require the use of specialized protein channels to transport substance across the plasma membrane. Unlike active transport, facilitated diffusion does not require energy.



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 - C

- A. Incorrect – the ER does not assemble nucleic acids.
- B. Incorrect – lysosome break down old, damaged molecules.
- C. **Correct – the ER packages proteins into vesicles in order to transport them to the golgi, where they are modified.**
- D. Incorrect – the ER is involved in protein synthesis, but the needs of the cell determine which proteins are synthesized.



BIO.A.4.2 – Explain the mechanisms that permit organisms to maintain biological balance between their internal and external environments.

- Explain how organisms maintain homeostasis.



Which example is an activity that a fish **MOST LIKELY** 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 - D

- A. Incorrect – predator avoidance is not a part of homeostasis, which deals with internal balance.
- B. Incorrect – a fish needs to regulate body temperature at all times, regardless of whether it is feeding.
- C. Incorrect – deeper water will not help regulate metabolic wastes.
- D. **Correct – fish exchange oxygen and carbon dioxide between their bodies and the water in order to maintain appropriate oxygen levels.**