أسئلة تدريبية لنهاية الفصل لمنهج انسباير

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إعداد: Elhddad Ahmed	

التواصل الاجتماعي بحسب الصف التاسع المتقدم					
صفحة المناهج الإماراتية على فيسبوك					
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UNITED ARAB EMIRATES · MINISTRY OF EDUCATION

GRADE 9 BIOLOGY

ADVANCED INSPIRE · END OF TERM 1 (EOT1)

Coverage Practice Questions · 2026–27

Mr. Ahmed Elhddad
"The 1st Biology Teacher"
0563720249

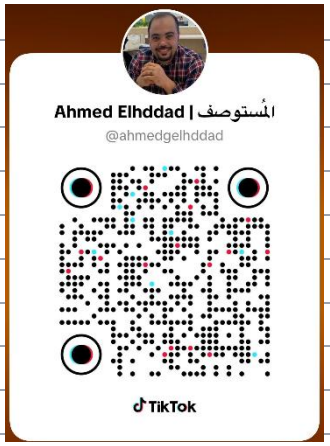
Student name: _____ Class: _____

Textbook: Inspire Biology UAE Edition, Grade 9 Advanced (printed page numbers). Questions may appear in a different order in the actual exam. Each question shows its outcome and textbook reference, then **practice questions (P1, P2, …)** from past exams, practice collections and the textbook review that match it.

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Q1
MCQ

LEARNING OUTCOME

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.

Textbook: Figure 13 · page 11

TEXTBOOK REFERENCE



(l) Steve Humphreys/E+/Getty Images (r) Richard Hutchings/Digital Light Sou

Figure 13 After a chemical change, such as rusting, a new substance is formed. During a physical change, such as water boiling, the chemical makeup of the water is not altered.

PRACTICE QUESTIONS

P1. Which statement is true of chemical equations? *[Past exam collection]*

- **A.** Reactants are on the right side of the arrow and products are on the left side of the arrow.
- **B.** Products have fewer atoms than reactants.
- **C.** Reactants have fewer atoms than products.
- **D.** The number of atoms of each element on the reactants is equal to the number of atoms of the same element on the products.

P2. In the chemical reaction A + B → AB, which statement correctly identifies the parts of the reaction? *[Textbook review]*

- **A.** A and B are the reactants and AB is the product.
- **B.** A and B are the products and AB is the reactant.
- **C.** A is the reactant, B is the enzyme, and AB is the product.
- **D.** A and AB are the reactants and B is the product.

P3. In which of the following are bonds broken and new bonds formed? *[Textbook review]*

- **A.** Elements
- **B.** Solutions
- **C.** Polar molecules
- **D.** Chemical reactions

P4. Why must the number of reactant atoms equal the number of product atoms in a chemical equation? *[Textbook review]*

- **A.** Atoms are destroyed in the reactants and new atoms form in the products.
- **B.** Products always contain more atoms than reactants.
- **C.** Atoms are not created or destroyed in a chemical reaction; they are only rearranged.
- **D.** Energy is converted into new atoms during the reaction.

P5. Which balanced equation correctly represents the breakdown of hydrogen peroxide (H_2O_2) into water (H_2O) and oxygen (O_2)? *[Textbook review]*

- **A.** $H_2O_2 \rightarrow H_2O + O_2$
- **B.** $2H_2O_2 \rightarrow 2H_2O + O_2$
- **C.** $2H_2O_2 \rightarrow H_2O + 2O_2$
- **D.** $H_2O_2 \rightarrow 2H_2O + O_2$

@ELHDDAD37

Q2
MCQ

LEARNING OUTCOME

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.

Textbook: Figure 14 · page 13

TEXTBOOK REFERENCE

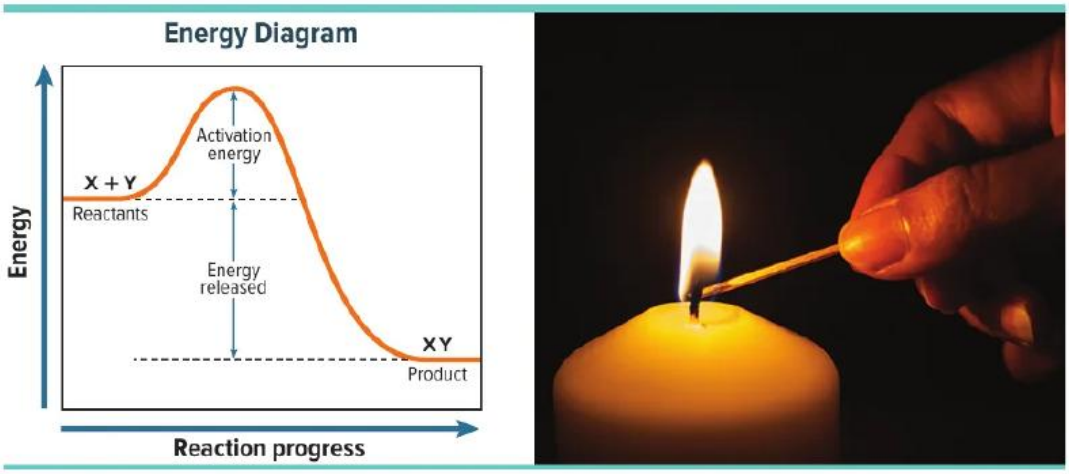
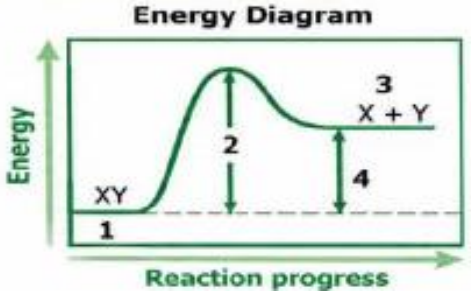
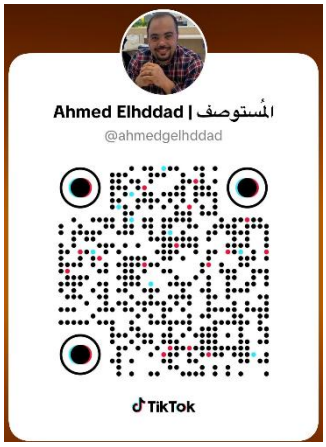


Figure 14 The flame of the match provides activation energy—the amount of energy needed to begin a reaction. The reaction gives off energy in the form of heat and light.

PRACTICE QUESTIONS

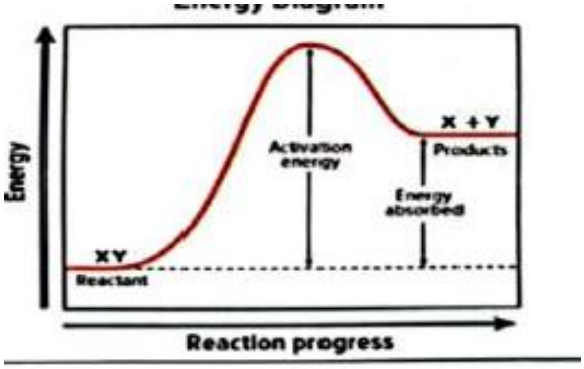
P1. Based on the diagram below, which number represents the energy absorbed during the chemical reaction? *[Past exam collection]*





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

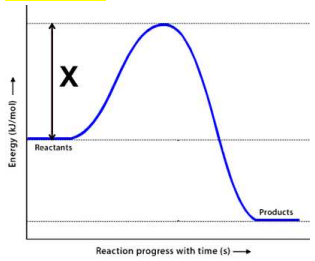
P2. Which statement is true regarding the energy diagram below? *[Past exam collection]*



A. It shows an endothermic reaction.
B. It shows an exothermic reaction.
C. Reactant and product energy are equal.

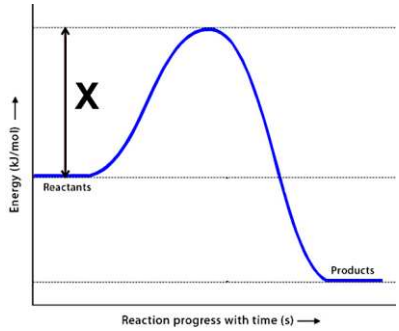
D. Product energy is less than reactant energy.

P3. Use the energy graph. Which of the following does the arrow labeled X represent? *[Practice collection]*



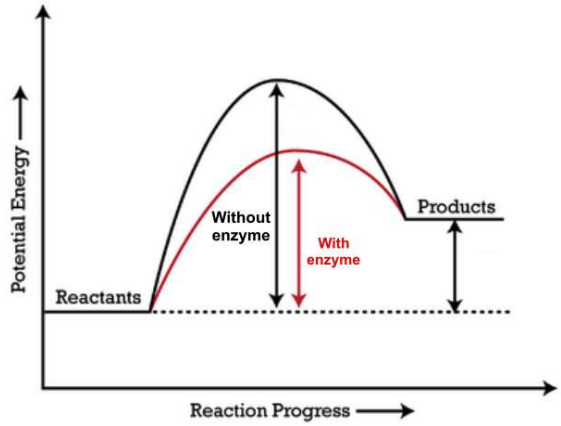
A. The free energy
B. The lost energy
C. The reactant energy
D. The activation energy

P4. Use the energy graph. Which of the following is the correct definition of the energy labeled X? *[Practice collection]*



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

P5. The graph shows an _____ reaction because a net amount of energy is _____. *[Practice collection]*



A. endothermic … released
B. endothermic … absorbed
C. exothermic … absorbed
D. exothermic … released



P6. Activation energy is best defined as: *[Textbook review]*

A. the energy required to start a chemical reaction.
B. the energy released at the end of a reaction.
C. a protein that speeds up a reaction.
D. a substance formed during a reaction.

Q3
MCQ

LEARNING OUTCOME

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.

Textbook: Figure 17 · page 15

TEXTBOOK REFERENCE

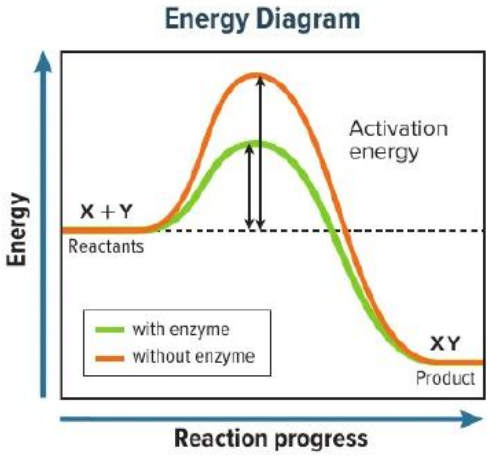


Figure 17 When an enzyme acts as a biological catalyst, the reaction occurs at a rate that is useful to cells.

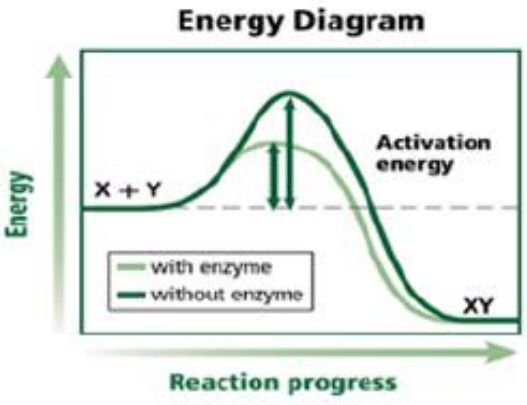
Compare *the activation energy of the reaction without an enzyme to the activation energy of the reaction with an enzyme.*

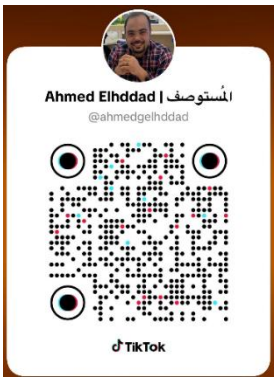
PRACTICE QUESTIONS

P1. Match each term on the right with its appropriate definition on the left. *[Past exam collection]*

Definition	Term
A – A protein that speeds up reactions in living processes.	Activation energy
B – The chemical substances formed during a reaction.	Reactant
C – The energy required to start a reaction.	Catalyst
D – A substance that reduces the activation energy.	Enzyme
E – A substance that binds to an enzyme.	Products

P2. Based on the comparison of the reaction progress in the energy diagram below, which of the following describes the effect of the enzyme on a chemical reaction? *[Past exam collection]*



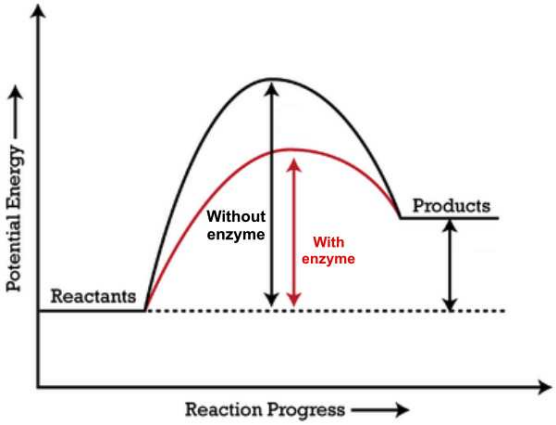


A. The absence of enzyme decreases the activation energy of a chemical reaction.
B. The presence of enzyme increases the activation energy of a chemical reaction.
C. The presence of enzyme decreases the activation energy of a chemical reaction.
D. The presence of enzyme does not affect the activation energy of a chemical reaction.

P3. Which of the following is NOT a characteristic of enzymes? *[Past exam collection]*

- **A.** Speed up a chemical reaction
- **B.** Not consumed in the reaction
- **C.** Cannot be used again
- **D.** Specific to one reaction

P4. Which of the following correctly describes how the presence of the enzyme affects the reaction shown in the graph? *[Practice collection]*



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

P5. Which of the following is considered a substance that lowers activation energy? *[Textbook review]*

- **A.** Ion
- **B.** Catalyst
- **C.** Reactant
- **D.** The substance that reacts with the enzyme

P6. Which statement best describes the importance of enzymes to living organisms? *[Textbook review]*

- **A.** They speed up the chemical reactions that cells need so that these reactions happen fast enough to support life.
- **B.** They provide the energy that cells use for movement.
- **C.** They are used up to make the products of reactions.
- **D.** They store the genetic information of the cell.

P7. Which statement is true of every reaction that contains an enzyme? *[Textbook review]*

- **A.** The enzyme raises the activation energy so the reaction is controlled.
- **B.** The enzyme is consumed as the products form.
- **C.** The enzyme changes the energy of the products.
- **D.** The enzyme lowers the activation energy and is not used up in the reaction.

P8. Why can an enzyme deficiency prevent an organism from performing a specific function? *[Textbook-based]*

- **A.** The reactants of the reaction would be changed into enzymes.
- **B.** The activation energy of every reaction would become zero.
- **C.** The reaction that the enzyme catalyzes would proceed too slowly to support that function.
- **D.** All the other enzymes in the cell would stop working immediately.

Q4
MCQ

LEARNING OUTCOME

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.

Textbook: Figure 18 · page 16

TEXTBOOK REFERENCE

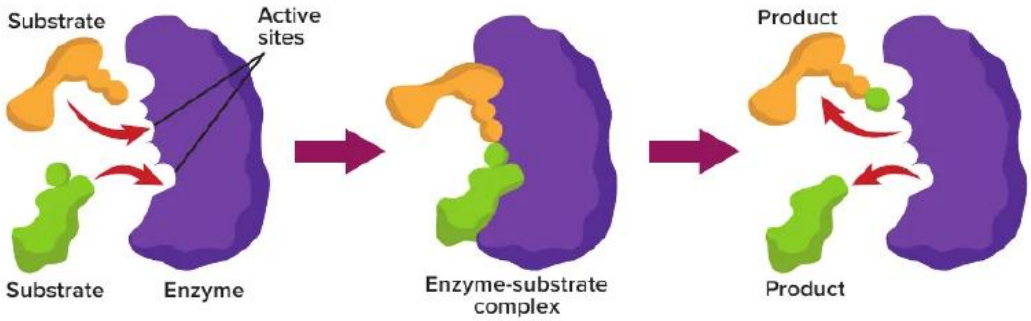
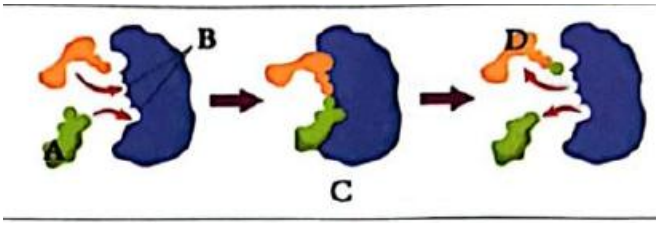


Figure 18 Substrates interact with enzymes at specific places called active sites. Only substrates with a specific shape can bind to the active site of an enzyme. Once the substrates bind, the active site changes shape and forms the enzyme-substrate complex. The substrates react to form products. The products are then released.

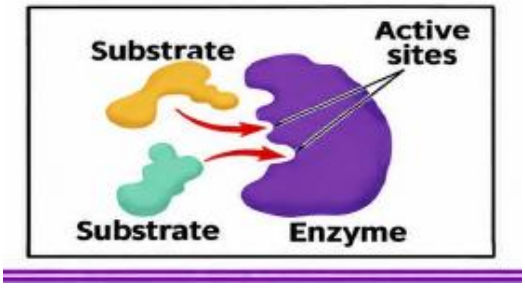
PRACTICE QUESTIONS

P1. The figure below represents the enzyme action. Which of the following letters indicates the product? *[Past exam collection]*

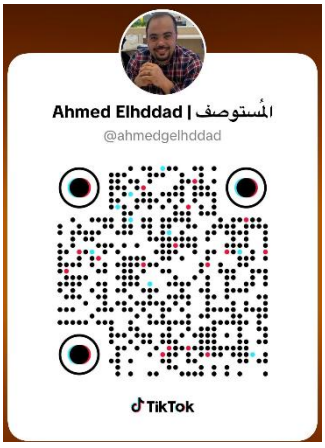


A. A
B. B
C. C
D. D

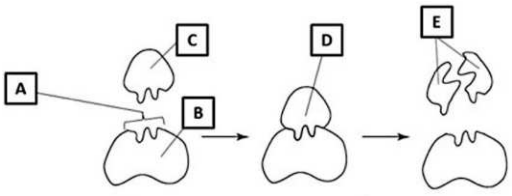
P2. Why is the active site of an enzyme important to the enzyme activity? *[Past exam collection]*



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 interaction to continue without stopping.

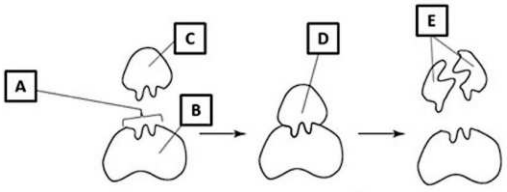


P3. The diagram shows how an enzyme works. Which letter represents the enzyme's active site? *[Practice collection]*



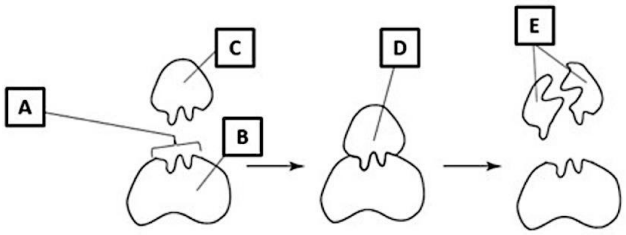
A. A
B. B
C. C
D. E

P4. In the same diagram, which letter represents the substrate? *[Practice collection]*



A. B
B. C
C. D
D. E

P5. In the same diagram, which letter represents the enzyme–substrate complex? *[Practice collection]*



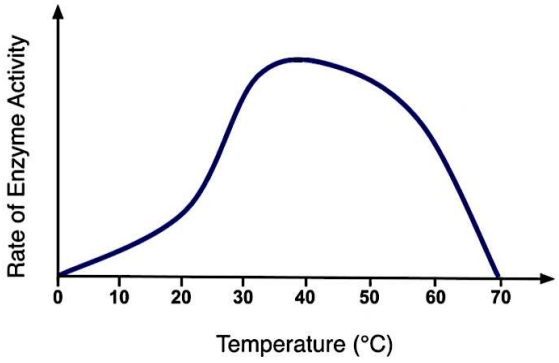


A. A
B. B
C. C
D. D

P6. Enzymes are said to be specific. Which statement explains this? *[Practice collection]*

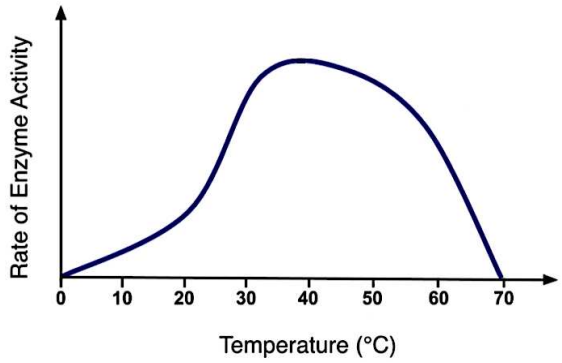
A. Each enzyme can catalyze any reaction if the temperature is high enough.
B. Each enzyme is made of different chemical elements.
C. The active site of each enzyme fits only certain substrates, so it catalyzes a particular reaction.
D. Each enzyme works only inside the nucleus.

P7. According to the graph, what is the optimum temperature of this enzyme? *[Practice collection]*



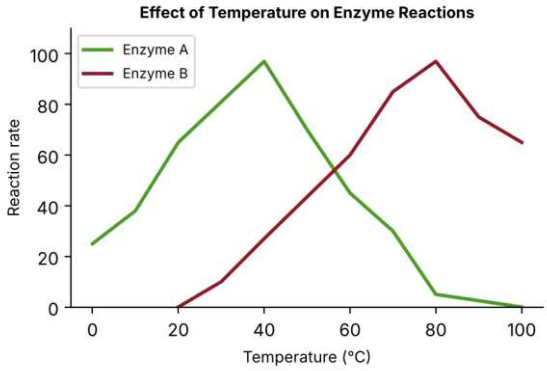
A. About 20 °C
B. About 40 °C
C. About 60 °C
D. About 70 °C

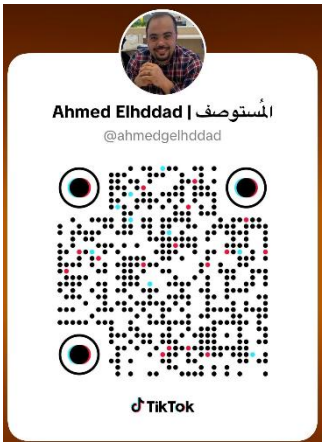
P8. Why is the rate of enzyme activity zero at 70 °C? *[Practice collection]*



A. The enzyme is denatured, so its active site no longer fits the substrate.
B. The substrate has been used up.
C. The activation energy has fallen to zero.
D. The enzyme has become a substrate.

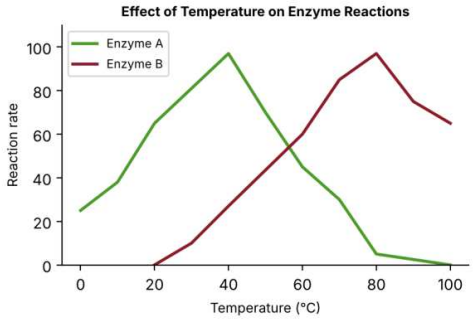
P9. Which statement correctly describes the effect of temperature on the reaction rate shown in the graph? *[Textbook review]*





A. The rate of both enzymes keeps rising as the temperature increases.
B. The rate of both enzymes is the same at every temperature.
C. The rate falls as the temperature increases from 0 °C to the optimum.
D. For each enzyme the rate rises to an optimum temperature and then falls sharply.

P10. Which enzyme is more active in human cells, and why? *[Textbook review]*



A. Enzyme B, because its optimum temperature is higher than body temperature.
B. Enzyme B, because it works at 100 °C.
C. Enzyme A, because its optimum temperature is close to normal human body temperature.
D. Enzyme A, because it works only at 0 °C.

P11. How is the structure of an enzyme related to its ability to lower activation energy? *[Textbook review]*

A. Its straight chain shape stores energy that is released as heat.
B. Its folded shape forms an active site that binds the substrate and makes the reaction easier to start.
C. Its shape lets it bind to any molecule in the cell.
D. Its structure has no effect on activation energy.

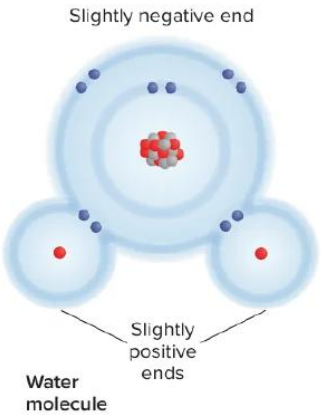
Q5 MCQ

LEARNING OUTCOME

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.

Textbook: Figure 19 · page 18

TEXTBOOK REFERENCE



called **polar molecules,** meaning that they have oppositely charged regions. Water is a polar molecule, as shown in **Figure 19**. Notice that it has a slightly negative end and two slightly positive ends.

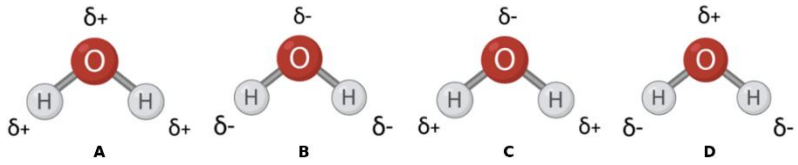
Figure 19 Water molecules have a bent shape, and electrons are not shared equally between hydrogen and oxygen. This results in a molecule with oppositely charged regions.

Summarize *the structure of a water molecule.*

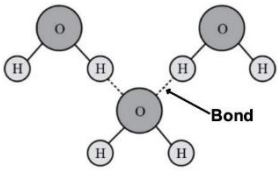
PRACTICE QUESTIONS

P1. Which of the following models shows the correct polarity of water? *[Practice collection]*

A. A
B. B
C. C
D. D



P2. Which of the following is the name of the bond shown by the arrow in the diagram? *[Practice collection]*



A. Covalent bond
B. Ionic bond
C. Metallic bond
D. Hydrogen bond

P3. What is the relationship between a solute and a solvent? *[Textbook review]*

A. A solvent is dissolved in a solute to form a solid.
B. A solute is always the liquid that does the dissolving.
C. A solute is dissolved in a solvent to form a solution.
D. A solvent is always a gas.

P4. What is the relationship between a polar molecule and a hydrogen bond? *[Textbook review]*

A. Hydrogen bonds join the atoms inside every water molecule.
B. The slightly positive end of one polar molecule is attracted to the slightly negative end of another, forming a hydrogen bond.
C. Hydrogen bonds form only between nonpolar molecules.
D. Polar molecules repel each other through hydrogen bonds.

P5. Which feature of water's structure makes it an effective solvent? *[Textbook review]*

A. Its polarity, which attracts and surrounds polar and charged solutes
B. Its lack of any charge
C. Its nonpolar bonds
D. Its very large size

P6. Which statement does NOT apply to pure water? *[Textbook review]*

A. Its pH is 7.0.
B. It is made of polar molecules.
C. It is a good solvent.

@ELHDDAD37

D. It is made of ionic bonds.

Q6
MCQ

LEARNING OUTCOME

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.

Textbook: Figure 21 · page 19

TEXTBOOK REFERENCE

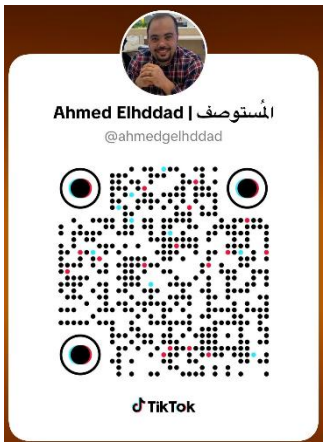




Figure 21 Due to the attractive forces between water molecules, the surface of water supports a water strider.

PRACTICE QUESTIONS

P1. Water is essential for life on Earth. Its properties enable it to provide suitable conditions for life and help living organisms maintain internal balance. Humans can survive without food for a long period, but they can survive for only a few days without water. Which of the following properties of water allows insects and leaves to float on the surface of a body of water? *[Past exam collection]*

A. Ice is denser than liquid water.
B. Water is denser than ice when its temperature reaches 4 °C.
C. Water is adhesive, which causes capillary action.
D. Water is cohesive, which creates surface tension.

P2. Why are hydrogen bonds important to living organisms? *[Textbook review]*

A. They store the genetic information of the cell.
B. They break down proteins into amino acids.
C. They make water a nonpolar molecule.
D. They give water properties such as cohesion and a strong solvent ability that support life processes.

P3. Which of the following describes one way water helps an organism maintain internal balance? *[Textbook review]*

A. It lowers the pH of cells to zero.
B. It acts as a nonpolar solvent for fats.
C. Its high heat capacity lets it absorb heat with only a small change in temperature.
D. It stores genetic information.

P4. When table salt (NaCl) dissolves in water, which model is correct? *[Textbook review]*

A. Water molecules surround the ions, with their slightly positive hydrogen ends toward Na^+.
B. Water molecules surround the Na^+ and Cl^- ions, with their slightly negative oxygen ends toward Na^+.
C. Whole NaCl molecules float unchanged between the water molecules.
D. The water molecules break down into Na^+ and Cl^-.

Q7 MCQ

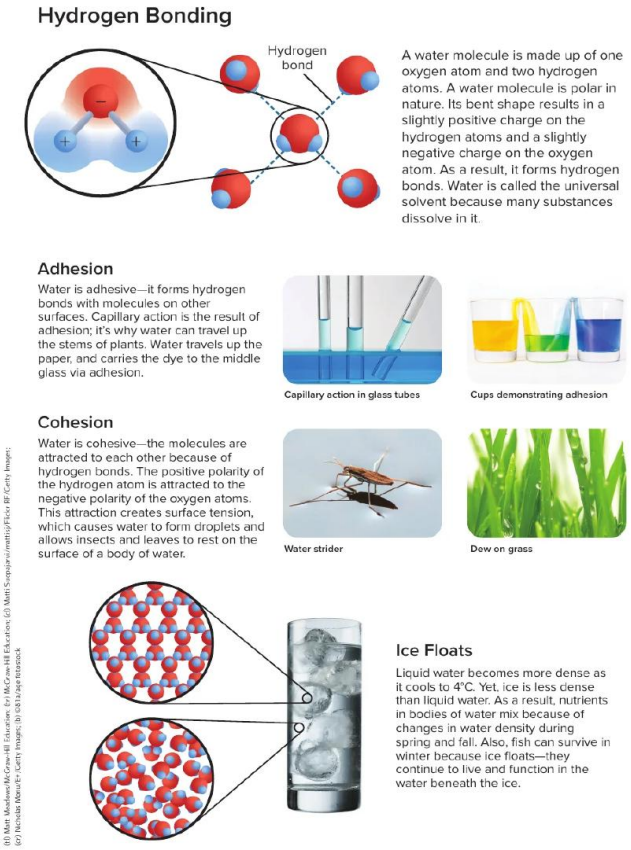
LEARNING OUTCOME

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.

Textbook: Figure 23 · page 21

TEXTBOOK REFERENCE

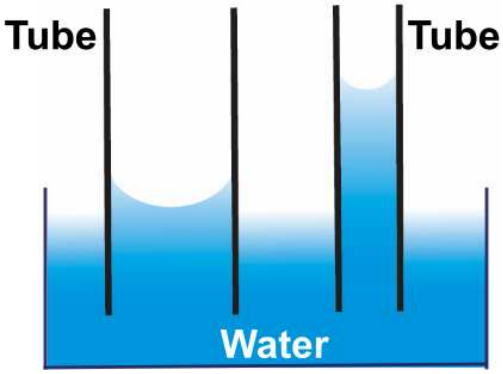
Figure 23 Visualizing Hydrogen Bonding



(b) Matt Meadows/McGraw-Hill Education; (c) Matt Suess/Photographer's Choice RF/Getty Images; (d) Nicholas Monu/E+/Getty Images; (e) Oktay Ortakcioglu/Getty Images

PRACTICE QUESTIONS

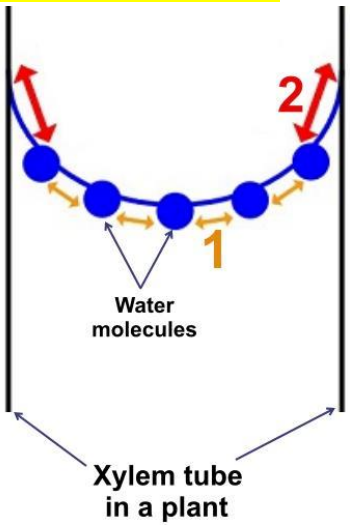
P1. Which water property is shown in the diagram of narrow tubes in water? *[Practice collection]*



A. Evaporative cooling
B. Permeability
C. Capillary action
D. Solubility

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P2. Which pair of water properties together allows water to travel up the narrow xylem tubes of a plant? *[Practice collection]*



A. Polarity and permeability
B. Cohesion and adhesion
C. Evaporation and solubility
D. Density and conductivity

P3. Which statement best describes how these properties transport water up a plant? *[Practice collection]*

A. Water molecules stick to each other and to the xylem walls, so water is pulled up as a continuous column.
B. Water molecules repel one another and are pushed upward by the soil.
C. Water molecules are changed into sugar molecules that float upward.
D. Water molecules are carried upward by the plasma membrane.

P4. Which term describes the unequal distribution of charge among the atoms connected by a bond, such as in a water molecule? *[Practice collection]*

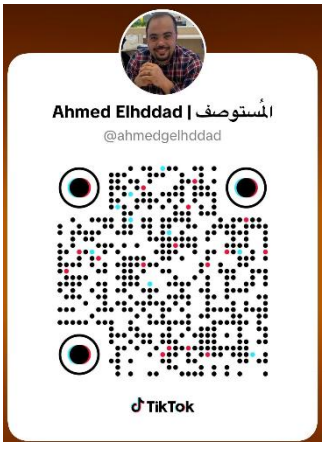
A. Cohesion
B. Capillary action
C. Solubility
D. Polarity

P5. Which term describes the attraction between one water molecule and another water molecule? *[Practice collection]*

A. Adhesion
B. Polarity
C. Cohesion
D. Solubility

P6. Which term describes the property that makes water travel up from the roots through the xylem tissue of a plant? *[Practice collection]*

A. Polarity
B. Capillary action
C. Evaporation
D. Buffering



Q8
MCQ

LEARNING OUTCOME

BIO.3.1.02.018: Distinguish between homogeneous mixtures (solutions) and heterogeneous mixtures.

Textbook: Figure 24 · page 22

TEXTBOOK REFERENCE

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Mixtures with Water

You are probably familiar with powdered drink products that dissolve in water. When you add a powdered substance to water, it does not react with water to form a new product. You create a **mixture.** A mixture is a combination of two or more substances in which each substance retains its individual characteristics and properties

Homogeneous mixtures

A mixture with a uniform composition throughout is called a homogeneous (hoh muh JEE nee us) mixture. A **solution** is another name for a homogeneous mixture. In the powdered drink mix solution shown in **Figure 24**, the drink mix is on top, in the middle, and at the bottom. The water retains its properties, and the drink mix retains its properties.

In a solution, there are two components: a solvent and a solute. A **solvent** is a substance in which another substance is dissolved. A **solute** is the substance that is dissolved in the solvent. In the drink mix, water is the solvent, and the powder is the solute. A mixture of salt and water is another example of a solution because the solute (salt) dissolves completely in the solvent (water). Saliva moistens your mouth and begins the digestion of some foods. It is a solution that contains water, proteins, and salts. Air is a solution of gases.



Figure 24 The drink mix forms a homogeneous mixture in water. The particles of the solute (drink mix) are dissolved and spread throughout the solvent (water).

Heterogeneous mixtures

A salad containing lettuce, croutons, and dressing is a heterogeneous mixture. In a heterogeneous mixture, the components remain distinct; you can tell what they are individually. Compare the mixture of sand and water to the solution of salt and water next to it in **Figure 25**. Sand and water form a type of heterogeneous mixture called a suspension. Over time, the particles in a suspension settle to the bottom.

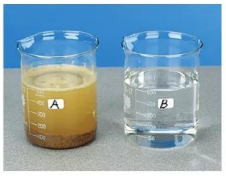


Figure 25 Sand and water form a heterogeneous mixture; you can see both the liquid and the solid. The homogeneous mixture of salt and water is a liquid; you cannot see the salt.

Get It?
Distinguish between solutions and suspensions.

PRACTICE QUESTIONS

P1. What does the image below show? *[Past exam collection]*



- **A.** a heterogeneous mixture
- **B.** a suspension
- **C.** a solution
- **D.** a homogeneous mixture

P2. What is the relationship between a solution and a mixture? *[Textbook review]*

- **A.** A mixture is a type of solution in which the parts stay separate.
- **B.** A solution is a type of mixture in which the particles are evenly distributed.
- **C.** Solutions and mixtures are completely unrelated.
- **D.** A solution has visible separate parts that can be picked apart.

P3. Which statement correctly compares solutions and suspensions? *[Textbook review]*

- **A.** In a solution the particles stay dissolved, while in a suspension larger particles settle over time (for example, salt in water compared with sand in water).
- **B.** In a solution the particles settle over time, while in a suspension they stay dissolved.
- **C.** Both a solution and a suspension are heterogeneous mixtures.
- **D.** Neither a solution nor a suspension contains a solvent.

P4. Which of the following is an example of a homogeneous mixture? *[Textbook-based]*

- **A.** A salad with lettuce and croutons
- **B.** Sand mixed in water
- **C.** A bag of mixed nuts and bolts
- **D.** Salt completely dissolved in water

P5. Sand and water form a mixture in which the particles settle over time. This is an example of: *[Textbook-based]*

- **A.** a homogeneous mixture.
- **B.** a pure substance.
- **C.** a heterogeneous mixture (a suspension).

D. a solution.

Q9 MCQ

LEARNING OUTCOME

BIO.3.1.02.023: Use acid-base indicators or pH test strips to classify solutions as acidic, basic, or neutral.

Textbook: Figure 28 · page 24

TEXTBOOK REFERENCE



Figure 28 The pH scale is used to indicate the relative strength of acids and bases.

PRACTICE QUESTIONS

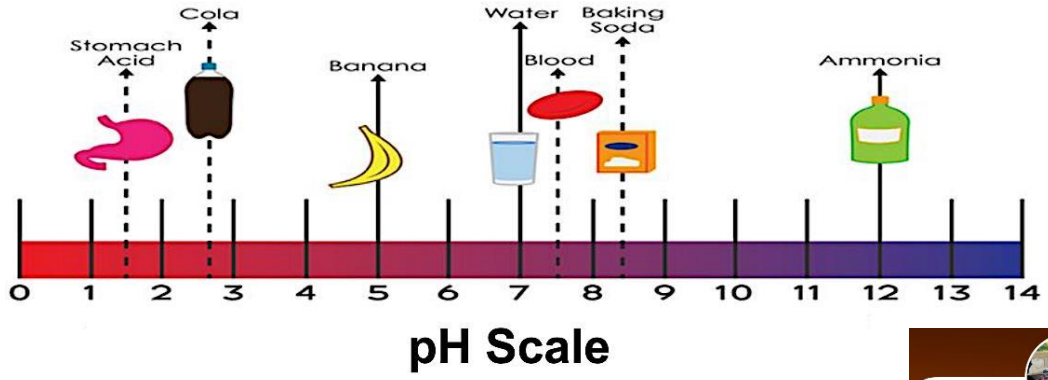
P1. Which of the following is NOT a correct explanation of the importance of buffers to living organisms? *[Past exam collection]*

A. Buffers allow large fluctuations in the concentrations of hydrogen ions in a cell.
B. Buffers help maintain the pH level in the cell between 6.5 and 7.5.
C. Buffers play a role in maintaining homeostasis.
D. Buffers help maintain the proper environment for enzymatic reactions and biological processes to occur.

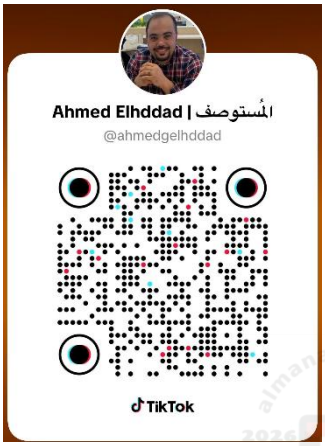
P2. Which of the following substances produces OH^- ions when dissolved in water? *[Past exam collection]*

A. The base
B. The acid
C. The salt
D. The buffer

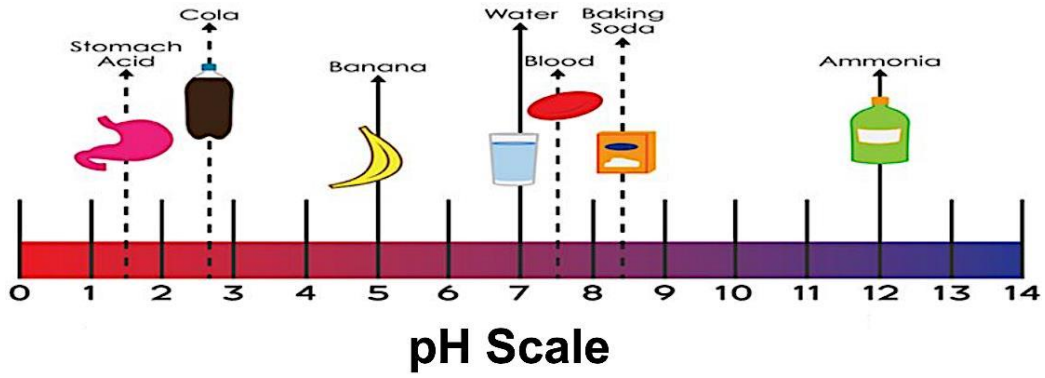
P3. Use the pH scale diagram. Which of the following substances is acidic? *[Practice collection]*



A. Cola
B. Blood
C. Ammonia
D. Water



P4. Use the pH scale diagram. Which of the following has the highest concentration of hydrogen ions (H^+)? *[Practice collection]*



A. Blood
B. Ammonia
C. Water
D. Cola

P5. Hydrochloric acid (HCl) is a strong acid. What happens when HCl dissolves in water? *[Textbook review]*

A. It releases OH^- ions, which raises the pH.
B. It does not change the H^+ concentration of the water.
C. It releases H^+ ions, which increases the H^+ concentration and lowers the pH.
D. It releases H^+ ions, which raises the pH.

P6. Baking soda ($NaHCO_3$) is classified as a base. What is its effect on stomach contents with a pH of 4? *[Textbook review]*

A. It raises the H^+ concentration, so the pH decreases.
B. It lowers the H^+ concentration, so the pH increases.
C. It does not change the H^+ concentration.
D. It turns the stomach contents into pure acid.

P7. Which statement describes the importance of buffers to living organisms? *[Textbook review]*

A. Buffers resist sharp changes in pH, keeping conditions suitable for cells and enzymes.
B. Buffers make the pH of cells change quickly.
C. Buffers turn bases into acids permanently.
D. Buffers remove all water from the cell.

P8. What is the relationship between an acid and a base? *[Textbook review]*

A. An acid releases OH^- ions, while a base releases H^+ ions.
B. Both acids and bases release only H^+ ions.
C. Neither acids nor bases release ions in water.
D. An acid releases H^+ ions in water, while a base releases OH^- ions in water.

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Q10 MCQ

LEARNING OUTCOME

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.

Textbook: Figure 29 · page 25

TEXTBOOK REFERENCE

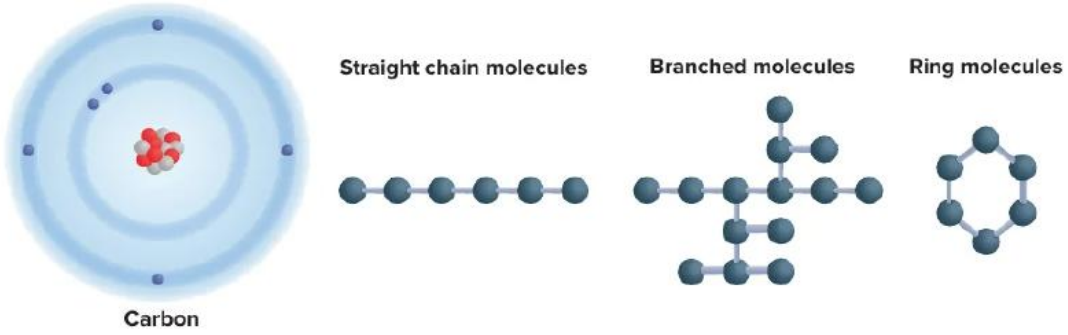


Figure 29 Life is based on carbon compounds. The half-filled outer energy level of carbon, shown in the image on the left, allows for the formation of straight chain, branched, and ring molecules.

PRACTICE QUESTIONS

P1. Which two elements are always found in amino acids? *[Past exam collection]*

- **A.** Carbon and oxygen
- **B.** Nitrogen and sulfur
- **C.** Sulfur and oxygen
- **D.** Hydrogen and phosphorus

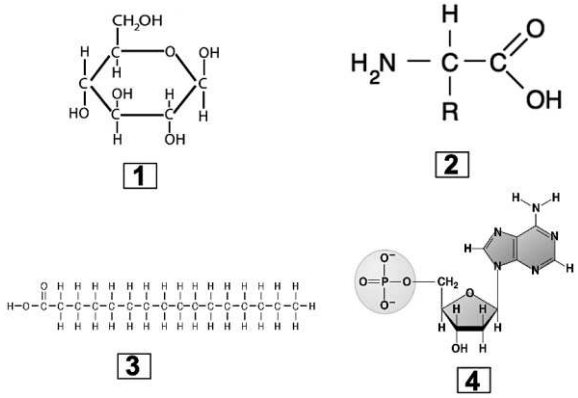
P2. Which substance would be extensively studied during a college organic chemistry course? *[Past exam collection]*

- **A.** Water
- **B.** Glucose
- **C.** Sodium
- **D.** Oxygen

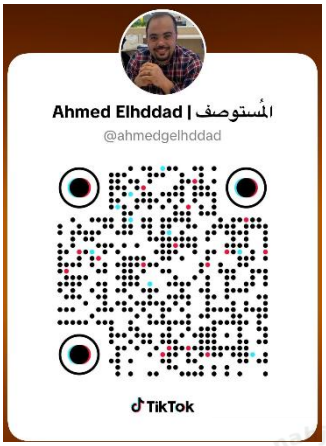
P3. An unknown substance found on a meteorite contains no trace of carbon. What can scientists conclude? *[Textbook review]*

- **A.** It must contain living cells.
- **B.** It contains DNA and proteins.
- **C.** It proves that life exists on other planets.
- **D.** It is unlikely to contain the organic molecules of life, so it is not evidence of life.

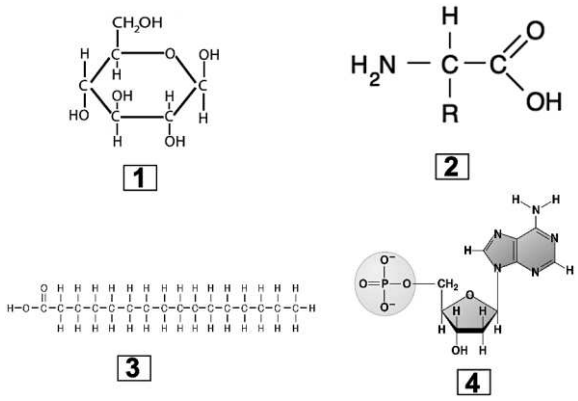
P4. Which number in the diagram represents a carbohydrate? *[Practice collection]*



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



P5. Which number in the diagram represents the building block of a protein? *[Practice collection]*



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

P6. Which type of bond links amino acids together? *[Textbook review]*

A. Peptide bonds
B. Hydrogen bonds
C. van der Waals forces
D. Ionic bonds

P7. Why can cells contain both large molecules and small carbon compounds at the same time? *[Textbook review]*

A. Carbon atoms cannot bond to other atoms, so they stay small.
B. Large molecules are made only from nitrogen.
C. Small carbon compounds are destroyed when large molecules form.
D. Carbon atoms form four bonds, so small carbon compounds can be joined into very large molecules.

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Q11 MCQ

LEARNING OUTCOME

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.

Textbook: Figure 32 · page 28

TEXTBOOK REFERENCE

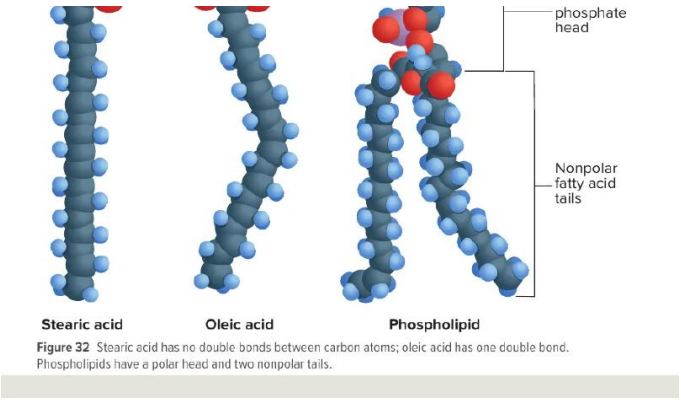
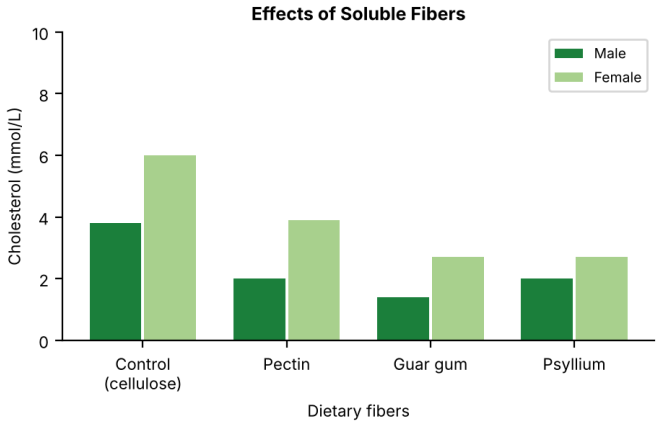
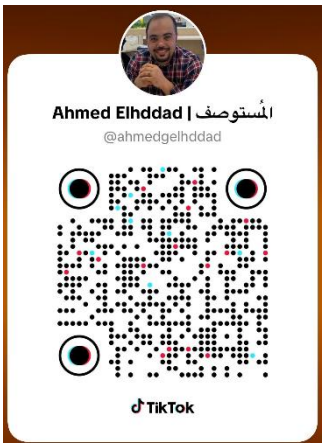


Figure 32 Stearic acid has no double bonds between carbon atoms; oleic acid has one double bond. Phospholipids have a polar head and two nonpolar tails.

PRACTICE QUESTIONS

P1. High levels of the steroid known as cholesterol in the blood are associated with heart disease. Researchers are studying the effects of soluble dietary fiber on blood cholesterol levels. In this experiment, the effects of three soluble fibers (pectin, guar gum, and psyllium) on blood cholesterol levels were examined. Cellulose was used as the control. Use the accompanying graph to answer the following question: Which of the following is a similarity between the effects of psyllium fiber and guar gum fiber on blood cholesterol levels? *[Past exam collection]*





A. Both lower cholesterol levels in females to the same extent.
B. Both raise cholesterol levels in males compared with cellulose.
C. Both raise cholesterol levels in females compared with cellulose.
D. Both lower cholesterol levels in males to the same extent.

P2. Which of the following macromolecules is matched with its correct role in the cell? *[Past exam collection]*

A. Nucleic acid – Transport substances
B. Carbohydrates – Make hormones
C. Lipids – Store genetic information
D. Proteins – Speed reactions

P3. Which of the following functions can't be attributed to carbohydrates? *[Past exam collection]*

A. Structural support
B. Signalling between cells
C. Energy storage
D. Genetic information storage

P4. Which of the following functions can be attributed to carbohydrates? *[Past exam collection]*

- **A.** Provide a barrier
- **B.** Chemical signaling between cells
- **C.** Store energy
- **D.** Genetic information storage and transmission

P5. Which of the following carbohydrates is NOT digestible and provides dietary fiber? *[Past exam collection]*

- **A.** Cellulose
- **B.** Starch
- **C.** Glycogen
- **D.** Sucrose

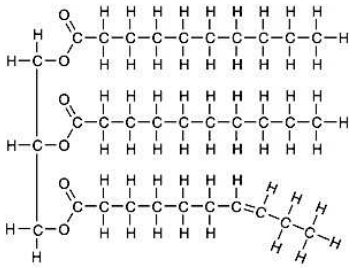
P6. Which of the following correctly describes the importance of steroids in the human body? *[Practice collection]*

- **A.** They control the digestion of proteins.
- **B.** They fight off diseases directly.
- **C.** They help build some hormones.
- **D.** They provide energy for immediate use.

P7. Which row correctly compares glycogen with cellulose? *[Practice collection]*

- **A.** Glycogen: found in plants, gives structural support; cellulose: found in animals, stores energy.
- **B.** Glycogen: found in animals, stores energy; cellulose: found in plants, gives structural support.
- **C.** Glycogen: found in animals, gives structural support; cellulose: found in plants, stores genetic information.
- **D.** Glycogen and cellulose: both found in animals and used only to store genetic information.

P8. The diagram shows a triglyceride in which one fatty acid tail contains a double bond. Which prediction is most likely correct? *[Practice collection]*



- **A.** It is likely to be liquid at room temperature because the double bond prevents the tails from packing tightly.
- **B.** It is likely to be solid at room temperature because the double bond makes the tails pack tightly.
- **C.** It is a protein and has no state at room temperature.
- **D.** It is a carbohydrate that dissolves completely in water.

P9. Fats, oils and waxes are made of _____. *[Textbook review]*

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

P10. Why can't humans digest all carbohydrates? *[Textbook review]*

- **A.** All carbohydrates are made of nitrogen.
- **B.** Humans have no stomach acid.
- **C.** Humans lack the enzymes needed to break the bonds in some carbohydrates, such as cellulose.
- **D.** Carbohydrates are not made of sugar units.

P11. Which of the following is among the major groups of biological macromolecules? *[Practice collection]*

- **A.** Aromatic hydrocarbons
- **B.** Carbohydrates
- **C.** Polyethylene compounds

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D. Silicates

Q12
MCQ

LEARNING OUTCOME

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.

Textbook: Get It · page 29

TEXTBOOK REFERENCE

Proteins

Another primary building block of living things is protein. A **protein** is a compound made of small carbon compounds called amino acids. **Amino acids** are small compounds that are made of carbon, nitrogen, oxygen, hydrogen, and sometimes sulfur. All amino acids share the same general structure.

Amino acid structure Amino acids have a central carbon atom like the one shown in **Figure 33**. Recall that carbon can form four covalent bonds. One of those bonds is with hydrogen. The other three bonds are with an amino group ($-NH_2$), a carboxyl group ($-COOH$), and a variable group ($-R$). The variable group makes each amino acid different. There are 20 different variable groups, 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, which is also shown in **Figure 33**. A peptide bond forms between the amino group of one amino acid and the carboxyl group of another.

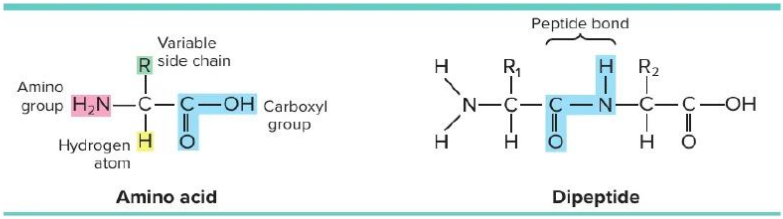


Figure 33 **Left:** The general structure of an amino acid has four groups around a central carbon. **Right:** The peptide bond in a protein happens as a result of a chemical reaction.

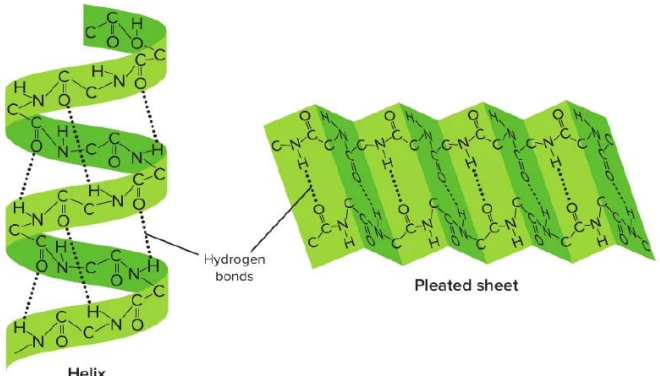
Interpret *which other molecule is a product when a peptide bond forms.*

Protein function 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. Your cells contain about 10,000 different proteins that provide structural support, transport substances inside the cell and between cells, communicate signals within a cell and between cells, speed up chemical reactions, and control cell growth.

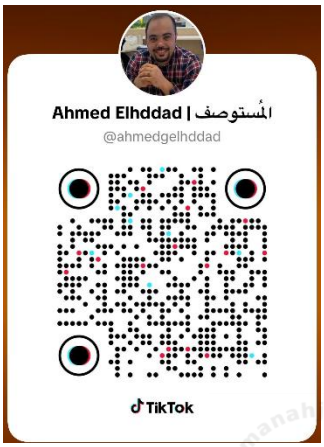
Get It?
Describe What are the primary functions of proteins?

PRACTICE QUESTIONS

P1. The accompanying figure shows some forms of protein structure that depend on interactions between amino acids. Which of the following helps a protein maintain its shape? *[Past exam collection]*



A. Peptide bonds
B. Binding to phospholipids
C. The function it performs
D. Hydrogen bonds



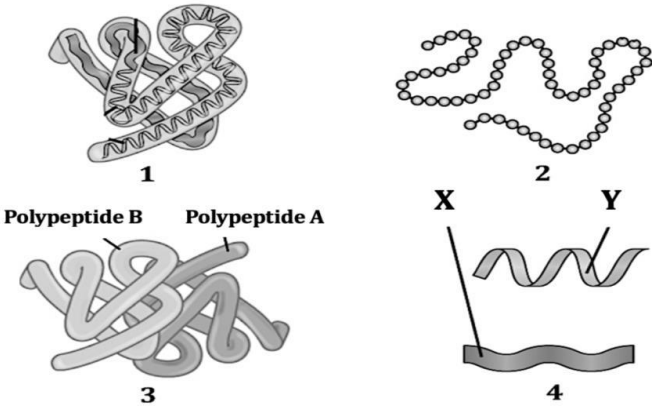
P2. Compare between proteins and fats (lipids) by completing the table. Some cells are already filled in. *[Past exam collection]*

Basis of comparison	Proteins	Fats (lipids)
Building unit		
Site of digestion	Stomach	Small intestine
Function		
Example	Hemoglobin	Beeswax
Type of macromolecule (protein / lipid)		
Example	Cellulose	Glycogen
Type of cell that contains it (animal cell / plant cell)		
Type of sugar (simple / complex)	Starch	Glucose

P3. Which macromolecule is involved in nearly every function in the human body? *[Past exam collection]*

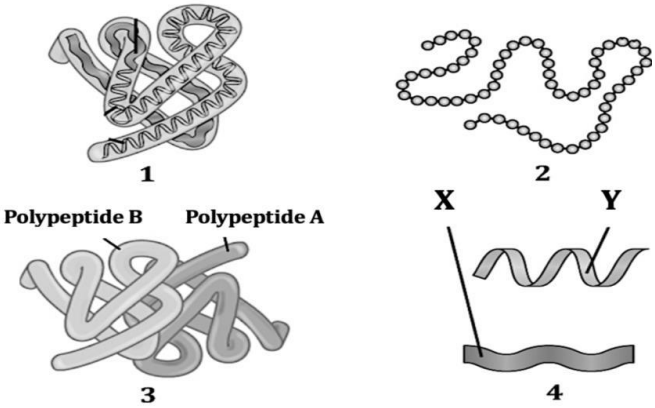
- **A.** Nucleotide
- **B.** Lipid
- **C.** Protein
- **D.** Carbohydrate

P4. In the diagram of protein structure, which shapes are labeled X and Y? *[Practice collection]*



- **A.** X is a helix and Y is a pleated sheet.
- **B.** X is a pleated sheet and Y is a helix.
- **C.** X and Y are both nucleotides.
- **D.** X is a phospholipid and Y is a steroid.

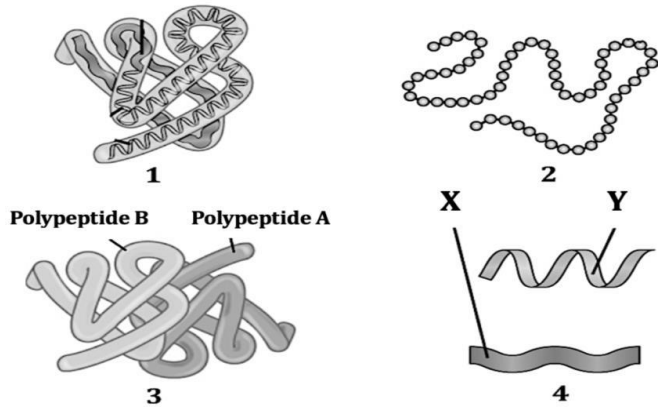
P5. In the diagram, which number represents the tertiary structure of a protein? *[Practice collection]*



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



P6. In the diagram, which number represents the quaternary structure of a protein? *[Practice collection]*



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

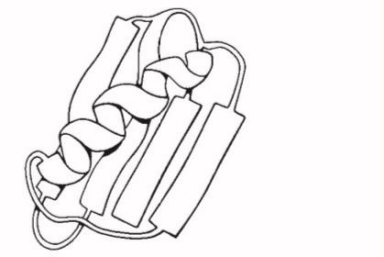
P7. Why is the order of amino acids important to the function of a protein? *[Textbook review]*

A. The order determines which element the protein contains.
B. The order has no effect on how a protein folds.
C. The order determines how the chain folds into its three-dimensional shape, which determines its function.
D. The order decides whether the protein is a carbohydrate.

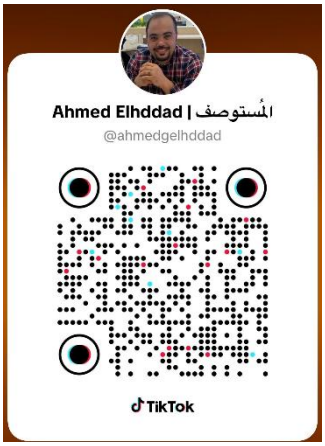
P8. Given the large number of proteins in the body, why is the shape of an enzyme important to its function? *[Textbook review]*

A. The shape lets the enzyme bind to every molecule.
B. Only a substrate that fits the enzyme's active site can bind, so each enzyme catalyzes a specific reaction.
C. The shape stores energy for the cell.
D. The shape makes the enzyme a nonpolar molecule.

P9. What type of macromolecule has a structure similar to the one shown in the drawing? *[Textbook review]*



A. Protein
B. Carbohydrate
C. Lipid
D. Nucleotide



P10. Which molecular activity needs a folded structure? *[Textbook review]*

A. Acting as a nonpolar compound
B. Moving across cell membranes
C. Serving as an energy-storage molecule in the cell
D. Working as an active site

Q13
MCQ

LEARNING OUTCOME
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.

Textbook: Figure 35 · page 31

TEXTBOOK REFERENCE

Figure 35 shows the basic structure of a nucleotide and nucleic acid. There are five major nucleotides, all of which have three units—a phosphate, a nitrogenous base, and a ribose sugar. In nucleic acids, the sugar of one nucleotide bonds to the phosphate of another. The nitrogenous base that sticks out from the chain is available for hydrogen bonding with other bases in other nucleic acids.

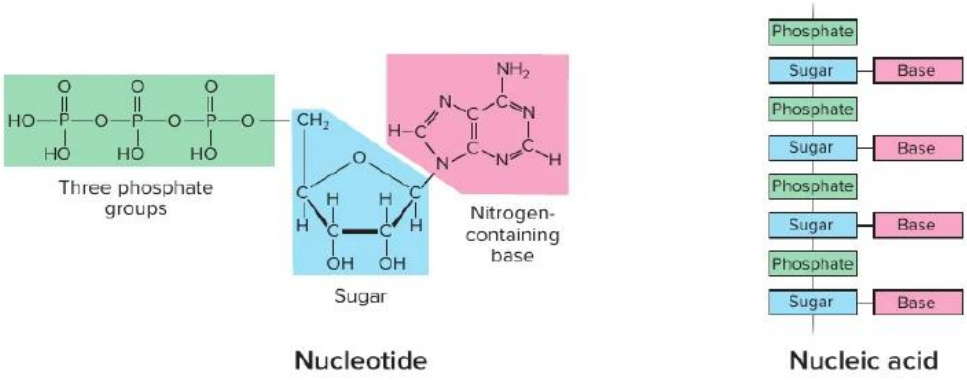


Figure 35 **Left:** DNA nucleotides contain the sugar deoxyribose. RNA nucleotides contain the sugar ribose. **Right:** Nucleotides are joined together by bonds between their sugar group and phosphate group.

PRACTICE QUESTIONS

P1. Which substance is NOT part of a nucleotide? *[Past exam collection]*

- **A.** A phosphate
- **B.** A base
- **C.** A sugar
- **D.** Nitrate group

P2. Which of the following functions can be attributed to nucleic acids and nucleotides? *[Past exam collection]*

- **A.** Barrier in biological membranes
- **B.** Chemical signaling between cells
- **C.** Long-term energy storage
- **D.** Genetic information storage and transmission

P3. Which of the following is a function of nucleic acids? *[Practice collection]*

- **A.** Store and communicate genetic information
- **B.** Provide barriers
- **C.** Provide structural support
- **D.** Transport substances

P4. Which of the following are among the types of nucleic acids? I. ADH II. DNA III. RNA *[Practice collection]*

- **A.** I and II only
- **B.** I and III only
- **C.** I, II, and III
- **D.** II and III only

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P5. **An analysis of an unknown sample showed that it is made of phosphate groups, nitrogen bases, and sugars. Which class of macromolecules is it most probably?** *[Practice collection]*

- **A.** Carbohydrates
- **B.** Lipids
- **C.** Nucleic acids
- **D.** Proteins

P6. **DNA and RNA are examples of _____.** *[Textbook review]*

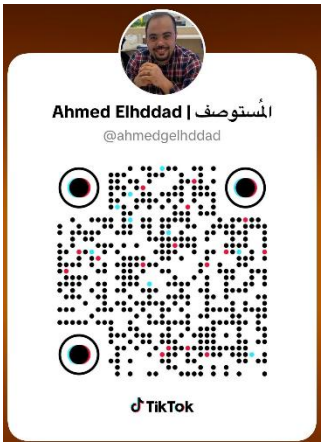
- **A.** carbohydrates
- **B.** nucleic acids
- **C.** lipids
- **D.** proteins

P7. **Carbohydrates, lipids, proteins and nucleic acids are all examples of _____.** *[Textbook review]*

- **A.** macromolecules
- **B.** elements
- **C.** solvents
- **D.** mixtures

P8. **Which pair correctly identifies the components of carbohydrates and proteins?** *[Textbook review]*

- **A.** Carbohydrates are made of amino acids; proteins are made of sugar units.
- **B.** Carbohydrates are made of nucleotides; proteins are made of fatty acids.
- **C.** Carbohydrates are made of fatty acids; proteins are made of sugar units.
- **D.** Carbohydrates are made of sugar units; proteins are made of amino acids.



Q14
MCQ

LEARNING OUTCOME

BIO.3.1.01.076: Assess the role of selected technologies in enhancing our understanding of cells and cellular processes.

Textbook: Figure 1 · page 37

TEXTBOOK REFERENCE



History of the Cell Theory

For centuries, scientists had no idea that the human body or the bodies of other complex organisms consist of trillions of cells. Cells are so small that their existence was unknown before the invention of the microscope. In 1665, as indicated in the time-line on the next page, an English scientist named 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, such as those shown in **Figure 1**. He called them cellulae (the Latin word meaning *small rooms*) because the boxlike cells of cork reminded him of the cells in which monks live at a monastery. 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 (LAY vun hook) 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.

Continuous investigations by these scientists and many others, along with the development of new technologies, led to new scientific information. This has led to the development of new branches of science, and many new and exciting discoveries, as shown in the timeline in **Figure 2**, on the next page. Research on

Light micrograph 100x



Figure 1 Robert Hooke used a basic light microscope to see what looked like empty chambers in a cork sample.
Infer *what you think Hooke would have seen if these were living cells.*

PRACTICE QUESTIONS

P1. The light microscope shown has an eyepiece magnification of 5× and an objective-lens magnification of 10×. Which of the following represents the total magnification of the microscope? *[Past exam collection]*



- **A.** 50×
- **B.** 2×
- **C.** 0.5×
- **D.** 15×

P2. If a microscope has a series of three lenses that magnify individually 4×, 5×, and 6×, what is the total magnification of the microscope? *[Past exam collection]*

- **A.** 20×
- **B.** 24×
- **C.** 30×
- **D.** 120×

P3. Which of the following is the total magnification of a microscope with an ocular lens (eyepiece) of 10× and an objective lens of 4×? *[Practice collection]*

- **A.** 4×
- **B.** 400×
- **C.** 4000×
- **D.** 40×

P4. A microscope has a series of three lenses with magnifications of 5×, 5× and 7×. What is the total magnification? *[Textbook review]*

- **A.** 25×
- **B.** 35×
- **C.** 175×
- **D.** 17×

P5. How did the microscope change the way scientists study living things? *[Textbook review]*

- **A.** It allowed scientists to study living things without examining them.
- **B.** It let scientists observe cells and structures too small to see, which led to the discovery of cells and cell theory.
- **C.** It showed that cells do not exist.
- **D.** It replaced the need for all experiments.

Q15 MCQ

LEARNING OUTCOME

BIO.3.1.01.075: Identify that all living things are composed of cells.

Textbook: Information from text and Get It · page 39

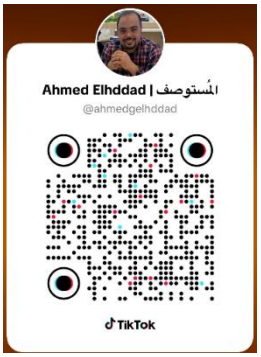
TEXTBOOK REFERENCE

The cell theory

Scientists continued observing the living microscopic world using glass lenses. In 1838, German scientist Matthias Schleiden carefully studied plant tissues and concluded that all plants are composed of cells. A year later, another German scientist, Theodor Schwann, reported that animal tissues also consisted of individual cells. Prussian physician Rudolph Virchow proposed in 1855 that all cells are produced from the division of existing cells. The observations and conclusions of these scientists and others are summarized as the cell theory. The **cell theory** is one of the fundamental ideas of modern biology and includes the following three principles:

1. All living organisms are composed of one or more cells.
2. Cells are the basic unit of structure and organization of all living organisms.
3. Cells arise only from previously existing cells, with cells passing copies of their genetic material on to their daughter cells.

Get It?



PRACTICE QUESTIONS

P1. During their mission to planet Mars, astronauts have found material that might be a cell. Which of the following must the material have to be considered a cell? *[Past exam collection]*

- **A.** The material must have a nucleus.
- **B.** The material must have chloroplasts.
- **C.** The material must have mitochondria.
- **D.** The material must have a cell membrane.

P2. Which of the following statements are NOT principles of the cell theory? *[Past exam collection]*

- **A.** Cells contain membrane-bound organelles.
- **B.** Cells are the basic unit of life.
- **C.** Cells come from pre-existing cells.
- **D.** All living organisms are composed of cells.

P3. Which of the following statements is a principle of cell theory? *[Past exam collection]*

- **A.** All cells contain membrane-bound genetic material.
- **B.** Cells are the basic unit of life.
- **C.** Tissue is the basic unit of life.
- **D.** All living organisms are composed of more than one cell.

P4. In 1858 Rudolf Virchow observed cancer cells dividing to give new cells. Which principle of the cell theory resulted from this observation? *[Practice collection]*

- **A.** All living organisms are composed of one or more cells.
- **B.** Cells contain membrane-bound organelles.
- **C.** Cells arise only from previously existing cells.
- **D.** Cells arise spontaneously from nonliving matter.

P5. Which term correctly completes the statement "_____ are the basic building units of all living things"? *[Textbook review]*

- **A.** Organelles
- **B.** Cells
- **C.** Nuclei
- **D.** Atoms

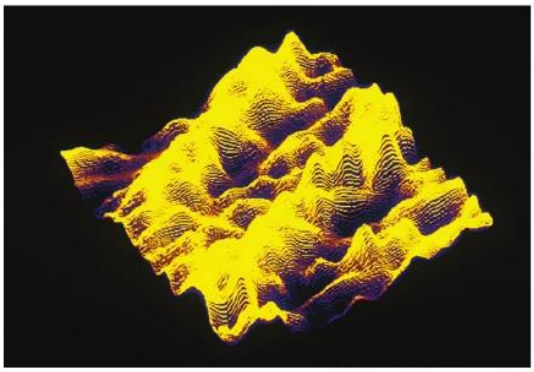
Q16
MCQ

LEARNING OUTCOME
BIO.3.1.01.076: Assess the role of selected technologies in enhancing our understanding of cells and cellular processes.

Textbook: Figure 3 · page 40

TEXTBOOK REFERENCE

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 DNA, the cell's genetic material, magnified with a scanning tunneling electron microscope.



STM Magnification: unavailable

Figure 3 The scanning tunneling microscope (STM) provides images, such as this DNA molecule, in which cracks and depressions appear darker and raised areas appear lighter.

Compare and contrast *the structures and functions of a STM to those of other types of microscopes.*

ACADEMIC VOCABULARY

PRACTICE QUESTIONS

P1. Which of the following is a disadvantage of using transmission electron microscopes (TEM) and scanning electron microscopes (SEM)? *[Past exam collection]*

A. They use a beam of electrons instead of light rays.
B. They allow only dead cells and tissues to be observed.
C. They use magnets instead of lenses.
D. Their maximum magnification without image distortion is 1,000×.

P2. Why might a microscopist choose a light microscope instead of an electron microscope to study a sample? *[Textbook review]*

A. A light microscope has higher magnification than an electron microscope.
B. A light microscope can be used to observe living specimens.
C. A light microscope uses a beam of electrons.
D. An electron microscope can only be used to study nonliving matter.

P3. Which type of microscope produces a three-dimensional image of the surface of a specimen? *[Textbook-based]*

A. Scanning electron microscope (SEM)
B. Simple light microscope
C. Compound light microscope
D. Transmission electron microscope (TEM)

P4. Electron microscopes differ from light microscopes because they use: *[Textbook-based]*

A. a beam of light focused by glass lenses.
B. heat to magnify the specimen.
C. sound waves to produce an image.
D. a beam of electrons aimed by magnets instead of light and lenses.

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Q17 MCQ

LEARNING OUTCOME

Compare the structure and function of plant and animal cells and that of eukaryote and prokaryote cell.

Textbook: Figure 4 · page 41

TEXTBOOK REFERENCE

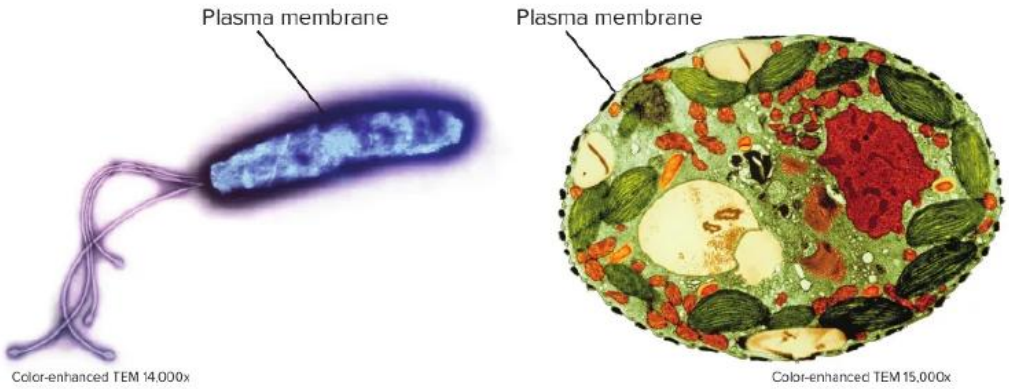
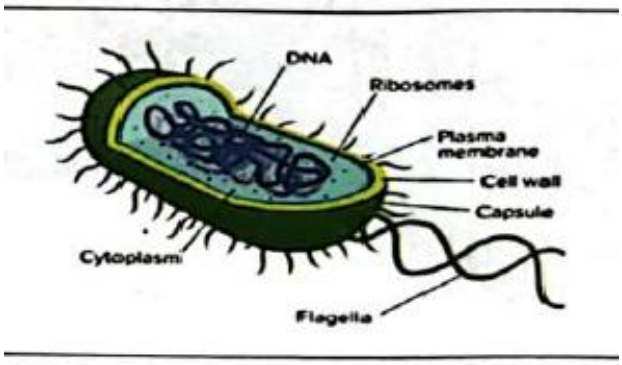
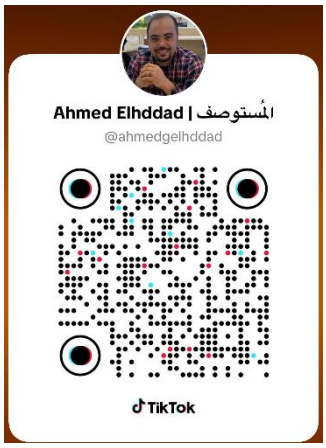


Figure 4 The prokaryotic cell on the left is smaller and appears less complex than the eukaryotic cell on the

PRACTICE QUESTIONS

P1. What kind of cell is shown in the picture below? *[Past exam collection]*



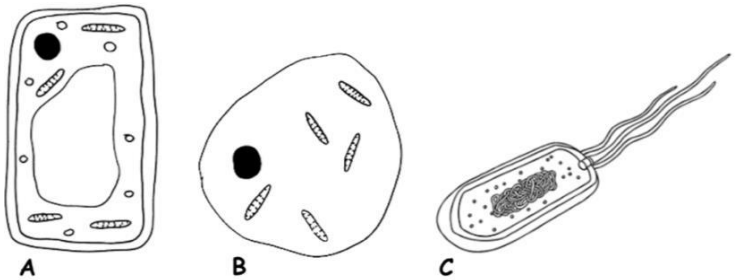


A. Blood cell
B. Plant cell
C. Prokaryotic cell
D. Animal cell

P2. In which of the following structures would you expect to find a cell wall? *[Past exam collection]*

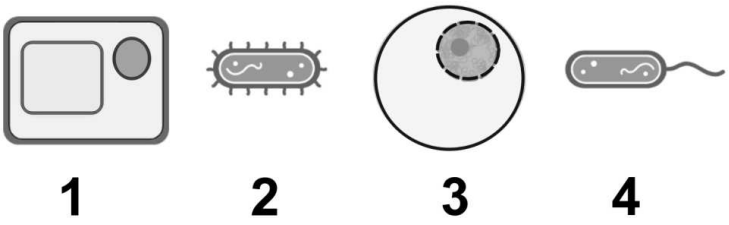
A. Leaf cells from a tree
B. Human muscle cells
C. Blood cells from a cow
D. Skin cells from a cat

P3. Based on the diagram, which of the cells (A, B and C) is/are prokaryotic? *[Practice collection]*



A. C only
B. B only
C. A and B only
D. B and C only

P4. **The diagram shows four cells as seen under the microscope. Which of the following represents eukaryotic cells?** *[Practice collection]*

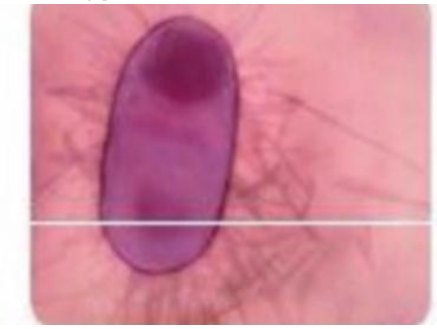


A. 1 and 2
B. 2 and 3
C. 2 and 4
D. 1 and 3

P5. **Which statement correctly compares prokaryotic and eukaryotic cells?** *[Practice collection]*

A. Prokaryotic cells have a nucleus, while eukaryotic cells do not.
B. Prokaryotic cells have membrane-bound organelles, while eukaryotic cells do not.
C. Prokaryotic cells have no nucleus and no membrane-bound organelles, and are generally smaller than eukaryotic cells.
D. Prokaryotic cells are generally larger than eukaryotic cells.

P6. **What type of cell is shown in the micrograph?** *[Textbook review]*



A. A plant cell
B. A prokaryotic cell
C. An animal cell
D. A eukaryotic cell

P7. **Which of the following can be found in both prokaryotic cells and eukaryotic cells?** *[Practice collection]*

A. Ribosome
B. Chloroplast
C. Golgi apparatus
D. Nucleus

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Q18 MCQ

LEARNING OUTCOME

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.

Textbook: Figure 5 · page 43

TEXTBOOK REFERENCE

plasma membrane to exist in the watery environment.

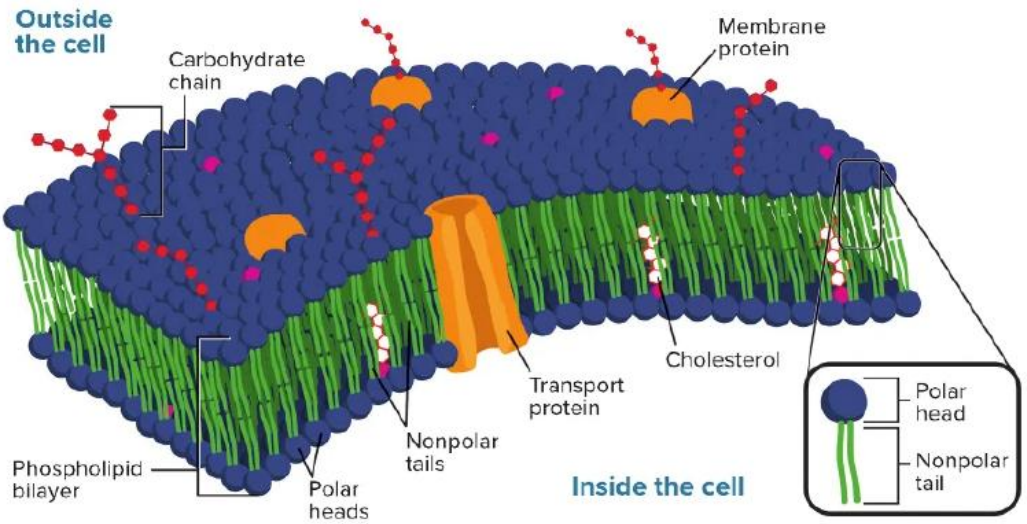
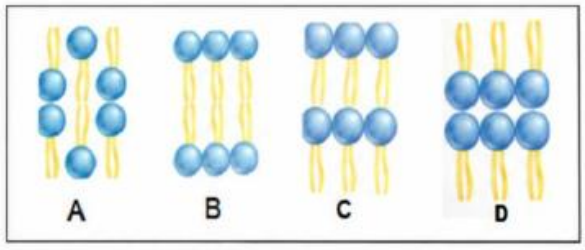


Figure 5 The phospholipid bilayer looks like a sandwich, with the polar heads facing the outside and the nonpolar tails facing the inside.

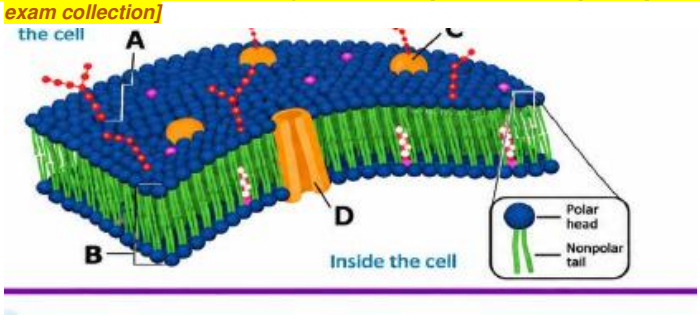
PRACTICE QUESTIONS

P1. Which of the following orientations of phospholipids best represents the phospholipid bilayer of the plasma membrane? *[Past exam collection]*

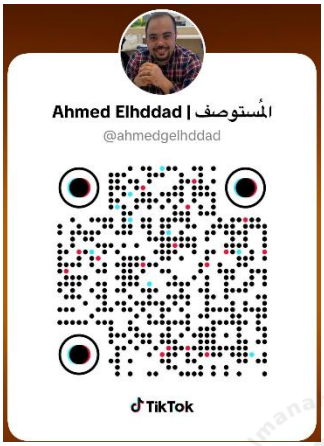


A. A
B. B
C. C
D. D

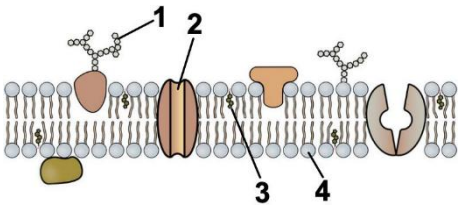
P2. Which of the following letters represents a phospholipid bilayer in the cell membrane? *[Past exam collection]*



A. A
B. B
C. C
D. D

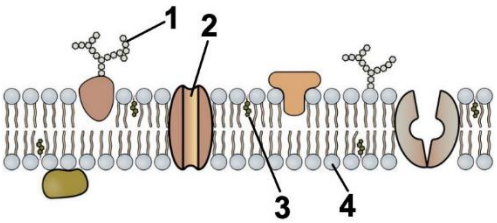


P3. **Use the membrane diagram. Which number represents the major component of the plasma membrane that forms a barrier between the inside and outside of the cell?** *[Practice collection]*



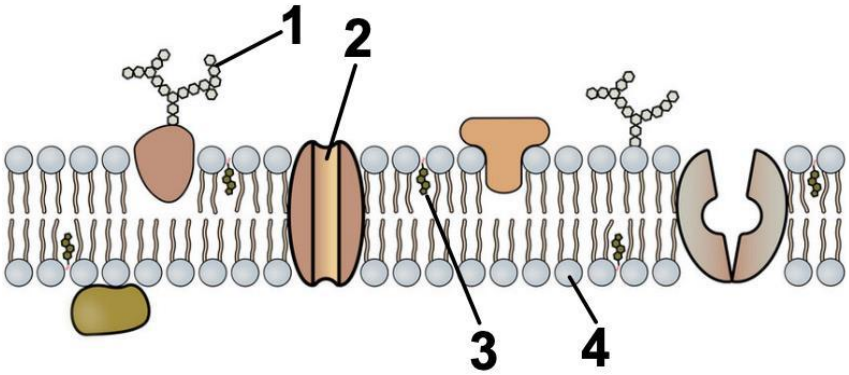
A. 1
B. 2
C. 3
D. 4

P4. **Use the membrane diagram. Which number represents the component that helps in cell identification and cellular communication?** *[Practice collection]*



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

P5. **Use the membrane diagram. Which component of the plasma membrane is represented by number 3?** *[Practice collection]*



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A. Carbohydrate
B. Cholesterol
C. Phospholipid
D. Protein

P6. **The basic structure that forms the plasma membrane is the _____.** *[Textbook review]*

A. phospholipid bilayer
B. cell wall
C. nuclear envelope
D. protein chain

P7. **What is the role of phospholipids in membranes?** *[Practice collection]*

A. They make proteins for the cell.
B. They store genetic information.
C. They digest food for the cell.
D. They form a double layer that acts as a barrier around the cell.

P8. **How does the arrangement of phospholipids in the bilayer allow the cell to interact with its surroundings?** *[Textbook review]*

A. The water-repelling tails face the watery inside and outside of the cell.
B. All the heads and tails mix randomly with no pattern.
C. The water-attracting heads face the watery inside and outside of the cell, while the water-repelling tails face each other in the middle.
D. The phospholipids form a solid wall with no fluid movement.

Q19
MCQ

LEARNING OUTCOME
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.

Textbook: Figure 6 · page 45

TEXTBOOK REFERENCE

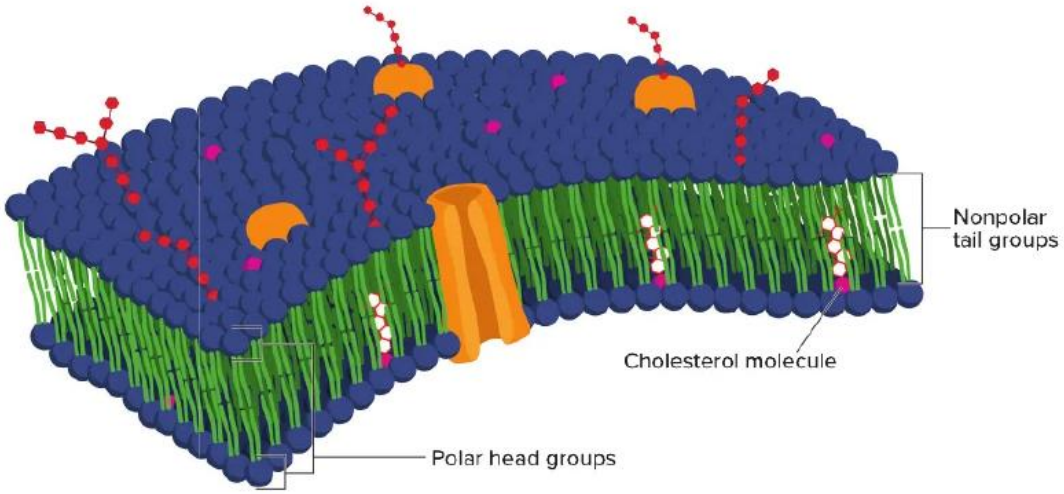
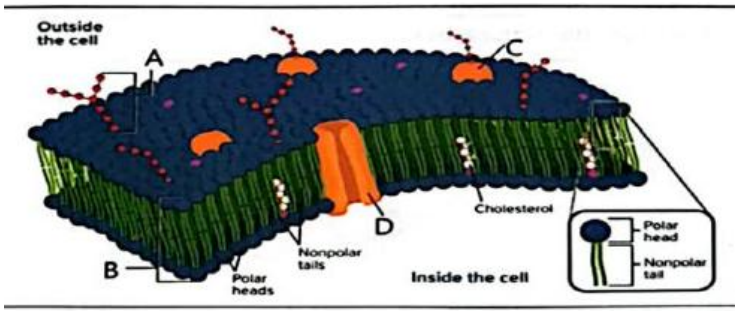
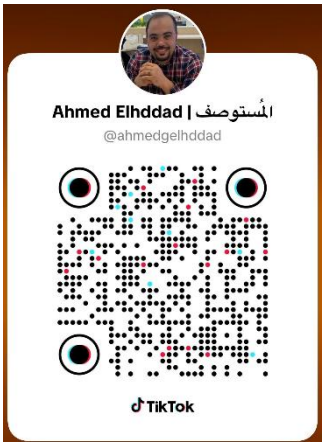


Figure 6 The fluid mosaic model refers to a plasma membrane with substances that can move around within the membrane.

PRACTICE QUESTIONS

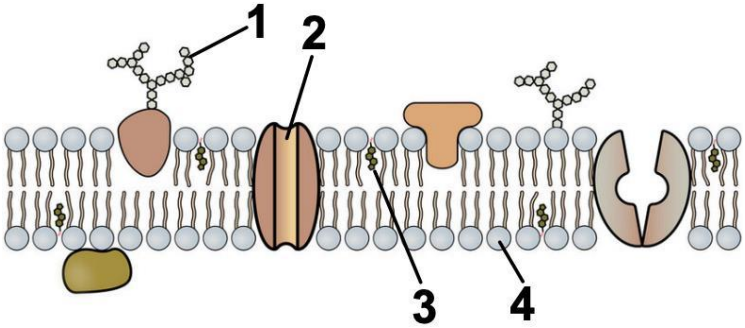
P1. Which of the following letters represents the transport protein in the plasma membrane? *[Past exam collection]*





A. A
B. B
C. C
D. D

P2. Use the membrane diagram. Which number represents a transport protein? *[Practice collection]*



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

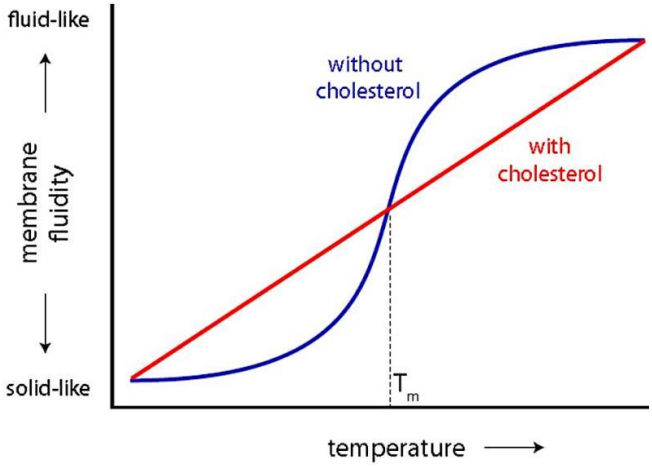
P3. Transport proteins in the plasma membrane _____. *[Textbook review]*

- **A.** store genetic information
- **B.** move essential materials across the membrane
- **C.** digest nutrients in the cell
- **D.** make the membrane waterproof

P4. Which condition leads to increased fluidity of the phospholipid bilayer? *[Textbook review]*

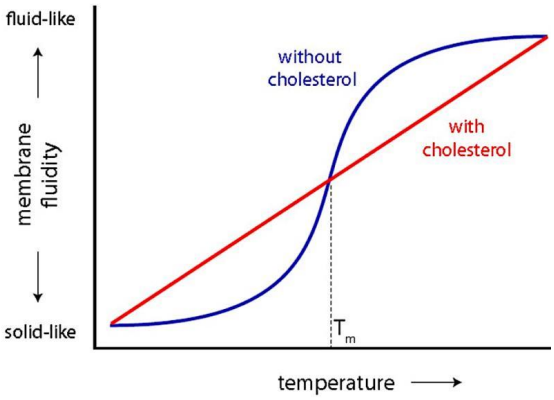
- **A.** An increase in the number of unsaturated fatty acids
- **B.** A decrease in temperature
- **C.** An increase in the number of cholesterol molecules
- **D.** An increase in the number of proteins

P5. According to the graph, at low temperatures which plasma membrane is more fluid? *[Practice collection]*



- **A.** The one without cholesterol
- **B.** Both are equally fluid
- **C.** Neither is fluid
- **D.** The one with cholesterol

P6. An organism lives in a very cold aquatic environment. Which is better for it, and why? *[Practice collection]*



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- **A.** Not having cholesterol, because cholesterol makes the membrane freeze.
- **B.** Having cholesterol, because cholesterol makes the membrane solid at low temperatures.
- **C.** Having cholesterol in its plasma membrane, because cholesterol keeps the membrane fluid at low temperatures.
- **D.** Not having cholesterol, because cholesterol makes the membrane too fluid.

P7. Which statement explains why the plasma membrane is described by the "fluid mosaic model"? *[Textbook review]*

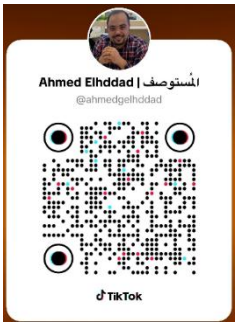
- **A.** It is a rigid wall made of one type of molecule.
- **B.** Its phospholipids and proteins move sideways within the membrane, forming a mosaic pattern.
- **C.** It contains only proteins that never move.
- **D.** It is a thin layer that has no pattern.

Q20
MCQ

LEARNING OUTCOME
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.

Textbook: Figure 7 · page 46

TEXTBOOK REFERENCE



membrane. The arrows show that substances enter and leave the cell through the plasma membrane. Control of how, when, and how much of these substances enter and leave a cell relies on the structure of the plasma membrane.

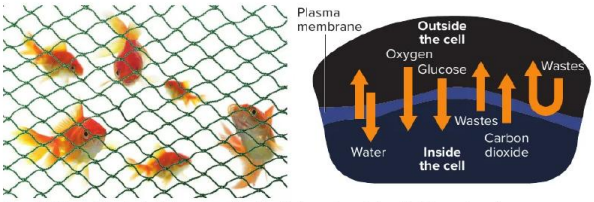


Figure 7 **Left:** The fish net selectively captures fish while allowing water and other debris to pass through.
Right: Similarly, the plasma membrane is selective for substances entering and leaving the cell.

PRACTICE QUESTIONS

P1. In the figure below, a fishing net traps fish according to their size while allowing water and other substances to pass through it. Which of the following cell structures functions in a similar way? *[Past exam collection]*



A. Cell wall
B. Cytoskeleton
C. Lysosome
D. Plasma membrane

P2. The property that allows only some materials to enter or leave a cell is called _____. *[Textbook review]*

A. diffusion
B. selective permeability
C. homeostasis
D. cell division

P3. How does the plasma membrane help maintain the internal balance (homeostasis) of the cell? *[Textbook review]*

A. It controls which substances enter and leave the cell.
B. It makes proteins for the whole organism.
C. It stores the cell's DNA.
D. It keeps all substances out of the cell.

P4. What would most likely happen to a cell that lost its selective permeability? *[Textbook review]*

A. It would become more efficient.
B. It would stop needing water.
C. Nothing would change.
D. It could not control what enters and leaves, and would be harmed.

P5. Which of the following explains why water molecules need a special transport protein to cross the plasma membrane? *[Practice collection]*

A. Water molecules are repelled by the heads of the phospholipids.
B. Water molecules react with the phospholipids.
C. Water molecules are polar.
D. Water molecules are very large.

P6. Which of the following can pass through the plasma membrane without transport proteins? *[Practice collection]*

A. Ions
B. Small and hydrophobic molecules
C. Hydrophilic molecules
D. Polar molecules

Q21 MCQ

LEARNING OUTCOME

BIO.3.1.01.057: Explain the processes of diffusion and osmosis and their roles within a cell.

Textbook: Figure 8 · page 47

TEXTBOOK REFERENCE

Diffusion

CHEMISTRY Connection As the aroma of baking cookies makes its way to you, particles are moving and colliding with each other in the air. This happens because the particles in gases, liquids, and solids are in random motion. Similarly, substances dissolved in water move constantly in random motion called Brownian motion. This random motion causes **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.

Figure 8 illustrates the process of diffusion. Additional energy input is not required for diffusion because the particles already are in motion. 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.

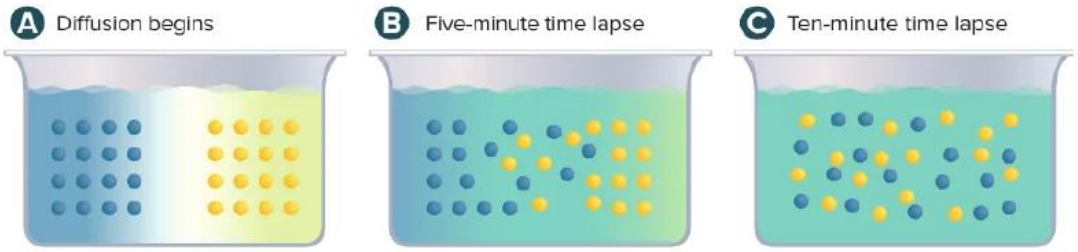


Figure 8 Diffusion causes the inks to move from high-ink concentration to low-ink concentration until the color become evenly blended in the water.

PRACTICE QUESTIONS

P1. The figure below shows a bouquet of flowers in a room. By which process does the pleasant fragrance spread throughout the room? *[Past exam collection]*





A. Diffusion
B. Active transport
C. Facilitated diffusion
D. Osmosis

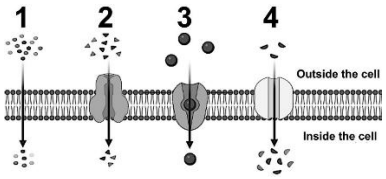
P2. Which is NOT a factor that affects the rate of diffusion? *[Past exam collection]*

A. Conductivity
B. Concentration
C. Pressure
D. Temperature

P3. What is the term that describes the net movement of particles from an area of higher concentration to an area of lower concentration? *[Past exam collection]*

- **A.** Osmosis
- **B.** Diffusion
- **C.** Active transport
- **D.** Exocytosis

P4. Which number in the diagram represents the type of transport that may be used for small uncharged (nonpolar) molecules such as O_2 and CO_2? *[Practice collection]*

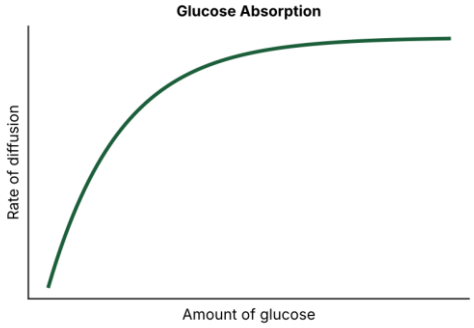


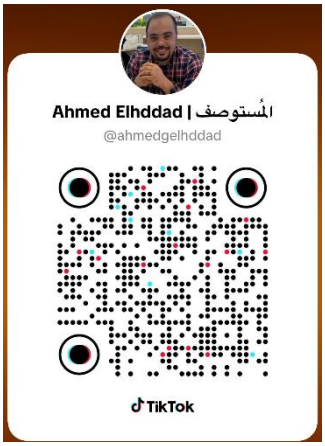
- **A.** 1
- **B.** 2
- **C.** 3
- **D.** 4

P5. If the oxygen concentration inside a cell is lower than outside, how does oxygen cross the plasma membrane? *[Textbook review]*

- **A.** It is pumped in by active transport using energy.
- **B.** It moves from the inside of the cell to the outside.
- **C.** It cannot cross the membrane.
- **D.** It moves by simple diffusion from the area of higher concentration (outside) into the cell.

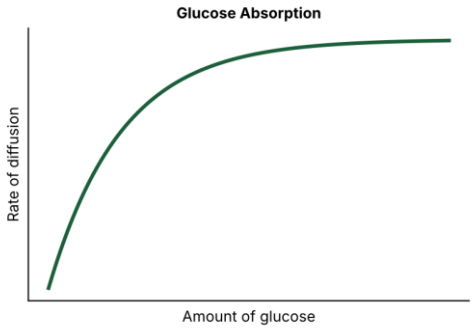
P6. The graph shows glucose absorption by diffusion. Which statement describes the relationship between the amount of glucose and the rate of diffusion? *[Textbook review]*





- **A.** The rate decreases as glucose increases.
- **B.** The rate stays the same at every amount of glucose.
- **C.** The rate increases as glucose increases, then levels off.
- **D.** The rate increases forever without leveling off.

P7. Why does the rate of diffusion level off as the amount of glucose increases? *[Textbook review]*



- **A.** The glucose is changed into water.
- **B.** All the transport proteins are being used, so the rate cannot increase further.
- **C.** The membrane stops being permeable to water.
- **D.** Glucose cannot move down its concentration gradient.

Q22
MCQ

LEARNING OUTCOME
BIO.3.1.01.057: Explain the processes of diffusion and osmosis and their roles within a cell.

Textbook: Figure 9 · page 48

TEXTBOOK REFERENCE

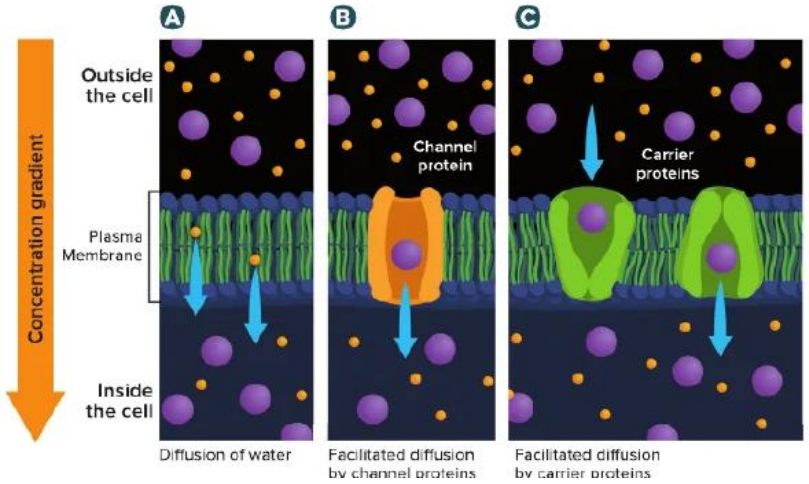
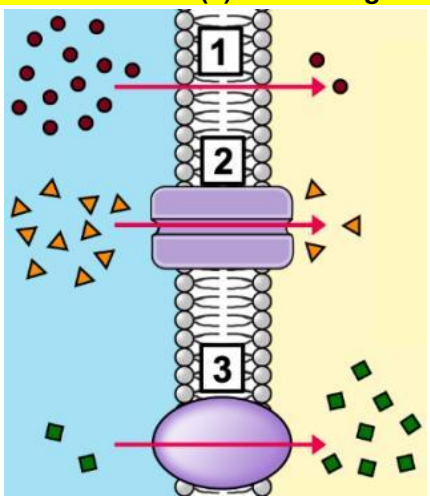


Figure 9 Although water moves freely through the plasma membrane (A), oth substances cannot pass through the phospholipid bilayer on their own. Chan proteins (B) and carrier proteins (C) are kinds of transport proteins that hel ions and small molecules move across the membrar in a process called facilita diffusion.

PRACTICE QUESTIONS

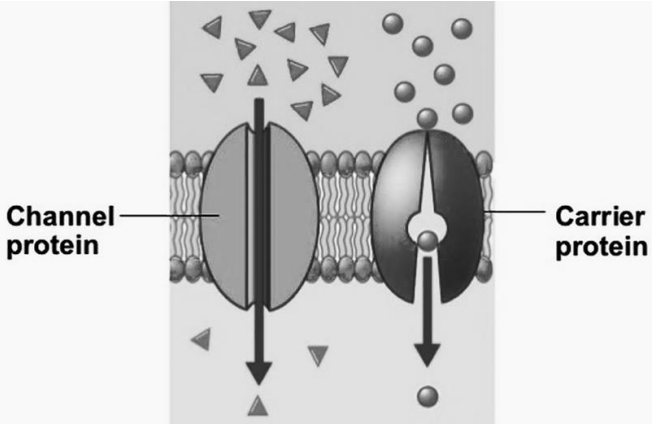
P1. Which number(s) in the diagram represent(s) facilitated diffusion? *[Practice collection]*

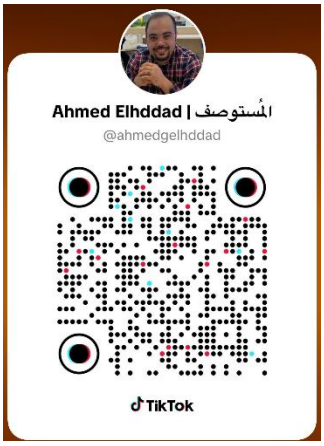


A. 1 only
B. 2 only
C. 3 only
D. 2 and 3 only

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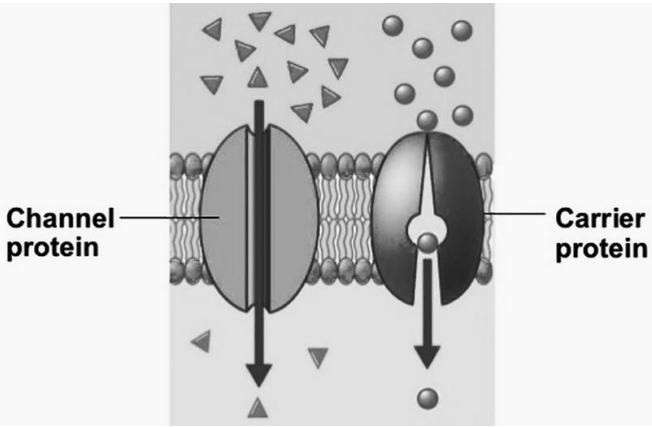
P2. Which of the following is the type of transport shown in the diagram with a channel protein and a carrier protein? *[Practice collection]*





A. Active transport
B. Endocytosis
C. Facilitated diffusion
D. Simple diffusion

P3. Which of the following is TRUE about the process shown in the diagram? *[Practice collection]*



A. It occurs through the plant cell walls.
B. No energy is required for molecules to move across the membrane.
C. Molecules are moving from low concentration to high concentration.
D. Only sugars are transported using this process.

P4. Why do ions and many polar molecules need transport proteins to cross the plasma membrane? *[Textbook-based]*

A. They cannot pass through the nonpolar interior of the phospholipid bilayer.
B. They are too small to be seen by the membrane.
C. They are destroyed by cholesterol.
D. They are repelled by the cytoplasm.

P5. Which statement correctly describes channel proteins and carrier proteins? *[Textbook-based]*

A. Channel proteins change shape, while carrier proteins form a pore.
B. Both are found only in the cell wall.
C. Both require ATP to move substances down their gradient.
D. Channel proteins form a pore for substances to pass through, while carrier proteins change shape to move substances across.

Q23 MCQ

LEARNING OUTCOME

BIO.3.1.01.057: Explain the processes of diffusion and osmosis and their roles within a cell.

Textbook: Figure 10 · page 49

TEXTBOOK REFERENCE

Get It?

Compare and contrast diffusion and osmosis.

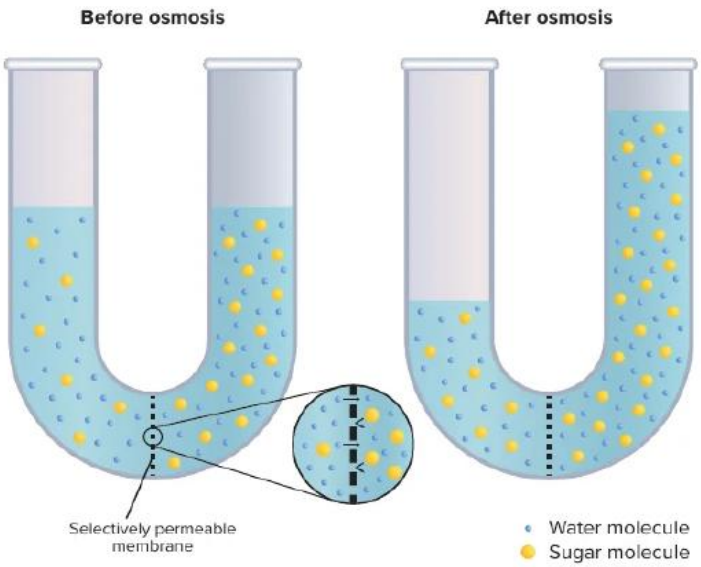
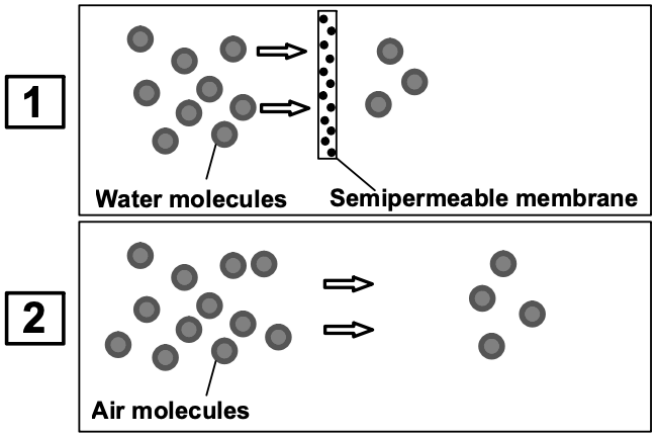


Figure 10 Before osmosis, the sugar concentration is greater on the right side. After osmosis, the concentrations are the same on both sides. Water molecules continue to move across the membrane.

Name *the term for the phenomenon shown in this figure.*

PRACTICE QUESTIONS

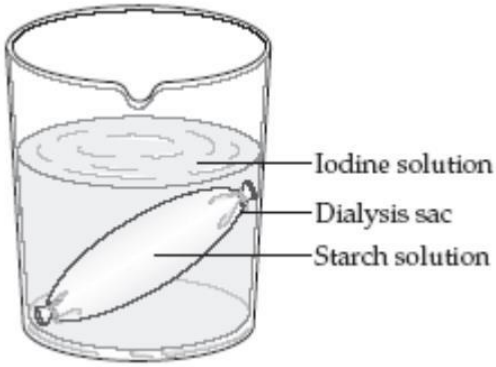
P1. Based on the diagram, which number shows the process of osmosis, and why? *[Practice collection]*





A. Number 1, because there is a semipermeable membrane only.
B. Number 2, because the molecules moving are air.
C. Number 1, because the molecules moving are water.
D. Number 2, because the movement is from high concentration to low concentration.

P2. The dialysis sac is permeable to iodine but not to starch. Iodine solution turns blue-black in the presence of starch. What will be observed after an hour? *[Practice collection]*



A. The solution inside the sac will turn blue-black as starch moves out of the sac.
B. The solution inside the dialysis sac will turn blue-black as iodine moves into the sac.
C. The solution outside the sac will turn blue-black as iodine moves into the sac.
D. The solution outside the sac will turn blue-black as starch moves out of the sac.

P3. Irrigation in very dry regions can cause salt to accumulate in the soil. Why does increased soil salinity harm plant cells? *[Textbook review]*

A. Water moves by osmosis out of the plant cells into the saltier soil.
B. Water moves by osmosis from the soil into the plant cells until they burst.
C. Salt turns into sugar inside the plant cells.
D. Salt makes the soil more permeable to oxygen.

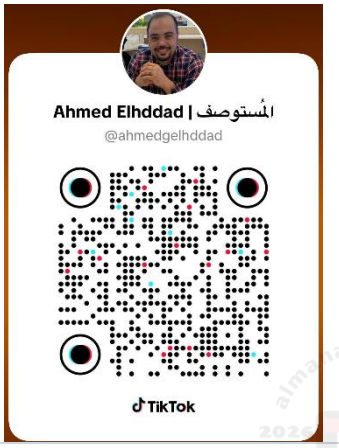
P4. Osmosis is the diffusion of _____ across a selectively permeable membrane. *[Textbook-based]*

A. glucose
B. oxygen
C. proteins
D. water

P5. Some protists living in a freshwater pond have contractile vacuoles that remove excess water. Why is this needed? *[Textbook review]*



A. Water moves out of the cell by osmosis because the pond is saltier.
B. The cell membrane makes water instead of absorbing it.
C. Water moves into the cell by osmosis because the inside of the cell is more concentrated than the pond water.
D. The vacuole stores salt to make the pond saltier.



Q24
MCQ

LEARNING OUTCOME

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

Textbook: Figure 11 A, B, C · page 51

TEXTBOOK REFERENCE

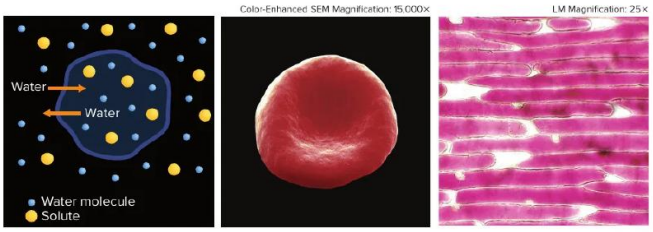


Figure 11(A) In an isotonic solution, water molecules move into and out of the cell at the same rate, and cells retain their normal shape. The animal cell and the plant cells have their normal shapes in an isotonic solution.



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.

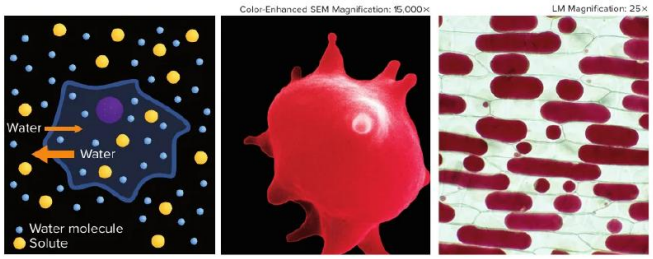
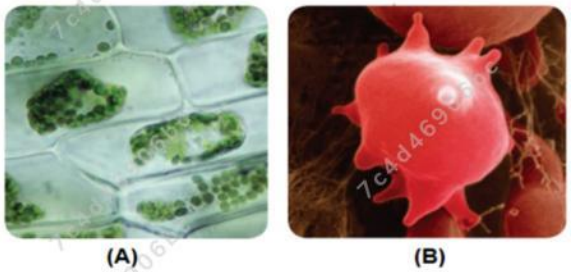


Figure 11(C) In a hypertonic solution, water leaves a cell by osmosis, causing the cell to shrink. Animal cells shrivel up as they lose water. As plant cells lose internal pressure, the plasma membrane shrinks away from the cell wall.

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PRACTICE QUESTIONS

P1. The figure below illustrates a type of cellular transport. Study it carefully, then answer the question. Which of the following would occur to cells (A) and (B) if they were placed in a hypertonic solution? *[Past exam collection]*



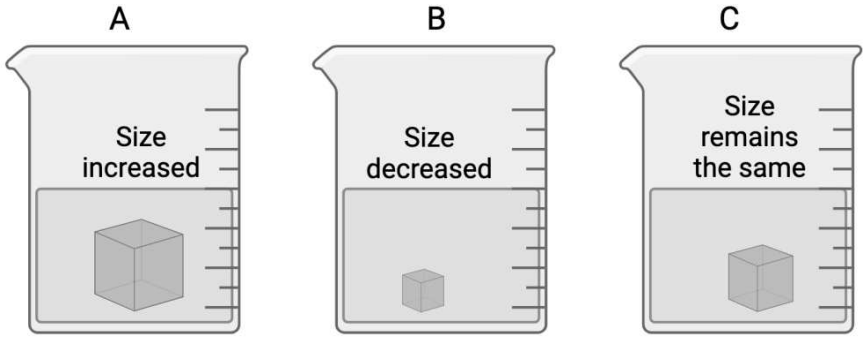
(A) (B)

A. Cell (A) shrinks, while the membrane of cell (B) pulls away from the cell wall.
B. Cell (A) loses water from its central vacuole, while water enters cell (B).
C. Cell (A) loses water from its central vacuole, and cell (B) shrinks.
D. The pressure inside cell (A) increases, while the pressure inside cell (B) decreases.

P2. Which of the following solutions would allow cells to retain their normal shapes? *[Past exam collection]*

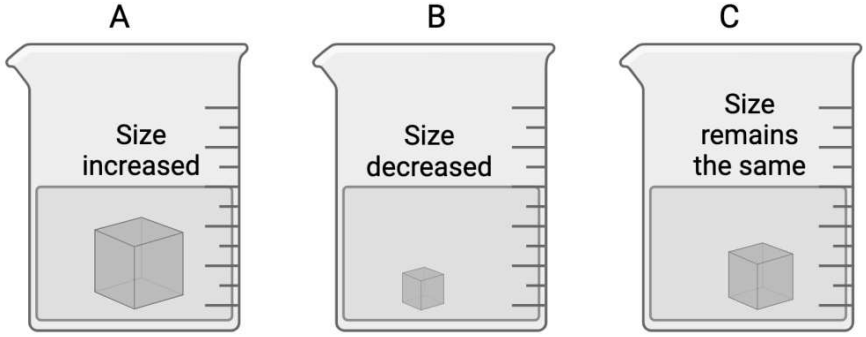
A. Isotonic
B. Hypotonic
C. Hypertonic
D. When the concentration inside the cell is lower

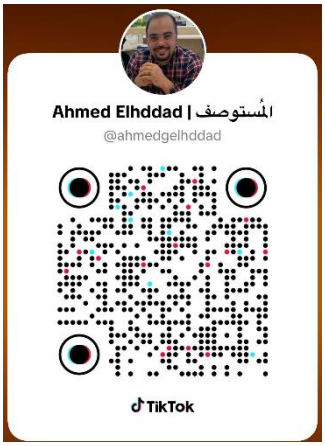
P3. **A potato cube of the same size is placed in each of three salt solutions. After one hour, the cube in solution A has increased in size. Solution A is:** *[Practice collection]*



A. hypertonic
B. hypotonic
C. isotonic
D. a buffer

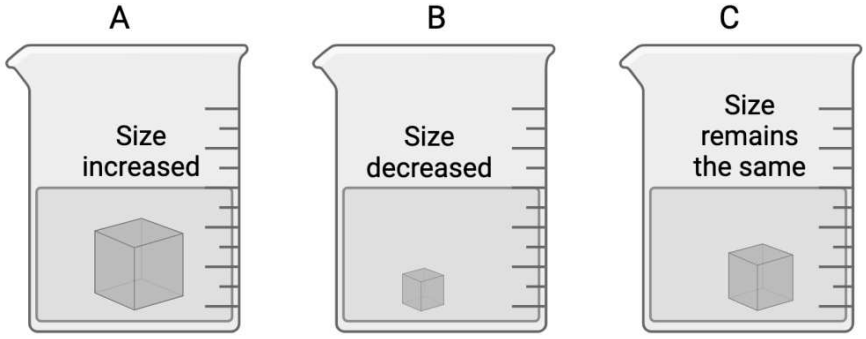
P4. **In the same experiment, the cube in solution B decreased in size. Solution B is:** *[Practice collection]*





A. hypertonic
B. hypotonic
C. isotonic
D. a buffer

P5. **In the same experiment, the size of the cube in solution C stayed the same. Solution C is:** *[Practice collection]*



A. hypertonic
B. hypotonic
C. a base
D. isotonic

P6. **Which statement correctly compares a hypertonic solution and a hypotonic solution?** *[Textbook review]*

A. A hypertonic solution has a lower solute concentration than the cell, and a hypotonic solution has a higher solute concentration.
B. Both have the same solute concentration as the cell.
C. A hypertonic solution has a higher solute concentration than the cell, and a hypotonic solution has a lower solute concentration.
D. Both contain no water.

Q25
MCQ

LEARNING OUTCOME

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.

Textbook: Information from text and Figure 18 · page 57

TEXTBOOK REFERENCE

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.

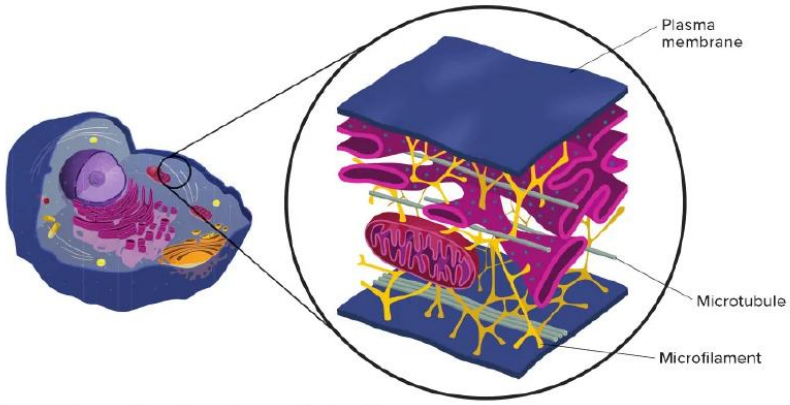


Figure 18 The cytoskeleton forms a framework for the cell.

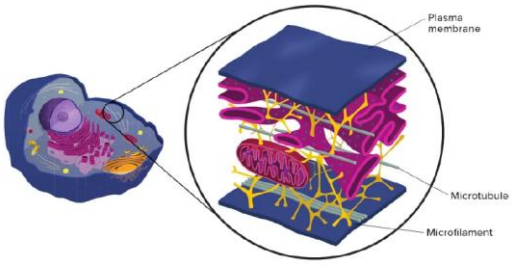
Microtubules and microfilaments

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.

Get It?
Summarize the structure and function of the cytoskeleton.

PRACTICE QUESTIONS

P1. The figure below shows a cell structure made up of microtubules and microfilaments. They assemble, branch, and slide past one another, allowing cells and other organelles to move. Which of the following structures does the figure most likely represent? *[Past exam collection]*



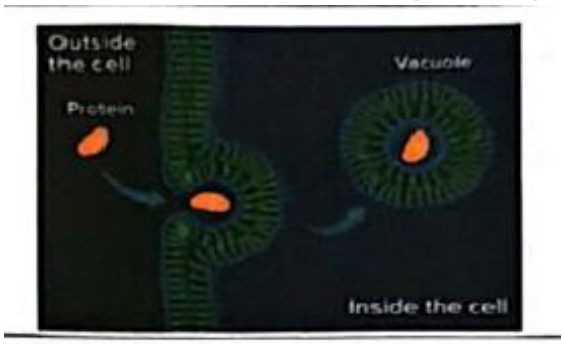
A. Cytoskeleton
B. Endoplasmic reticulum
C. Cilia
D. Golgi apparatus

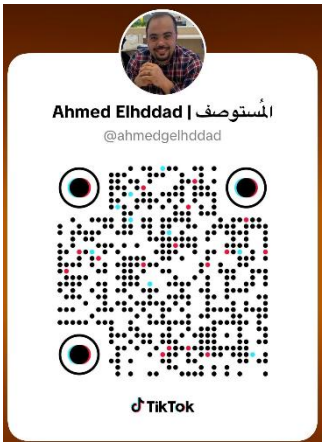
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P2. Which type of transport requires energy input from the cell? *[Past exam collection]*

A. Facilitated diffusion
B. Simple diffusion
C. Active transport
D. Osmosis

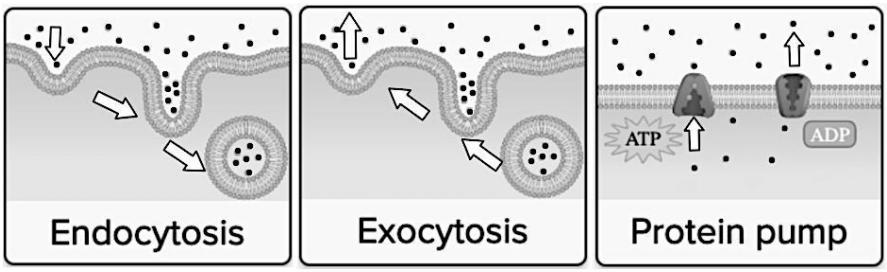
P3. Which method of cellular transport can you see in the picture below? *[Past exam collection]*





A. Endocytosis
B. Facilitated diffusion
C. Osmosis
D. Exocytosis

P4. Which of the following diagrams show types of active transport? I. Endocytosis II. Exocytosis III. Protein pump *[Practice collection]*



I II III

A. I, II, and III
B. I and II only
C. I and III only
D. II and III only

P5. Why is active transport an energy-consuming process? *[Textbook review]*

A. Substances are moved down their concentration gradient.
B. It occurs only through the cell wall.
C. Water molecules move without any membrane.
D. Substances are moved against their concentration gradient, which requires energy from the cell.

P6. Which statement correctly compares endocytosis and exocytosis? *[Textbook review]*

A. Endocytosis releases materials from the cell, while exocytosis brings materials into the cell.
B. Both move materials only by simple diffusion.
C. Endocytosis brings materials into the cell in vesicles, while exocytosis releases materials from the cell in vesicles.
D. Neither one requires energy.

P7. Which statement correctly compares active transport and facilitated diffusion? *[Textbook review]*

A. Active transport needs no energy, while facilitated diffusion needs energy.
B. Active transport requires energy and moves substances against their gradient, while facilitated diffusion needs no energy and moves substances down the gradient.
C. Both move substances only against the gradient.
D. Both occur without any proteins.

Q26
MCQ

LEARNING OUTCOME
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.

Textbook: Figure 22 · page 60

TEXTBOOK REFERENCE

Controlling Cell Activities

Just as a factory needs a manager to direct and oversee the tasks carried out in the factory, a cell needs an organelle to direct the cell processes.

The nucleus

The nucleus, shown in **Figure 22**, is the cell's managing structure. It contains most of the cell's DNA, which stores information used to make proteins for cell growth, function, and reproduction. Within the nucleus is the site of ribosome production called the **nucleolus.**

The nucleus is surrounded by a double membrane called the nuclear envelope. The nuclear envelope is similar to the plasma membrane, except the nuclear membrane has nuclear pores that allow larger-sized substances to move in and out of the nucleus. Chromatin, which is a complex DNA attached to protein, is spread throughout the nucleus.

Get It?
Describe the role of the nucleus.

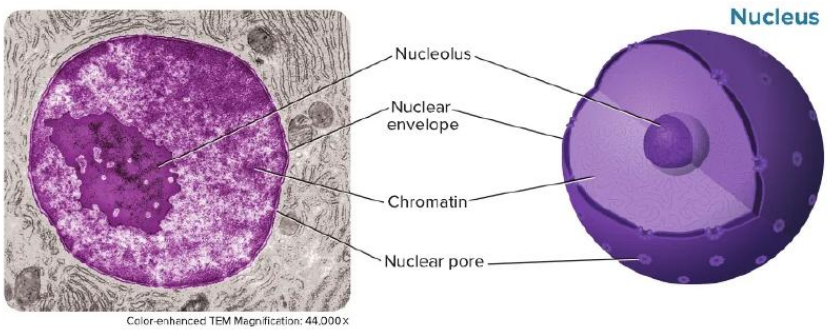


Figure 22 The nucleus of a cell is a three-dimensional shape. The photomicrograph shows a cross section of a nucleus.

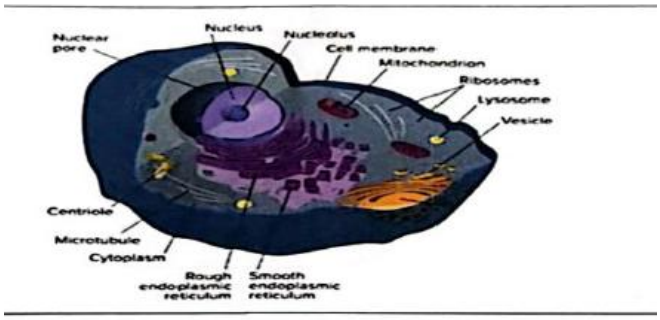
Infer *why all of the cross sections of a nucleus are not identical.*

PRACTICE QUESTIONS

P1. Which of the following organelles is matched with its correct role in the cell? *[Past exam collection]*

A. Mitochondria: the site of protein synthesis
B. Nucleus: provides support to the cell
C. Endoplasmic reticulum: forms a framework for the cell within the cytoplasm
D. Plasma membrane: controls the movement of substances into and out of the cells

P2. Use the figure below to answer the question: Which organelle manages the cell structures and contains most of the cell's DNA? *[Past exam collection]*



A. Ribosome
B. Mitochondria
C. Nucleus
D. Vesicle

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P3. What is the site of ribosome production? *[Past exam collection]*

- **A.** Nuclear pore
- **B.** Chromatin
- **C.** Endoplasmic reticulum
- **D.** Nucleolus

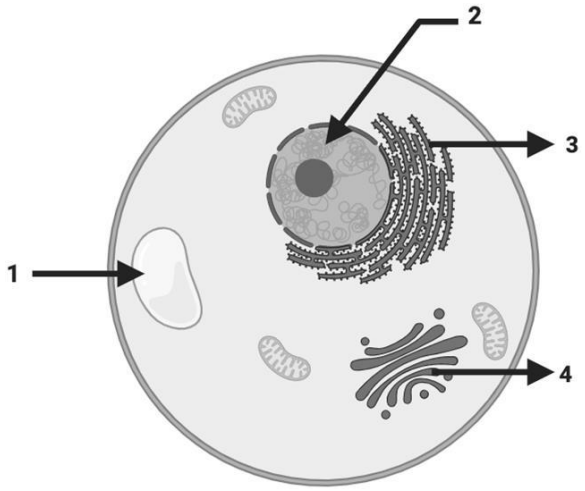
P4. Choose the correct letter from Column (A) and write it in the parentheses next to the appropriate function in Column (B). *[Past exam collection]*

Column (B): Function	Column (A): Component
Control center of the cell	(a) Cell skeleton (cytoskeleton)
Provide energy for the cell	(b) Cell membrane
Cell division	(c) Nucleus
Breakdown of cellular materials	(d) Mitochondria
Framework of the cell inside the cytoplasm	(e) Centrioles

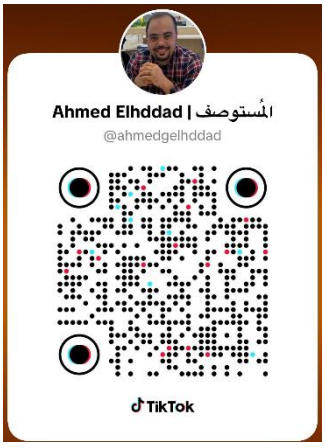
P5. Which of the following are among the functions of the nucleus? I. Converts light energy into chemical energy II. Site of ribosome production III. Stores the genetic information *[Practice collection]*

- **A.** I and II only
- **B.** I and III only
- **C.** I, II, and III
- **D.** II and III only

P6. Use the animal cell diagram. Which number represents the organelle responsible for storing the genetic material (DNA)? *[Practice collection]*



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



Q27
MCQ

LEARNING OUTCOME

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.

Textbook: Information from text and Figure 23 · page 61

TEXTBOOK REFERENCE

Processing Energy

Mitochondria

Cells have energy generators called **mitochondria** (mi tuh KAHN dree uh; singular, mitochondrion), which convert fuel (mainly sugars) into usable energy. **Figure 23** shows that a mitochondrion has an outer membrane and a highly folded inner membrane that provides a large surface area for breaking the bonds in sugar molecules. The energy produced is stored in the bonds of other molecules and later used by the cell.

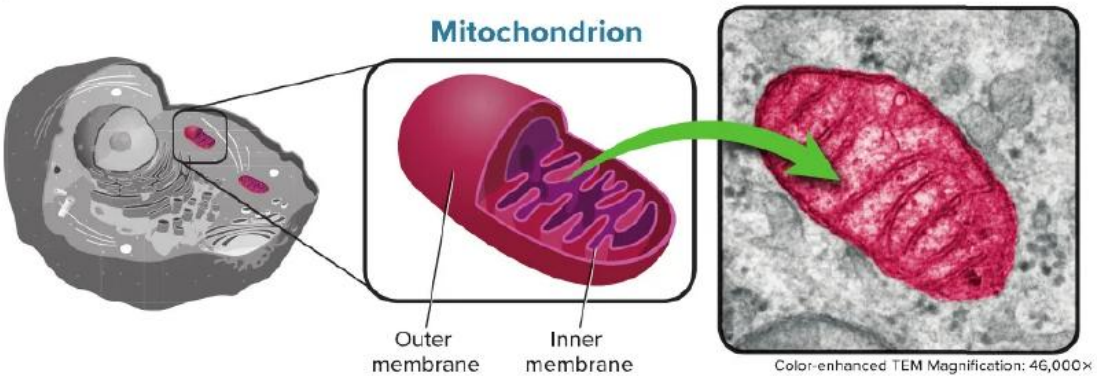


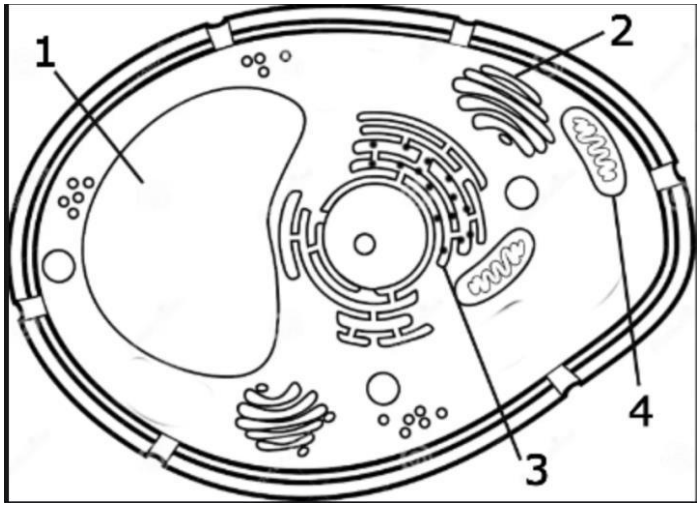
Figure 23 Mitochondria make energy available to the cell.

PRACTICE QUESTIONS

P1. Which of the following organelles is called the "powerhouse of the cell"? *[Past exam collection]*

- **A.** Ribosome
- **B.** Mitochondria
- **C.** Nucleus
- **D.** Vesicle

P2. Use the plant cell diagram. Which number represents the organelle responsible for producing energy from food? *[Practice collection]*



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

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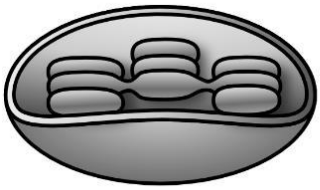
P3. Which organelle generates energy for the cell? *[Textbook review]*

- **A.** Vacuole
- **B.** Mitochondrion
- **C.** Ribosome
- **D.** Lysosome

P4. Which statement correctly compares mitochondria and chloroplasts? *[Textbook review]*

- **A.** Mitochondria release energy from food for the cell, while chloroplasts capture light energy for photosynthesis.
- **B.** Mitochondria capture light energy, while chloroplasts release energy from food.
- **C.** Both are found only in animal cells.
- **D.** Neither has a membrane.

P5. Which of the following is the function of structure Y (the mitochondrion)? *[Practice collection]*

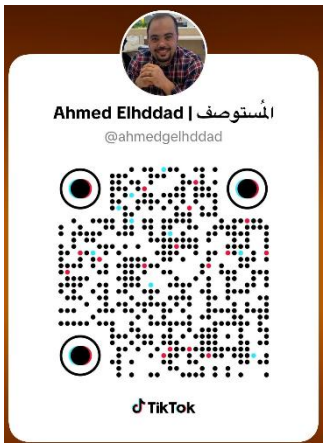


X



Y

- **A.** Captures light energy
- **B.** Removes toxic substances from the cell
- **C.** Produces cell membranes
- **D.** Produces energy



Q28
MCQ

LEARNING OUTCOME

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.

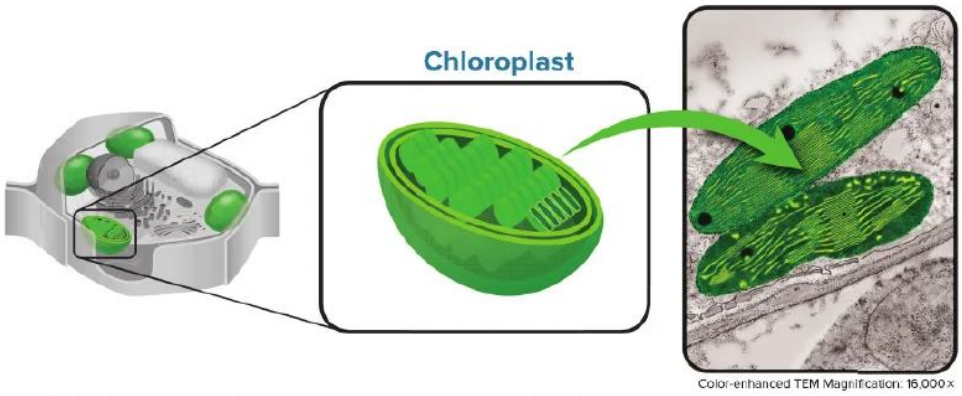
Textbook: Information from text and Figure 24 · page 61

TEXTBOOK REFERENCE

Chloroplasts

In addition to mitochondria, plants and some other eukaryotic cells contain **chloroplasts,** organelles that capture light energy and convert it to chemical energy through a process called photosynthesis. Examine **Figure 24**. Notice that inside the inner membrane are many small, disk-shaped compartments called thylakoids. This structure relates to their function—trapping energy from sunlight in a pigment called chlorophyll. Chlorophyll gives leaves and stems their green color.

Chloroplasts belong to a group of plant organelles called plastids, some of which are used for storage. Some plastids store starches or lipids. Others, such as chromoplasts, contain red, orange, or yellow pigments that trap light energy and give color to plant structures such as flowers and leaves.

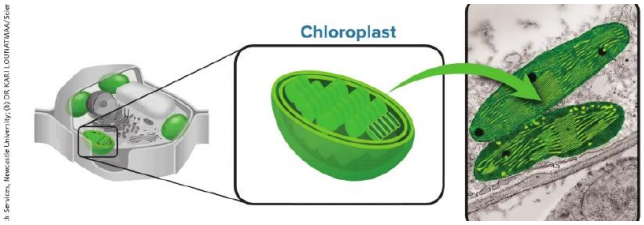


N; Research Services, Newcastle University; (b) DR KARI LOUNATMAA/Science Photo Library/Getty Images

Figure 24 In plants, chloroplasts capture and convert light energy to chemical energy

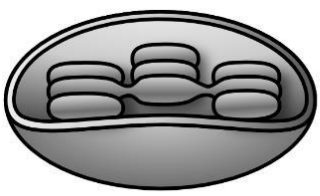
PRACTICE QUESTIONS

P1. The accompanying figure shows a chloroplast. Which of the following is NOT one of its characteristics? *[Past exam collection]*



A. It is found in all plants.
B. It absorbs light energy.
C. It is found in all eukaryotic cells.
D. Some are used to store starches and fats.

P2. Structure X (the chloroplast) could be found in which of the following cells? I. Animal cells II. Bacterial cells III. Plant cells *[Practice collection]*



X



Y

A. I only
B. III only
C. II only
D. II and III only

@ELHDDAD37

P3. Animal cells are unable to make their own food because they lack _____. *[Practice collection]*

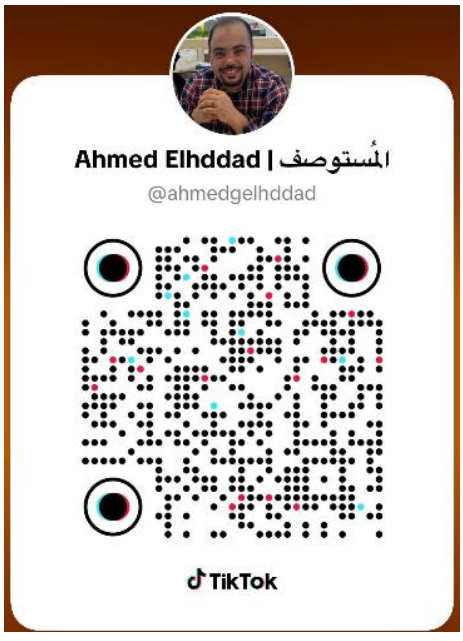
A. chloroplasts
B. endoplasmic reticula
C. mitochondria
D. ribosomes

P4. How does the structure of the cell wall help a plant survive in its natural environment? ***[Textbook review]***

A. It makes proteins for the plant.
B. It stores the genetic information of the plant.
C. It moves the plant from place to place.
D. It gives the plant cell strength and support so the plant can stay upright.

P5. Why do plant cells that transport water against gravity contain many mitochondria? ***[Textbook review]***

A. Mitochondria carry out photosynthesis in these cells.
B. Mitochondria store water for the plant.
C. Moving water uphill requires a lot of energy, which mitochondria supply.
D. Mitochondria give these cells their color.



Q29
MCQ

LEARNING OUTCOME

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.

Textbook: Information from text and Figure 25 · page 62

TEXTBOOK REFERENCE

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Manufacturing Proteins

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.

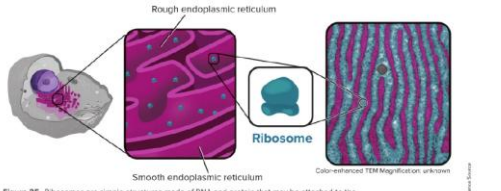
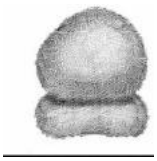


Figure 25 Ribosomes are simple structures made of RNA and protein that may be attached to the surface of the rough endoplasmic reticulum. They look like bumps on the endoplasmic reticulum.

PRACTICE QUESTIONS

P1. What is the structure shown in the adjacent figure, and which organelle is it part of? *[Past exam collection]*



A. Ribosome
B. Nucleus
C. Vacuole
D. Golgi apparatus

P2. Which structure is responsible for building the proteins the cell uses? *[Textbook review]*

A. Ribosome
B. Chromatin
C. Nucleolus
D. Endoplasmic reticulum

P3. Liver cells mainly break down and remove harmful toxins from the body. Which two organelles would liver cells be rich in? *[Practice collection]*

A. Lysosomes and chloroplasts
B. Lysosomes and mitochondria
C. Mitochondria and central vacuoles
D. Lysosomes and smooth endoplasmic reticulum

P4. Which of the following is a correct match between a structure and its function? *[Practice collection]*

A. Endoplasmic reticulum: breakdown of waste
B. Mitochondria: harvesting energy from sunlight
C. Ribosomes: making proteins
D. Nucleus: storage of water

Q30
MCQ

LEARNING OUTCOME
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.

Textbook: Figure 26 · page 63

TEXTBOOK REFERENCE

Processing, Transporting, and Storing Molecules

Golgi apparatus

After hiking boots are made in a factory, they must be organized into pairs, boxed, and shipped. Similarly, after proteins are made in the endoplasmic reticulum, some might be transferred to the Golgi (GAWL jee) apparatus, illustrated in **Figure 26**. The **Golgi apparatus** is a flattened stack of membranes that modifies, sorts, and packages proteins into sacs called vesicles. Vesicles then can fuse with the cell's plasma membrane to release proteins to the environment outside the cell.

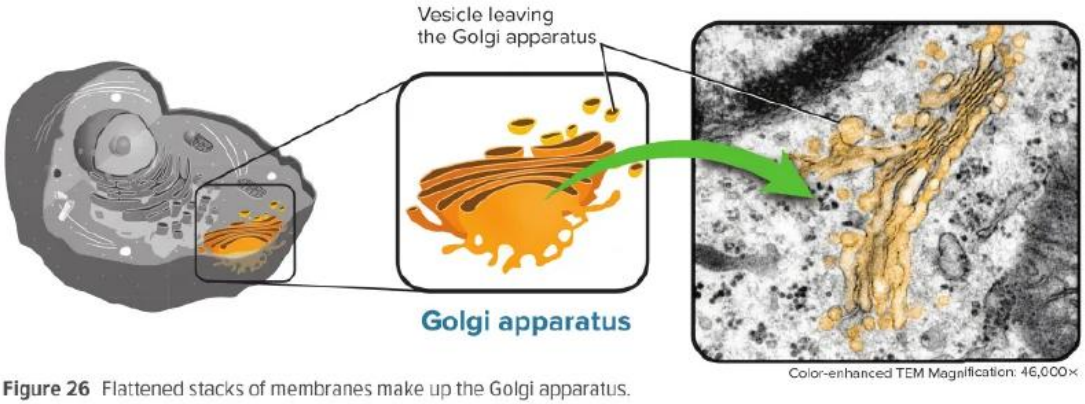
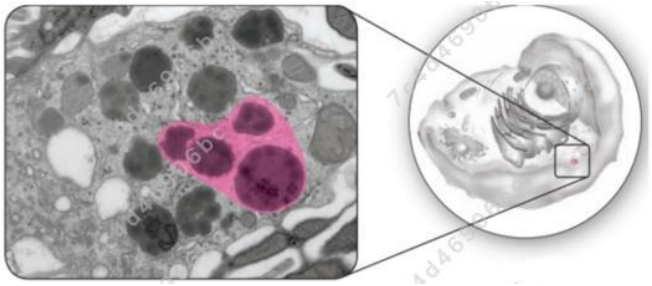


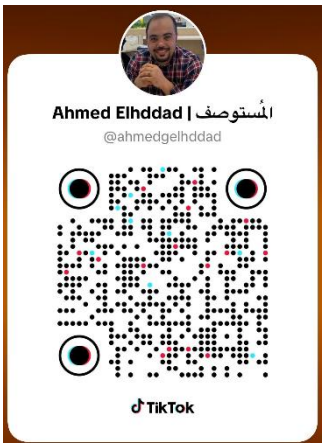
Figure 26 Flattened stacks of membranes make up the Golgi apparatus.

PRACTICE QUESTIONS

P1. Which of the following describes the function of the lysosome shown in the figure below?
[Past exam collection]



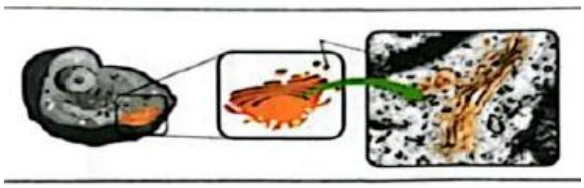
A. It plays an important role in cell division.
B. It modifies, sorts, and packages proteins.
C. It contains substances that digest bacteria and viruses.
D. It stores food, enzymes, and other materials.



P2. Which of the following organelles is large in plant cells but small or absent in animal cells?
[Past exam collection]

A. Vacuole
B. Chloroplast
C. Centriole
D. Nucleolus

P3. The figure shows a cell structure that modifies, sorts, and packages proteins for distribution outside the cell. What is this structure called? *[Past exam collection]*

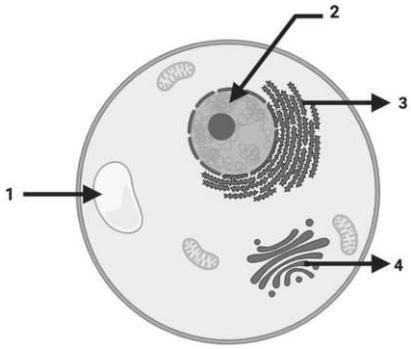


A. Vacuole
B. Chloroplast
C. Centriole
D. Golgi apparatus

P4. Which of the following best describes the function of the vacuole in the cell? *[Practice collection]*

A. Cellular respiration and energy production
B. Regulation of cell shape and support
C. Synthesis of proteins and lipids
D. Storage of water and nutrients

P5. Use the animal cell diagram. Which number represents the organelle responsible for modifying, sorting, and packaging proteins into vesicles? *[Practice collection]*



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

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P6. Which organelle stores waste in the cell? *[Textbook review]*

A. Nucleolus
B. Vacuole
C. Mitochondrion
D. Ribosome

P7. Which organelle organizes proteins into vesicles? *[Textbook review]*

A. Golgi apparatus
B. Nucleus
C. Mitochondrion
D. Chloroplast

P8. Why do vesicles carrying packaged proteins sometimes fuse with lysosomes? *[Textbook review]*

A. Lysosomes make new proteins inside vesicles.
B. Lysosomes release energy from sunlight.
C. Lysosomes store the genetic information of the cell.
D. Lysosomes contain enzymes that break down materials, so the vesicle's contents can be digested.

**********the end 😊