مؤسسة الإمارات للتعليم المدرسي
EMIRATES SCHOOLS ESTABLISHMENT

EOT 2 Science Coverage

Grade 6 GEN
2023-2024

Paper part

الأسئلة المقالية - Paper part	1	1. Investigate what are the building blocks of life, and how to recognize that something is made up of cells 2. Compare Unicellular organisms and Multicellular organisms
	2	List all the differences between animal cells and plant cells, and explain the importance and the characteristics of each organelle they contain
	3	1. list the function of types of joints and location in the human body,2. give the function of the skeletal system, 3. compare between fluid support (hydrostatic skeleton) and external support (exoskeleton)
	4	List the parts of the digestive system and their function, compare chemical and physical digestion, and follow the steps of the digestion process
	5	Explain how human's body transports material, and list the parts of the respiratory system and the function of each

1	1. Investigate what are the building blocks of life, and how to recognize that something is made up of cells 2. Compare Unicellular organisms and Multicellular organisms	Textbook, figures, lab, investigation	11, 16, 17, 19, 20, 21

Paper part - الأسئلة المقالية

Building Blocks of Life All living things share seven characteristics of life. The first characteristic that living things have in common is what they are made of. Let's take a closer look at the building blocks of life.

LAB A Closer Look at Life

Safety

Materials

microscope

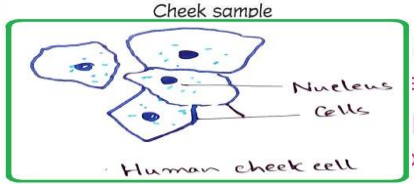
prepared slides of human cheek sample, onion, pond water, salt

Procedure

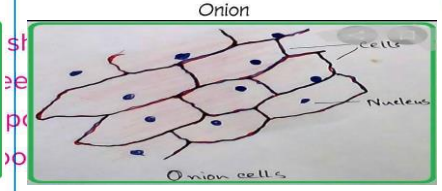
1. Read and complete a lab safety form.
2. Observe each slide under the microscope. What do you see? Illustrate and record your observations for each slide in the Data and Observations section below.
3. Follow your teacher's instructions for proper cleanup.

Data and Observations

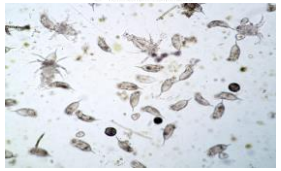
Cheek sample

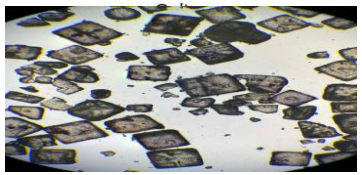


Onion



Pond water

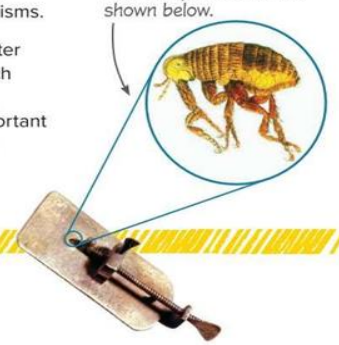




HISTORY Connection In the late 1600s, the Dutch merchant Anton van Leeuwenhoek (LAY vun hook) made improvements to the first microscopes. His microscope, similar to the one shown in the image, had one lens and could magnify an image about 270 times its original size. This made it easier to view organisms.

After Hooke's discovery, other scientists began making better microscopes and looking for cells in many other places, such as pond water and blood. The newer microscopes enabled scientists to see different structures inside cells. Three important observations about cells made by three different scientists were combined into one theory called the **cell theory.**

Anton van Leeuwenhoek observed pond water and insects using a microscope like the one shown below.



INVESTIGATION

Discovering the Cell Theory

GO ONLINE Watch the animation *The Cell Theory.*

As you watch the animation, fill in the table on the three principles of the cell theory below.

The Cell Theory	
Principle	**Example**
All living things are made of one or more cells.	Answers may vary. Sample answer: A frog's skin is made of many skin cells.
The cell is the basic unit of life.	Answers may vary. Sample answer: A single-celled amoeba performs all the functions of life, such as obtaining energy.
All new cells come from preexisting cells.	Answers may vary. Sample answer: A cell divides in two forming two new cells.

Cell Theory States:

1. All Living things are made of cell.
2. Cells are the basic unit of life.
3. All cells come from Pre-existing cells.

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Paper part - الأسئلة المقالية

Principles of the Cell Theory You might recall that all matter is made of atoms and that atoms combine and form molecules. Molecules make up cells. All living things are made up of cells, which are the smallest unit of life. Cells perform different functions to keep organisms alive. All cells come from preexisting cells through the process of cell division.

COLLECT EVIDENCE

What are living things made of that differentiates them from nonliving things, such as a flame? Record your evidence (A) in the chart at the beginning of the lesson.

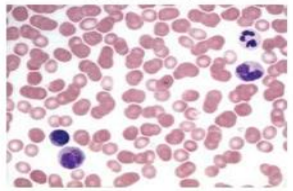
ENGINEERING Connection Since the development of the cell theory in the 1830s, microscopes have continued to become more advanced. If you have used a microscope in school, then you have probably used a light microscope. **Light microscopes** use light and lenses to enlarge an image of an object. Light microscopes can enlarge images up to 1,500 times their original size. In some cases, the object, such as the blood cells in the photo below, must be stained with a dye in order to see any details.

You might know that electrons are tiny particles inside atoms. **Electron microscopes** use a magnetic field to focus a beam of electrons through an object or onto an object's surface. An electron microscope can magnify an image up to 100,000 times or more. The two main types of electron microscopes are transmission electron microscopes (TEMs) and scanning electron microscopes (SEMs).

TEMs are usually used to study extremely small things such as cell structures. In a TEM, electrons pass through the object and a computer produces an image of the object. A TEM image of a white blood cell is shown below.

SEMs are usually used to study an object's surface. In an SEM, electrons bounce off the object and a computer produces a three-dimensional image of the object. An image of blood cells from an SEM is shown below. Note the difference in detail in this image compared to the image of blood cells from a light microscope.

Light Microscope

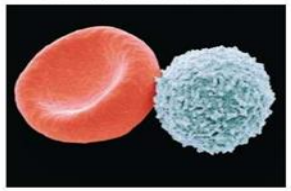


Stained LM Magnification: 640×

Transmission Electron Microscope

Color-Enhanced TEM Magnification: 8,900×

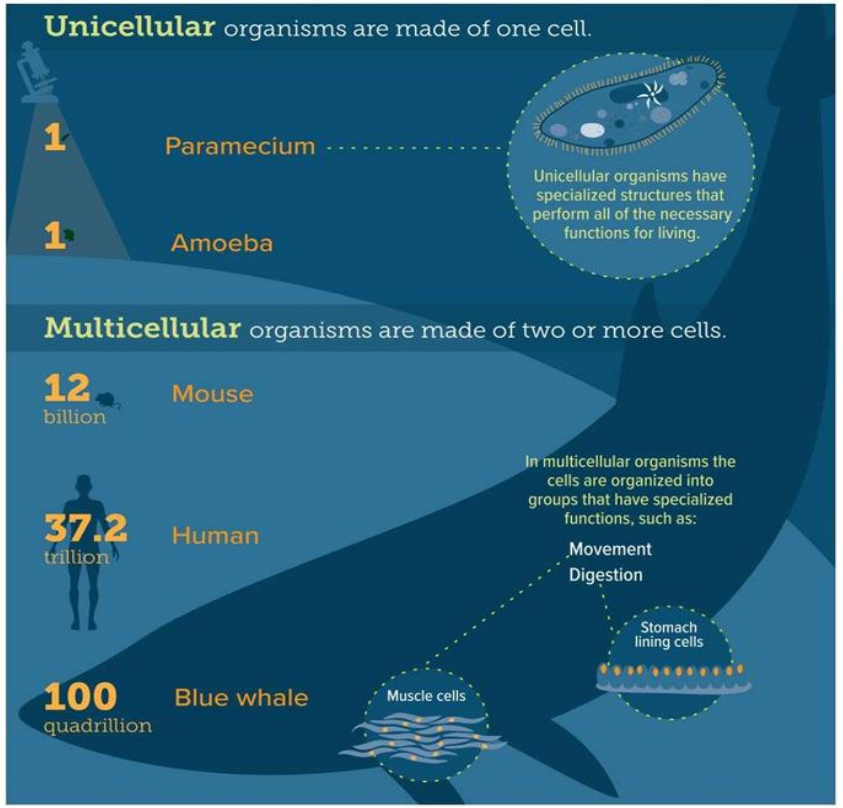
Scanning Electron Microscope



Color-Enhanced SEM Magnification: 8,500×

How many cells do living things have?

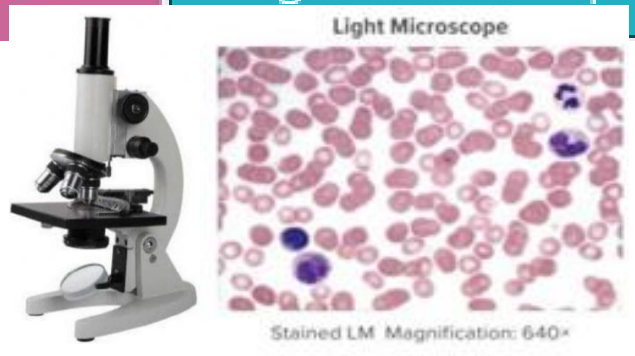
Organisms are organized in different ways. Living things that are made of only one cell are called **unicellular organisms.** Living things that are made of two or more cells are called multicellular organisms.



THREE-DIMENSIONAL THINKING

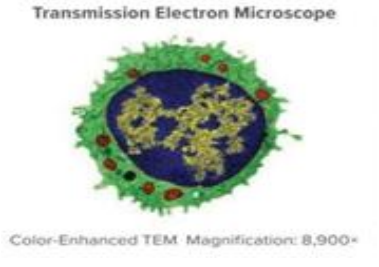
What do you notice about scale, proportion, and quantity of cells in unicellular versus multicellular organisms? Record your response in your Science Notebook.

	Light Microscope	Electron Microscope
Source	Use Light and Lenses to enlarge an image	Use a magnetic filed to focus a beam of electrons
Type of object	Blood Cells (stained with a dye)	Study extremely small things
Magnification	Enlarge up to 1,500 times	Enlarge up to 100,000 times
Example	Light Microscope used in school	TEMs - SEMs



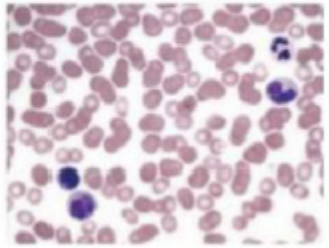
Transmission Electron Microscope
(Study Cell Structures)
Electron pass through the object and computer produces an image
Example: white blood cells

Scanning Electron Microscope
(study object's surface)
Electron bounce off the objects and a computer produces **3D** image.
Example: blood cells



2. The image below represents blood cells that were stained with a dye to see some details of their original size, which of the following was used to take this image?

A. Compound light microscope
B. Transmission electron microscope(TEMs)
C. Scanning electron microscope(SEMs)
D. Magnifying lens



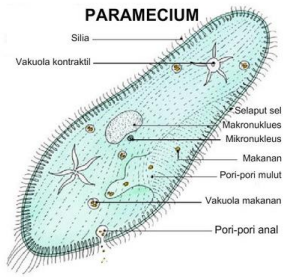
B. Write a U in the box next to unicellular organisms, and an M next to the multicellular ones.

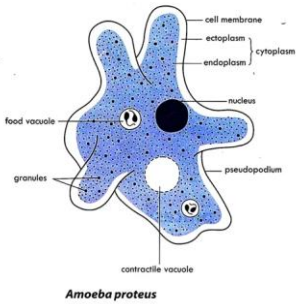

U


M


M


U





Amoeba proteus

Unicellular

1) Made of one cell

2) Have Specialized structures that perform all necessary functions (eat, reproduce, rid wastes, move)

3) Example – amoeba, bacteria

Paramecium

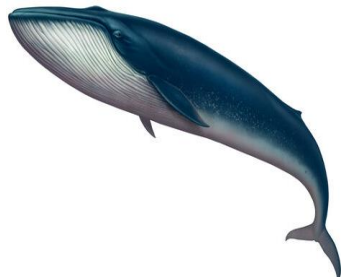
Multicellular

1) Made of more than one cell

2) Specialized cells perform different life functions (i.e. Nerve cells)

3) Example - humans

Mouse,
Human



1	1. Investigate what are the building blocks of life, and how to recognize that something is made up of cells 2. Compare Unicellular organisms and Multicellular organisms	Textbook, figures, lab, investigation	11, 16, 17, 19, 20, 21

Paper part - الأسئلة المقالية

Common Characteristics You now know that all living things are made of cells. What are the other six characteristics that all living things have in common? These include organization, growth and development, reproduction, response to stimuli, maintaining internal conditions, and using energy.

INVESTIGATION

Characteristics of Life

WRITING Connection Your teacher will assign one of the characteristics of life for you to research with your group. Use the graphic organizer for your characteristic to help guide your research. Your group will create a visual for your assigned characteristic and present it to the class. Fill in the graphic organizers for the rest of the characteristics as the other groups present.

1. Organization

Living things are organized by...
having different structures that perform different functions, such as digestion or movement.

Unicellular	Multicellular
organisms are less complex.	*organisms are more complex.*

2. Growth and development

Growth is...	*Development is...*
the process of increasing in size.	a series of changes that occur in an organism during its lifetime.

3. Reproduction

Reproduction is...
the process by which organisms create new organisms.

Types of reproduction:

asexual	sexual

4. Response to stimuli

Internal stimuli are...	*External stimuli are...*
inside the organism.	outside of the organism.
Examples:	*Examples:*
hunger, thirst	light, temperature

5. Maintaining internal conditions

Maintaining internal conditions is called homeostasis.

Examples of how organisms maintain internal conditions:
Sample answer: Organisms maintain internal conditions by regulating water and getting rid of wastes. Organisms can also regulate their body temperature.

2	List all the differences between animal cells and plant cells, and explain the importance and the characteristics of each organelle they contain	Textbook, figures, 3D, investigation	35, 38, 39, 40

Paper part - الأسئلة المقالية

Cell Membrane The cell membrane surrounds the cytoplasm. The **cytoplasm** is a fluid inside a cell that contains salts and other molecules. However, as you just observed, another important role of cell membranes is to control the movement of substances into and out of cells. A cell membrane is semipermeable. This means it allows only certain substances, like nutrients and wastes, to enter or leave a cell.

GO ONLINE for additional opportunities to explore!

Investigate cell membranes by performing one of the following activities.

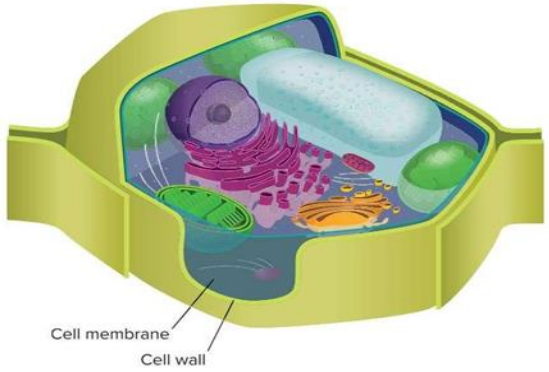
☐ **Discover** the function of a cell membrane in the **Lab** *How is a balloon like a cell membrane?*

OR

☐ **Explore** more about the cell membrane in the **PhET Interactive Simulation** *Membrane Channels.*

Cell Wall Every cell has a cell membrane, but some cells are also surrounded by a structure called the cell wall. Plant cells, fungal cells, bacteria, and some types of protists have cell walls. Take a look at the image of the plant cell to the right and compare it to the image of the cell on the previous page.

A **cell wall** is a stiff structure outside the cell membrane. A cell wall protects a cell from attack by viruses and other harmful organisms. In some plant cells and fungal cells, a cell wall helps maintain the cell's shape and gives structural support.



COLLECT EVIDENCE

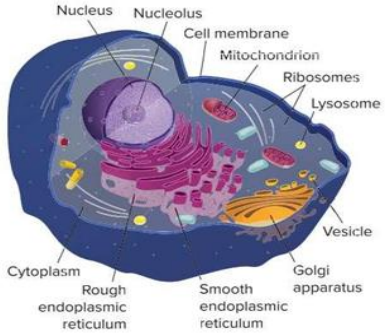
What structures surround a cell, and how do these structures help a cell function? Record your evidence (A) in the chart at the beginning of the lesson.

Want more information?
Go online to read more about cell structure and function.

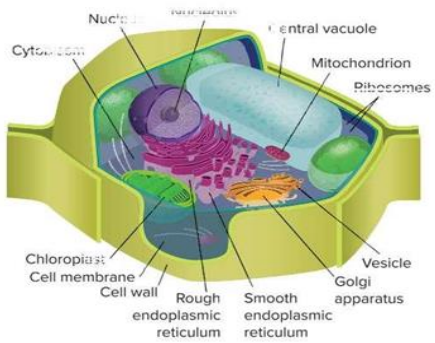
FOLDABLES
Go to the Foldables® library to make a Foldable® that will help you take notes while reading this lesson.

What organelles are involved in the transport of materials?

As you just discovered, the cell membrane enables materials to enter and leave the cell. There are several other organelles related to the transport of materials as well.



Animal Cell



Plant Cell

Ribosomes Amino acid molecules made up of carbon, hydrogen, oxygen, nitrogen, and sometimes sulfur, join together to form long chains called **proteins**. Some proteins help cells communicate with each other while others transport substances inside cells. Proteins are made on small structures called ribosomes. Unlike other cell organelles, a ribosome is not surrounded by a membrane.

Endoplasmic Reticulum Ribosomes can be attached to a weblike organelle called the endoplasmic reticulum (en duh PLAZ mihk • rih TIHK yuh lum), or ER. The ER spreads from the nucleus throughout most of the cytoplasm. Endoplasmic reticulum with ribosomes on its surface is called rough endoplasmic reticulum. Rough ER is the site of protein production. ER without ribosomes is called smooth ER. Smooth ER is important because it helps remove harmful substances from a cell.

Vacuoles Some cells also have saclike structures called vacuoles. Vacuoles are organelles that store food, water, and waste material. A typical plant cell usually has one large vacuole. Some animal cells have many small vacuoles. A plant cell's vacuole may take up half of the cell's size. This vacuole not only stores water and other substances, but also enables the plant to stay rigid and supported when filled with water.

2	List all the differences between animal cells and plant cells, and explain the importance and the characteristics of each organelle they contain	Textbook, figures, 3D, investigation	35, 38, 39, 40

Paper part - الأسئلة المقالية

The Golgi Apparatus Proteins are prepared for their specific jobs or functions by an organelle called the Golgi apparatus. Then the Golgi apparatus packages the proteins into tiny, membrane-bound, ball-like structures called vesicles. Vesicles are organelles that transport substances from one area of a cell to another area of a cell. Some vesicles in an animal cell are called lysosomes. Lysosomes contain substances that help break down and recycle cellular components.

THREE-DIMENSIONAL THINKING
Create a graphic organizer that explains how the various **structures,** or organelles, you just learned about help a cell **function** as a whole.

Graphic organizers will vary, but should explain organelles and their functions.

State the cell structures with their respective functions by using the words given.

Cell wall, nucleus, vacuole, cytoplasm, chloroplast, cell membrane, mitochondria

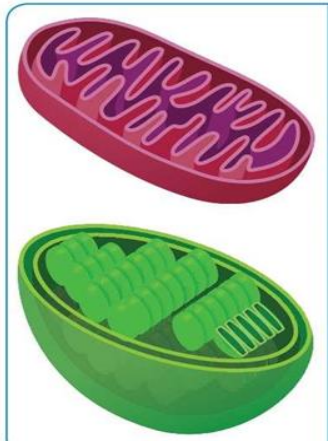
Cell structure	Function
a. mitochondria	Power the cell through chemical reaction and it's a vital part of cellular respiration which convert energy in food into ATP energy.
b. Cell Membrane	A flexible covering that protects the cells and control the movement of substance s into and out of cells.
c. Vacuole	Organelles that store food, water and waste materials and in plant usually larger .
d. Nucleus	The part of a eukaryotic cell that directs cell activities and contains important cellular information stored in DNA.
e. chloroplast	Organelles that use light energy and make food (a sugar called glucose) from water and carbon dioxide.
f. cytoplasm	A Fluid inside a cell that contains salts and other molecules.
g. Cell Wall	A stiff structure outside the cell membrane protects a cell from viruses and other harmful organisms and helps plant cells maintain shape and gives structural support.

What powers cellular activity?

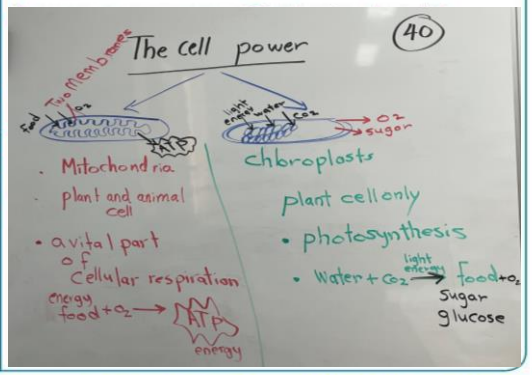
You learned about how cells transport materials across the cell membrane. How does the cell power such complex activity?

INVESTIGATION

Powering a Cell



What do you notice about the two organelles to the left? What are their differences, and what are their similarities? Can you infer what their functions are?



Mitochondria The bean-shaped organelle on top is called a mitochondrion, and it powers the cell through chemical reactions. Mitochondria are found in both plant and animal cells. It has two membranes to increase the surface area for these reactions to occur. Mitochondria are a vital part of cellular respiration. **Cellular respiration** is a series of chemical reactions that convert the energy in food molecules into a usable form of energy called ATP.

Powering Plant Cells In addition to mitochondria, plant cells contain organelles called chloroplasts (KLOR uh plasts). **Chloroplasts** are organelles that use light energy and make food—a sugar called glucose—from water and carbon dioxide.

COLLECT EVIDENCE

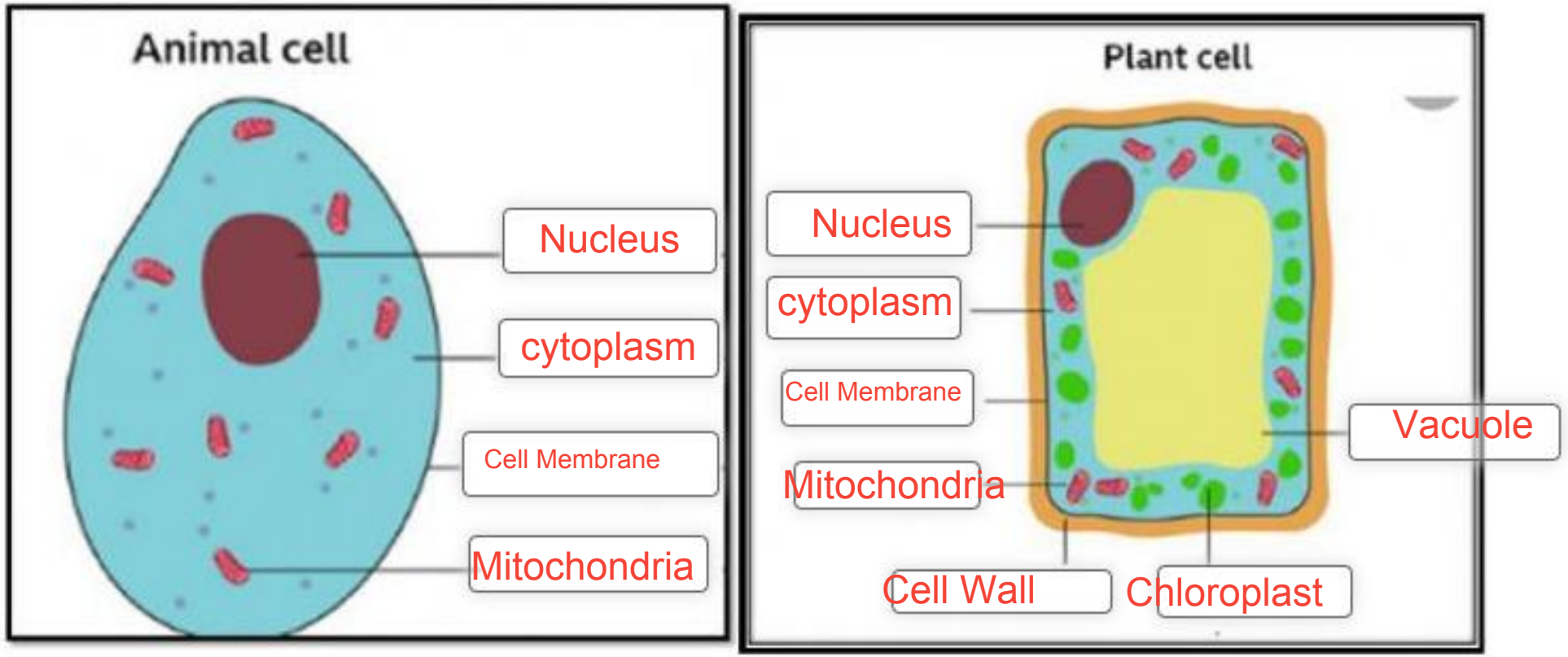
How is a plant or animal cell powered? Record your evidence (B) in the chart at the beginning of the lesson.

2	List all the differences between animal cells and plant cells, and explain the importance and the characteristics of each organelle they contain	Textbook, figures, 3D, investigation	35, 38, 39, 40

Paper part - الأسئلة المقالية

The following diagrams show two types of cells. Label the cells by using the word below.

Cell wall, nucleus, vacuole, cytoplasm, chloroplast, cell membrane, mitochondria



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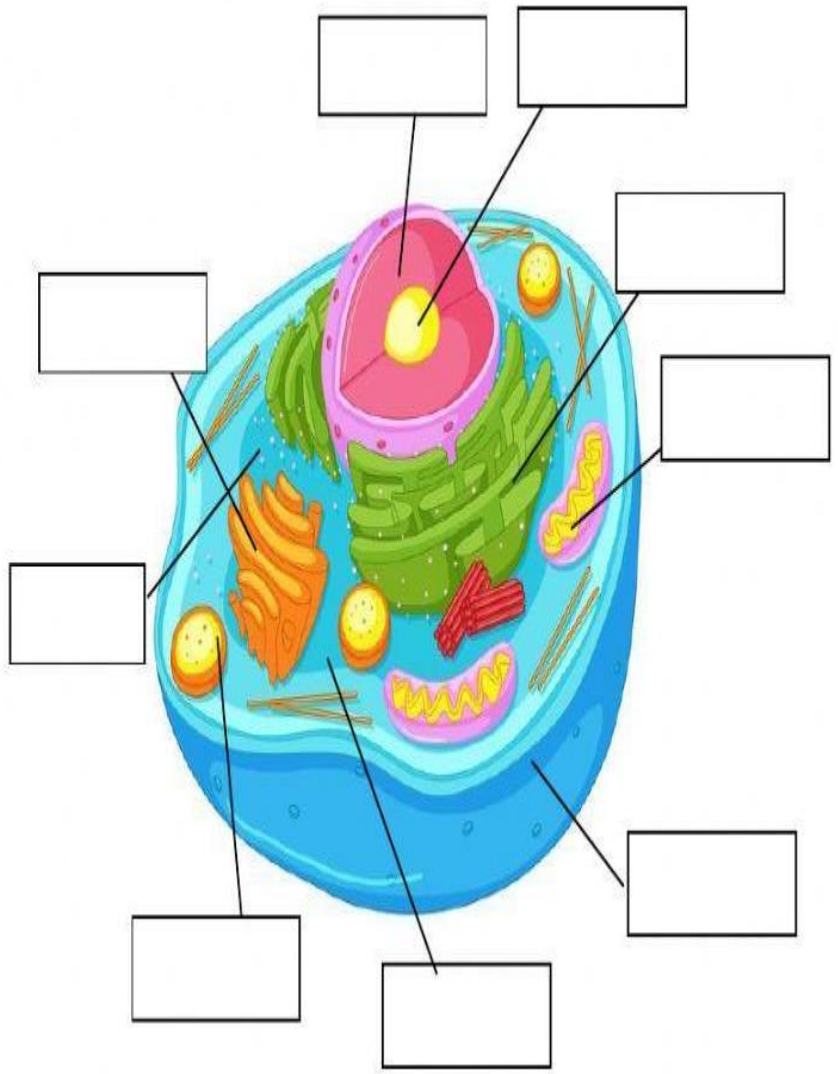
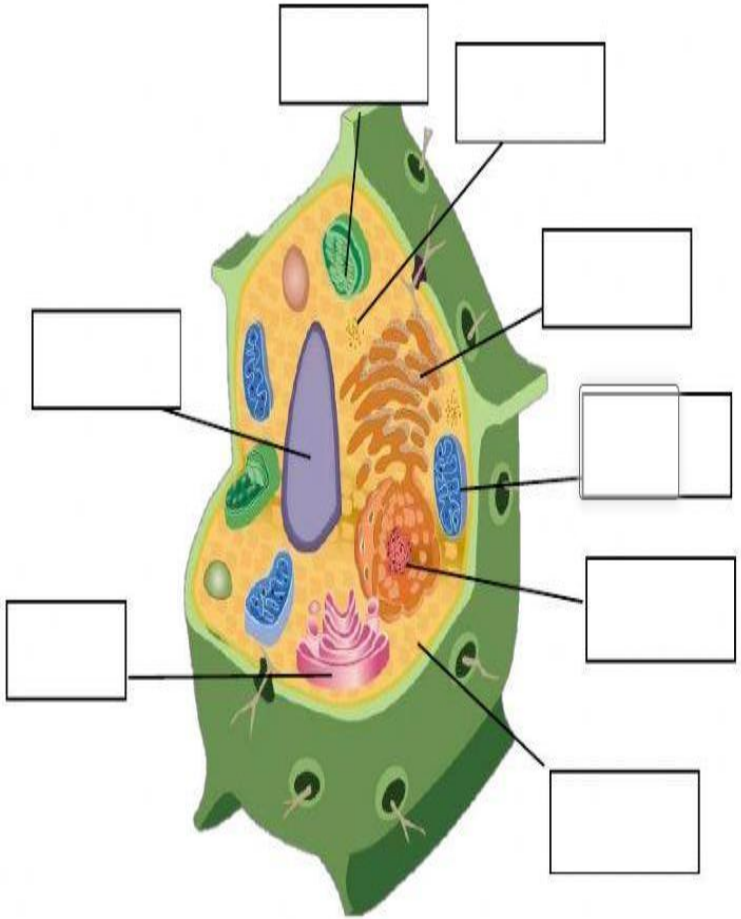
Paper part - الأسئلة المقالية



1. Nucleus
2. Nucleolus
3. Cytoplasm
4. Cell membrane
5. Lysosome
6. Endoplasmic Reticulum
7. Golgi Apparatus
8. Mitochondria
9. Ribosome



1. Ribosome
2. Cytoplasm
3. Golgi Apparatus
4. Mitochondria
5. Chloroplasts
6. Endoplasmic Reticulum
7. Vacuole
8. Nucleus

https://www.liveworksheets.com/w/en/science/1228119

2	List all the differences between animal cells and plant cells, and explain the importance and the characteristics of each organelle they contain	Textbook, figures, 3D, investigation	35, 38, 39, 40

Paper part - الأسئلة المقالية

State the cell structures with their respective functions by using the words given.

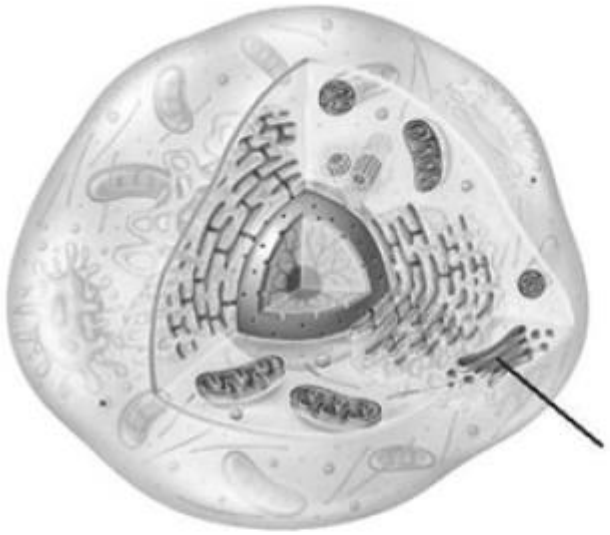
Cell wall, nucleus, vacuole, cytoplasm, chloroplast, cell membrane, mitochondria

Cell structure	Function
a.	**Power the cell through chemical reaction and it's a vital part of cellular respiration which convert energy in food into ATP energy.**
b.	**A flexible covering that protects the cells and control the movement of substance s into and out of cells.**
c.	**Organelles that store food, water and waste materials and in plant usually larger .**
d.	**The part of a eukaryotic cell that directs cell activities and contains important cellular information stored in DNA.**
e.	**Organelles that use light energy and make food (a sugar called glucose) from water and carbon dioxide.**
f.	**A Fluid inside a cell that contains salts and other molecules.**
g.	**A stiff structure outside the cell membrane protects a cell from viruses and other harmful organisms and helps plant cells maintain shape and gives structural support.**

2	List all the differences between animal cells and plant cells, and explain the importance and the characteristics of each organelle they contain	Textbook, figures, 3D, investigation	35, 38, 39, 40

Paper part - الأسئلة المقالية

To which organelle is the line pointing? What is its function?



Ans
- **A)** Golgi apparatus, packages proteins into vesicles
- **B)** Golgi apparatus, production of proteins
- **C)** Ribosome, packages proteins into vesicles
- **D)** Ribosome, production of proteins

Besides storage, what does a vacuole provide in a plant cell?

Ans
- **A)** energy
- **B)** protein production
- **C)** structure
- **D)** communication with other cells

What is the difference between a cell wall and a cell membrane?

Ans
- **A)** The cell wall is just outside the cell membrane and is strong and rigid.
- **B)** The cell membrane is just outside the cell wall and is strong and rigid.
- **C)** The cell wall is just outside the cell membrane and is more flexible.
- **D)** The cell membrane is just outside the cell wall and is more flexible.

In eukaryotes, the Mitochondria are important organelles for cellular respiration and the Chloroplast are organelles that use light energy and make food.

ER, Golgi Apparatus and Vesicle are organelles that transport proteins in the cell.

2	List all the differences between animal cells and plant cells, and explain the importance and the characteristics of each organelle they contain	Textbook, figures, 3D, investigation	35, 38, 39, 40

Paper part - الأسئلة المقالية

Which **best** explains the function of a cell membrane?

Ans
- **A)** offers protection from the outside environment
- **B)** provides a framework to help the cell move
- **C)** transforms energy in the cell into ATP
- **D)** removes viruses from inside the cell

What is the function of a lysosome?

- **A)** storing food
- **B)** preparing proteins
- **C)** making food

ans
- **D)** breaking down material

1. Which of the plant cell's structures protects the cell from attack by virus and **does not exist in animal cells?**

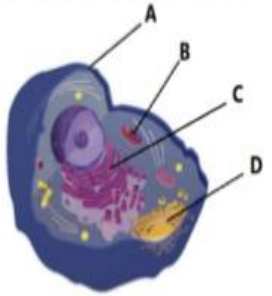
A. Golgi apparatus
ans B. Cell membrane
C. Cell wall
D. Nucleolus

3. The image below illustrates a chloroplast. Which of the following explains the importance?

A. It converts energy in food to ATP.
ans B. It helps the cell gather sunlight and make glucose
C. The cell eats it as food
D. It controls mineral movement inside the cell

13. The illustration below represents an animal cell, which of the following letters represents **not** involved in material transport?

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



Smooth
_____ ER is important because it helps remove harmful substances from a cell.

3	1. list the function of types of joints and location in the human body,2. give the function of the skeletal system, 3. compare between fluid support (hydrostatic skeleton) and external support (exoskeleton)	Textbook, lab, 3D, table	81, 83, 85, 95

Paper part - الأسئلة المقالية

Fluid Support Some animals have a hydrostatic skeleton, which is a fluid-filled internal cavity surrounded by muscle tissue. Muscles help the organisms move by pushing the fluid in different directions. Flatworms, such as the one shown to the right, sea anemones (uh NE muh neez), and earthworms are organisms that have hydrostatic skeletons.

External Support Hard outer coverings provide support and protection for many animals. Sometimes called shells, these outer coverings support animals such as crabs, snails, and the scorpion shown to the left. A thick, hard outer covering that protects and supports an animal's body is called an **exoskeleton.**

THREE-DIMENSIONAL THINKING

Compare and contrast the **structure** and **function** of hydrostatic skeletons and exoskeletons.

Sample answer: Both provide structure and support for animals, however hydrostatic skeletons help organisms move, while exoskeletons protect the internal parts of organisms. They differ in structure because hydrostatic skeletons are internal, fluid-filled cavities surrounded by muscle, and exoskeletons are hard outer coverings.

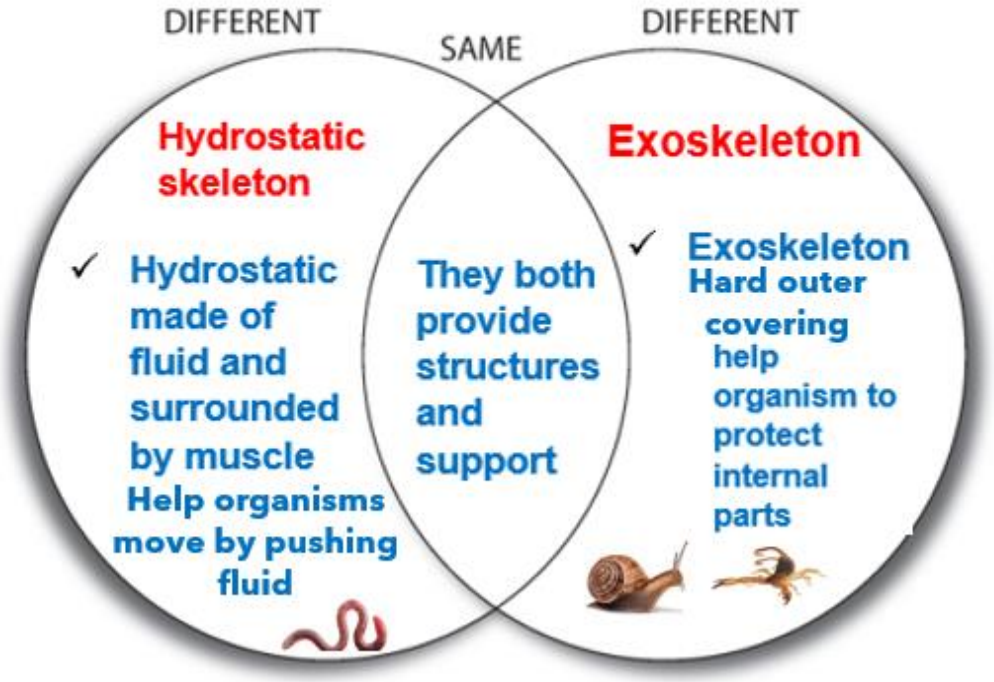
COLLECT EVIDENCE

How are different types of animals provided with structure and support? Record your evidence (B) in the chart at the beginning of the lesson.

As you just learned, some animals are provided with structure and can move without rigid bones or shells. Think about a squid, for example, and how it is provided with structure and is able to move. Learn more on the next page.

THREE-DIMENSIONAL THINKING

Compare and contrast the **structure** and **function** of hydrostatic skeletons and exoskeletons.



11. Which of the following skeletal systems support the body of the Flatworm?

A. Exoskeleton
B. Endoskeleton
C. Shell
D. Hydrostatic skeleton

3	1. list the function of types of joints and location in the human body,2. give the function of the skeletal system, 3. compare between fluid support (hydrostatic skeleton) and external support (exoskeleton)	Textbook, lab, 3D, table	81, 83, 85, 95

Paper part - الأسئلة المقالية

Three-Dimensional Thinking

3. Why do muscle cells have so many mitochondria?

A Muscle cells are bigger than every other cell and can fit more mitochondria.

B Muscle cells need to quickly respond to energy needs.

C The mitochondria in muscle cells are smaller so more are needed.

D There are more mitochondria only because there are more nuclei.

---

4. What is the effect when a muscle contracts?

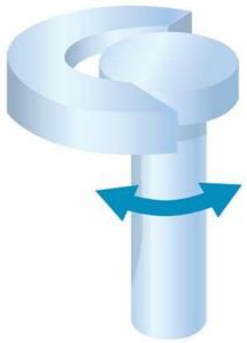
A The muscle lengthens.

B The muscle pushes on a bone.

C The muscle pushes on another muscle.

D The muscle shortens.

Use the diagram below to answer question 5.



5. The image above represents a joint that would be found in which structure?

A finger

B knee

C neck

D shoulder

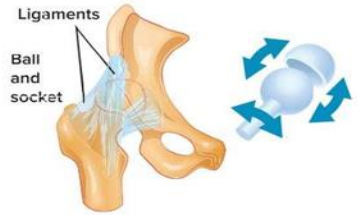
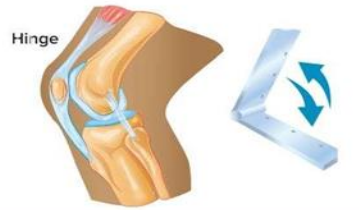
3	1. list the function of types of joints and location in the human body,2. give the function of the skeletal system, 3. compare between fluid support (hydrostatic skeleton) and external support (exoskeleton)	Textbook, lab, 3D, table	81, 83, 85, 95

Paper part - الأسئلة المقالية

Joints Your bones work together at places called joints. A **joint** is where two or more bones meet. Joints provide flexibility and movement, like you saw with the girl doing a handstand at the start of the lesson. Bones are connected to other bones by tissues called **ligaments.** When the bones in joints move, ligaments stretch and keep the bones from shifting away from each other.

PHYSICAL SCIENCE Connection Your arms and legs may not seem like machines, but in fact they are. When muscles pull on bones they act like a simple machine called a lever. Levers rotate about a fixed point, which in your body are the joints. Three different types of joints enable movement—ball and socket, hinge, and pivot joints. Examine the different joints in the table.

Types of Movable Joints

Joint	Description	Example
	allows bones to move and rotate in nearly all directions	hips and shoulder
	allows bones to move back and forth in a single direction	fingers, elbows, knees
	allows bones to turn	neck, lower arm below the elbow

Analyze and Conclude

6. Infer which function of the skeletal system this experiment modeled.

Answers may vary. Sample answer: I think that this modeled the protective function of the skeleton since the jar made less bubbles pop.

Bones provide support. They help you sit up, stand, and raise your arm over your head to ask a question. What else can the skeleton do for the body?

Protection Feel your head, and then feel your stomach. Your stomach is softer than your head. The hard, rigid structure you feel in your head is your skull. It protects the soft, fragile tissue of your brain from damage. Other bones protect the spinal cord, heart, lungs, and other internal organs.

Production and Storage Another function of bones is to produce and store materials needed by your body. Red blood cells are produced inside your bones. Bones store fat and calcium. Calcium is needed for strong bones and for many cellular processes.

THREE-DIMENSIONAL THINKING

Use an **argument** to support or refute the following claim: Your body would be able to **function** without your skeletal **system.**

Answers will vary. Sample answer: My body would not be able to function and would be like gelatin if I did not have the support of bones. This would leave my organs susceptible to damage. I would not be able to move without my muscles being attached to bones.

What about organisms that don't have bones, such as worms? What provides them with structure, and how do they move?

3	1. list the function of types of joints and location in the human body,2. give the function of the skeletal system, 3. compare between fluid support (hydrostatic skeleton) and external support (exoskeleton)	Textbook, lab, 3D, table	81, 83, 85, 95

Paper part - الأسئلة المقالية

Which of the following is stored in the skeletal system?

- A) potassium
- B) calcium
- C) sodium
- D) water

Ans

The function of the bones called the Skull is to protect the brain.

Of the following, which is NOT a function of the skeletal system?

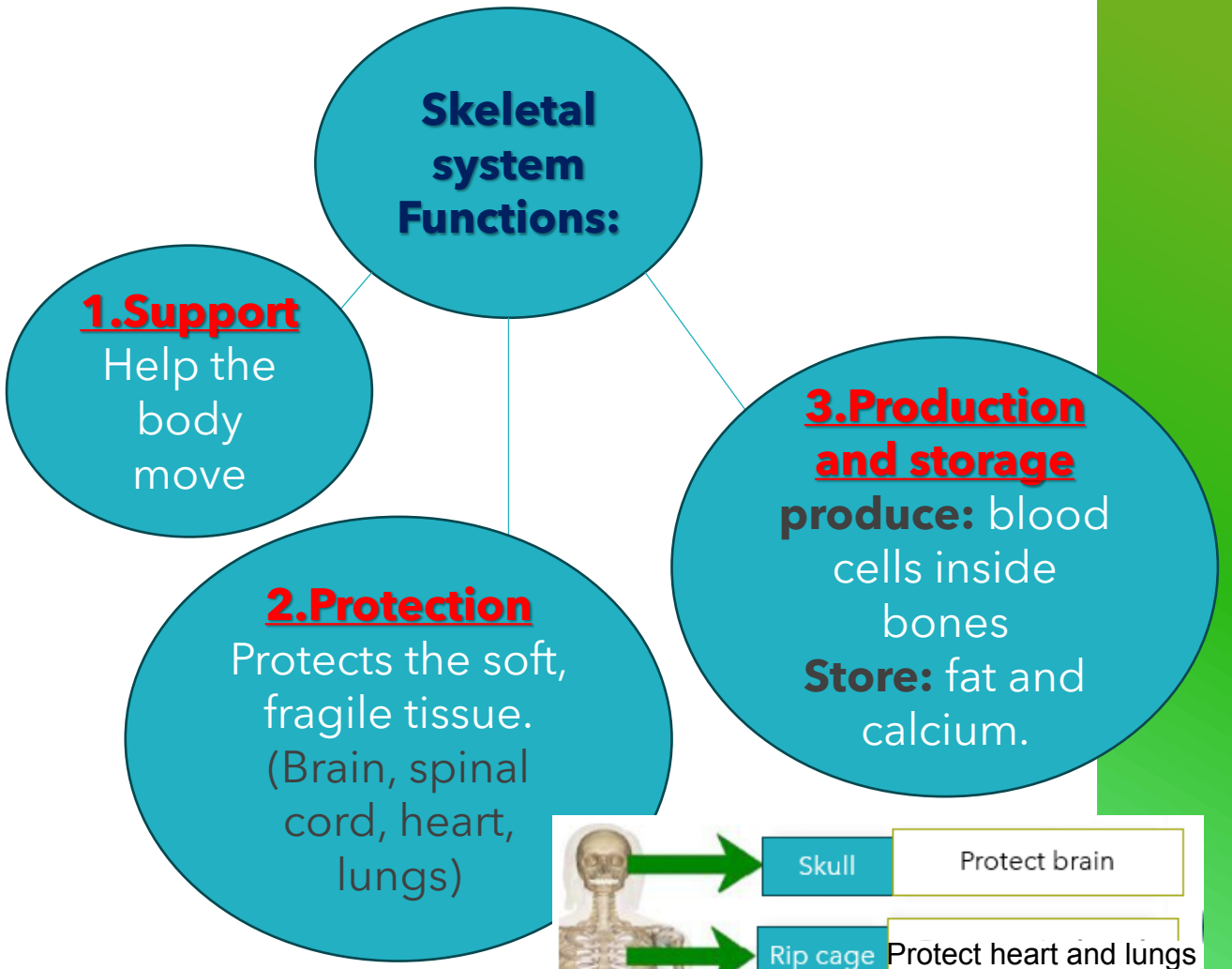
- A) protects interior organs
- B) gives shape and support to body
- C) stores minerals
- D) produces vitamin D

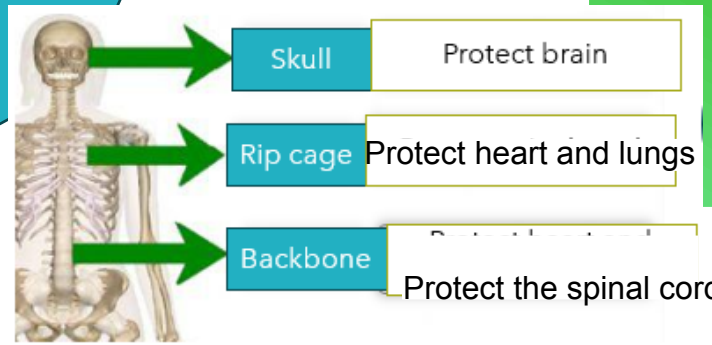
ans

Which function of the skeletal system will help the lungs keep from getting damaged if you fall?

- A) movement
- B) protection
- C) storage
- D) support

ans



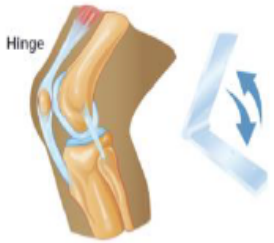


3	1. list the function of types of joints and location in the human body,2. give the function of the skeletal system, 3. compare between fluid support (hydrostatic skeleton) and external support (exoskeleton)	Textbook, lab, 3D, table	81, 83, 85, 95

Paper part - الأسئلة المقالية

4. The hinge joint in the graph below allows bones to move back and forth. Which of the following **do not** have hinge joints?

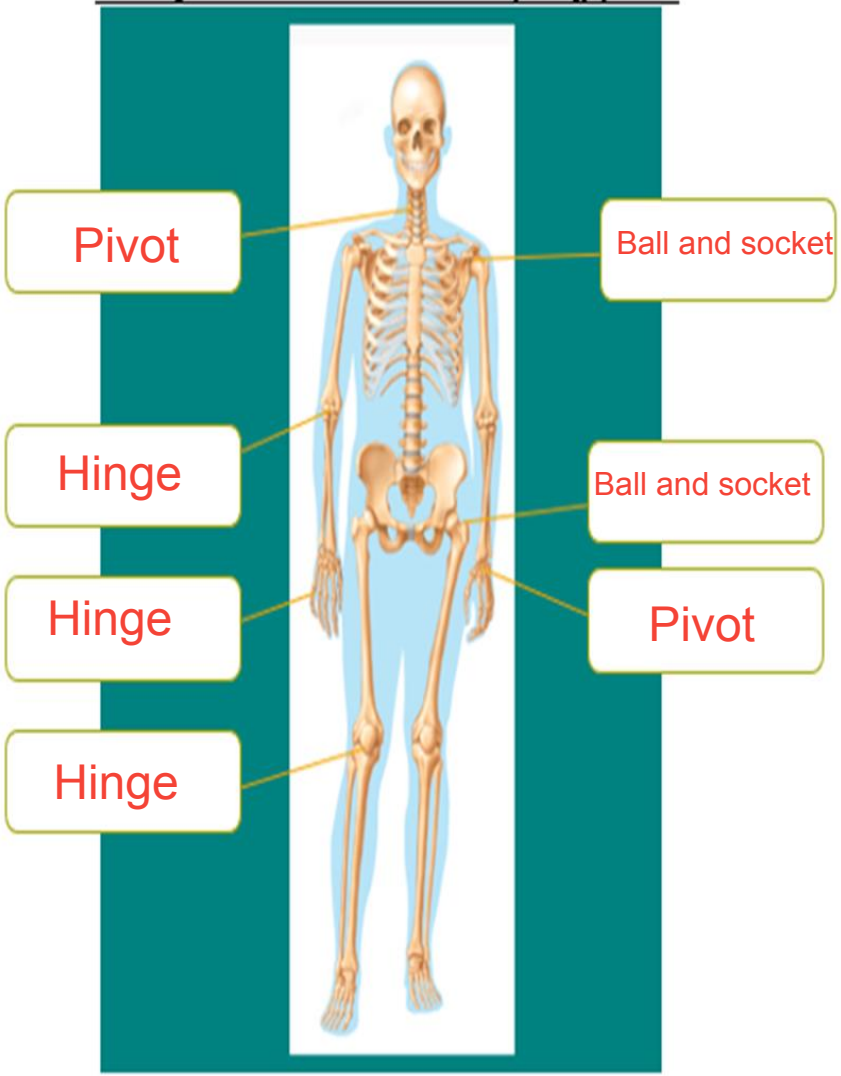
A. Shoulders
B. Fingers
C. Elbows
D. knees



Hinge, ball and socket, and pivot joints are all moveable joints.

		
example Elbow	example Hip	example neck
movement: back and forth	movement: rotation/ all directions	movement: side to side and up and down

Identify the Joints -Ball and socket, Hinge, Pivot



4	List the parts of the digestive system and their function, compare chemical and physical digestion, and follow the steps of the digestion process	textbook,lab, figures	106, 107, 108, 109

Paper part - الأسئلة المقالية

How does digestion work?

By breaking down a slice of bread, you just modeled digestion. **Digestion** is the mechanical and chemical breakdown of food into small particles and molecules that your body can absorb and use. In order for a body to obtain nutrients, food must be digested. Let's suppose that you have eaten the slice of bread from the previous page. We can observe the process of digestion by following the path of the bread through your digestive system.

Types of Digestion Before your body can absorb nutrients from the bread, it must be broken down into small molecules by digestion. There are two types of digestion—mechanical and chemical. In **mechanical digestion,** food is physically broken into smaller pieces. Mechanical digestion happens when you chew, mash, and grind food with your teeth and tongue. Smaller pieces of food are easier to swallow and have more surface area, which helps with chemical digestion. In **chemical digestion,** chemical reactions break down pieces of food into small molecules.

The Mouth Mechanical digestion of food begins in your mouth. Using muscles in your jaw, you mechanically digest your bread as you chew. But even before chewing begins, your mouth prepares for digestion. As you observed at the beginning of this lesson with crackers, saliva contains chemicals that help break down carbohydrates. Saliva also contains substances that neutralize acidic foods.

The Esophagus After you swallow a bite of your bread, it enters your esophagus (ih SAH fuh gus). The **esophagus** is a muscular tube that connects the mouth to the stomach. Food moves through the esophagus and the rest of the digestive tract by waves of muscle contractions, called **peristalsis** (per uh STAHL sus).

Peristalsis is similar to squeezing a tube of toothpaste. When you squeeze the bottom of the tube, toothpaste is forced toward the top of the tube. As muscles in the esophagus contract and relax, partially digested food is pushed down the esophagus and into the stomach.

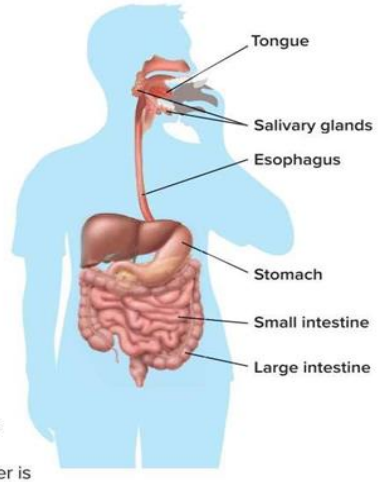

Peristalsis

In the Lab *The Greatest Thing Since Sliced Bread* you modeled mechanical digestion when you tore the bread into small pieces. After the bread was physically broken down, the vinegar and water mixture further broke the bread down, much like chemical digestion.

COLLECT EVIDENCE

Why is digestion important for organisms such as the chameleon? Record your evidence (A) in the chart at the beginning of the lesson.

The Stomach Once your partially digested bread leaves the esophagus, it enters the stomach. The stomach is a large, hollow organ. One function of the stomach is to temporarily store food. Another function of the stomach is to aid in chemical digestion. The stomach contains an acidic fluid called gastric juice. Acid helps break down some of the structures that hold plant and animal cells together, including those in the bread.



The Small Intestine Most chemical digestion occurs in the small intestine, a long tube connected to the stomach. It is also where nutrient absorption occurs. The folds of the small intestine are covered with fingerlike projections called **villi** (VIH li) (singular, villus). Each villus contains small blood vessels. Nutrients in the small intestine enter the blood through these blood vessels.

The Large Intestine Most of the water in ingested foods and liquids is absorbed in the small intestine. As the bread travels through the large intestine, even more water is absorbed. Materials that pass through the large intestine are the waste products of digestion. The waste products become more solid as excess water is absorbed. Then the semisolid waste is eliminated from the body.

THREE-DIMENSIONAL THINKING

As the bread was digested, it interacted with other body systems. **Explain** how the different body systems were involved in the digestion of the bread.

Answers may vary. Sample answer: The bread that was eaten travels through the digestive system. Along the way, it interacts with the muscular system by peristalsis when muscles push food down the esophagus. In the small intestine, nutrients are absorbed into the circulatory system.

GO ONLINE for additional opportunities to explore!

Investigate digestion further by performing one of the following activities.

☐ **Model** the human digestive system in the **Lab** *Model Digestion from Start to Finish.*

OR

☐ **Model** and **investigate** how a gizzard works in the **Lab** *How do gizzards help birds eat?*

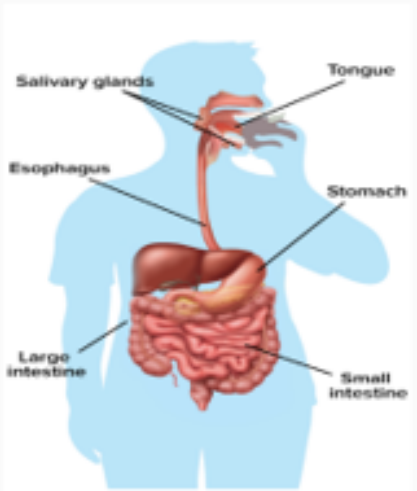
4	List the parts of the digestive system and their function, compare chemical and physical digestion, and follow the steps of the digestion process	textbook,lab, figures	106, 107, 108, 109

Paper part - الأسئلة المقالية

Digestion

1. Mechanical digestion
2. Chemical digestion

Is the mechanical and chemical breakdown of food into small particles and molecules that your body can absorb and use

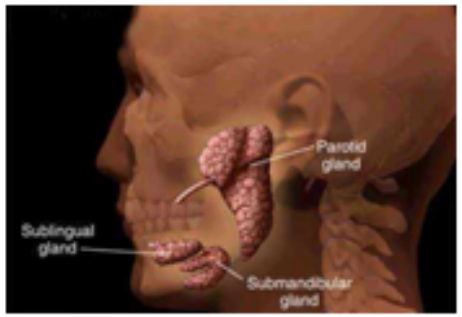


Mechanical digestion:

Food is physically broken into smaller pieces happens when you chew, mash and grind food with your teeth and tongue.
Muscles in jaw.

Chemical digestion:

Chemical reactions break down pieces of food into small molecules.
Saliva=contains chemicals that help break down carbohydrates and neutralize acidic foods.
Stomach=contains an acidic fluid called gastric juice helps break down food.
Small intestine= most chemical digestion occurs.



4	List the parts of the digestive system and their function, compare chemical and physical digestion, and follow the steps of the digestion process	textbook,lab, figures	106, 107, 108, 109

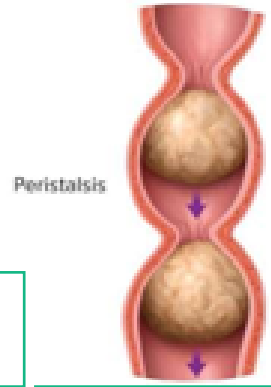
Paper part - الأسئلة المقالية

Digestion: Is the mechanical and chemical breakdown of food into small particles and molecules that your body can absorb and use

Mouth where mechanical digestion of food begins by chew, mash and grind with teeth and tongue.

Produce saliva that contains chemical help break down carbohydrates and neutralize acidic foods.

Is a muscular tube that connects the mouth to the stomach.



Wave of muscle contractions

Is a large, hollow organ temporarily store food and aid in chemical digestion (acidic fluid=gastric juice)

A long tube connected to the stomach. Its where nutrient absorption occurs. (Most chemical digestion occurs) villi: Fingerlike projections found in small intestine each villus contains small blood vessels where nutrients enter the blood.

Are where waste products of digestions pass and more water is absorbed. Then semisolid waste is eliminated from the body

4	List the parts of the digestive system and their function, compare chemical and physical digestion, and follow the steps of the digestion process	textbook,lab, figures	106, 107, 108, 109

Paper part - الأسئلة المقالية

What is the function of peristalsis?

ans **A)** to move food through the digestive system
- **B)** to remove excess liquid from the body
- **C)** to chemically digest food to release nutrients
- **D)** to absorb nutrients into the blood

When does the first step of digestion usually occur?

- **A)** when the organism discovers the food
ans **B)** when the food is chewed
- **C)** when the food is swallowed
- **D)** when the nutrients are absorbed

Food enters the human body through the _____.

- **A)** esophagus
ans **B)** mouth
- **C)** intestine
- **D)** liver

Choose the answer which lists the correct order of the digestion process.

A – Nutrients and water in the food are absorbed.	C – Food is ingested.
B – Undigested food is eliminated.	D – Food is digested.

ans **A)** C, D, A, B
- **B)** C, A, D, B
- **C)** A, C, D, B
- **D)** A, B, C, D

Absorption in the small intestines occurs through the walls of fingerlike projections called _____Villi_____.

Question	2

The figure below represents the digestive system. Study it and answer the following questions:

- Which part secretes acidic fluids to digest food?

Stomach

- Which part has Villi features that absorb food?

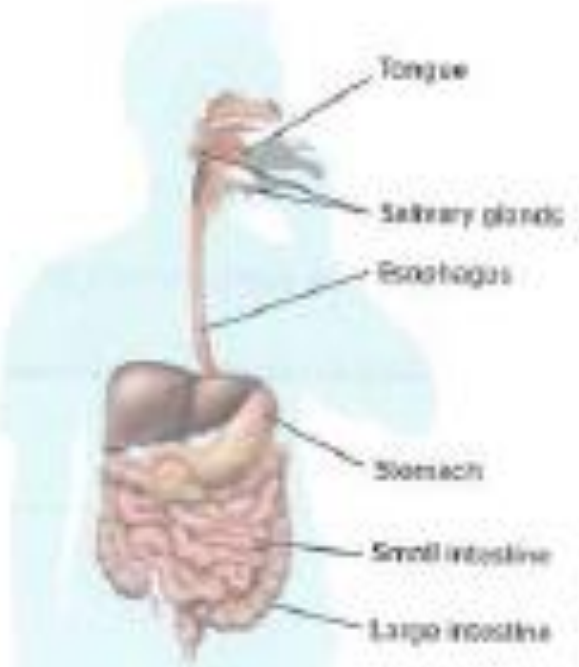
Small intestine

- Which part undergoes peristalsis movement and pushes food into the stomach?

Esophagus

- Which part in your mouth secretes chemicals that break down carbohydrates?

Salivary glands



4	List the parts of the digestive system and their function, compare chemical and physical digestion, and follow the steps of the digestion process	textbook,lab, figures	106, 107, 108, 109

Paper part - الأسئلة المقالية

Removing Waste When you modeled digestion, you may have noticed that there was leftover bread, representing food waste. The body produces other waste products as well. For example, some water and vinegar remained in the towel, representing liquid waste. Liquid waste is handled by the urinary system.

Your body excretes, or eliminates, different substances from different body systems. They are processed by the excretory system. The **excretory system** collects and eliminates wastes from the body and regulates the level of fluid in the body. The excretory system is made of different body systems. For example, you just read that liquid waste is handled by the urinary system. The respiratory system, which you will learn about in the next lesson, releases waste as carbon dioxide. Your skin also removes waste in the form of excess salt and water through sweat glands.

LAB Filtering Waste

You have two kidneys, one on each side of your body. The kidney is an important organ in the excretory system. Model the function of the kidneys to see how they work!

Safety

Materials

plastic cups (3)
fine gravel
sand
water
marker
tape
wire screen
filter paper
funnel

Procedure

1. Read and complete a lab safety form.
2. Label three plastic cups 1, 2, 3.
3. Mix a small amount of fine gravel and sand with water in cup 1.
4. Place a small piece of wire screen in a funnel, and place the funnel in cup 2.

5. Carefully pour the sand-water-gravel mixture into the funnel. Let it drain. Record your observations in your Science Notebook.
6. Remove the screen. Replace it with a piece of filter paper. Place the funnel in cup 3.
7. Carefully pour the contents of cup 2 into the funnel. Let it drain. Record your observations.
8. Follow your teacher's instructions for proper cleanup.

Analyze and Conclude

9. Describe what happened during each filtration.

The wire screen filtered the larger particles from the water mixture during the first filtration. The filter paper filtered smaller particles during the second filtration.

10. Why is the function of the kidney so important for the entire body?

Sample answer: It is important to filter waste from the blood because the circulatory system carries blood throughout the body. It is necessary to filter out harmful substances. If not, they would be toxic for the entire body.

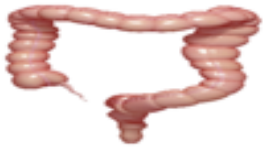
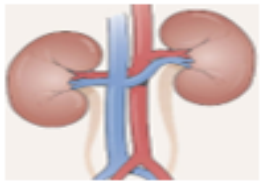
Kidneys The kidneys are bean-shaped organs that filter, or remove, waste from blood. They enable harmful substances to be removed from the body. If waste was allowed to build up in the blood, it would become toxic and harm the entire body.

COLLECT EVIDENCE

What happens after food is broken down and nutrients are absorbed? Record your evidence (B) in the chart at the beginning of the lesson.

4	List the parts of the digestive system and their function, compare chemical and physical digestion, and follow the steps of the digestion process	textbook,lab, figures	106, 107, 108, 109

Paper part - الأسئلة المقالية

Excretory system	Collects and eliminates wastes from the body and regulates the level of fluid in the body and it's made of different body system.	
	1. **Respiratory system:** Releases waste as carbon dioxide	
	2. **Skin:** Remove waste in the form of excess salt and water through the sweat glands	
	3. **Digestive system:** remove and eliminate semisolid waste	
	4. **Excretory system (Kidneys):** are bean shaped organs that filter and remove harmful waste from the blood. If the blood did not filter it would become toxic and harm.	

Removal of waste products in the body is called _____.

Ans
- **A)** excretion
- **B)** respiration
- **C)** circulation
- **D)** transpiration

The kidneys, skin, and lungs are each a part of the _____ system.

- **A)** respiratory

ans
- **B)** excretory
- **C)** digestive
- **D)** nervous

5	Explain how human's body transports material, and list the parts of the respiratory system and the function of each	textbook, figures, 3D	123, 124

Paper part - الأسئلة المقالية

The Respiratory System Gases are exchanged between the body and the environment. The parts of the respiratory system, shown to the right, work together and supply the body with oxygen. They also rid the body of wastes, such as carbon dioxide.

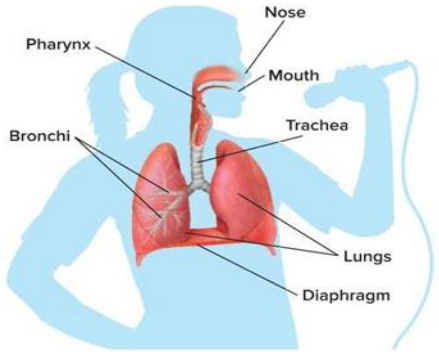
Oxygen enters the body when you inhale, or breathe in. Carbon dioxide leaves the body when you exhale. When you inhale, air enters the nostrils and passes through the pharynx. The **pharynx** is a tubelike passageway at the top of the throat that receives air, food, and liquids from the mouth or nose.

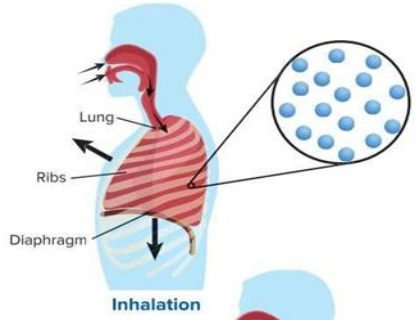
Because the pharynx is part of the throat, it is a part of both the digestive and respiratory systems. Food goes through the pharynx to the esophagus. Air travels through the pharynx to the **trachea,** a tube that is held open by C-shaped rings of cartilage. The trachea is also called the windpipe because it is a long, tubelike organ that connects the pharynx to the bronchi.

The **bronchi** are two narrower tubes that lead into the lungs. **Lungs** are the main organs of the respiratory system. Inside the lungs, the bronchi continue to branch into smaller and narrower tubes called bronchioles.

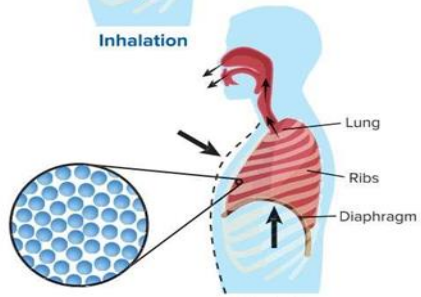
PHYSICAL SCIENCE Connection When high levels of carbon dioxide build up in your blood, the nervous system signals your body to breathe out. How does this happen?

The **diaphragm,** (DI uh fram) is a large muscle below the lungs that contracts and relaxes as air moves into and out of your lungs. The movement of your diaphragm causes changes in the air pressure inside your chest. Breathing occurs because of these changes in air pressure. For example, when your diaphragm contracts and moves down as you inhale, air rushes in to equalize air pressure. The diaphragm relaxes and moves up when you exhale. Air then rushes out to equalize the pressure.





Inhalation

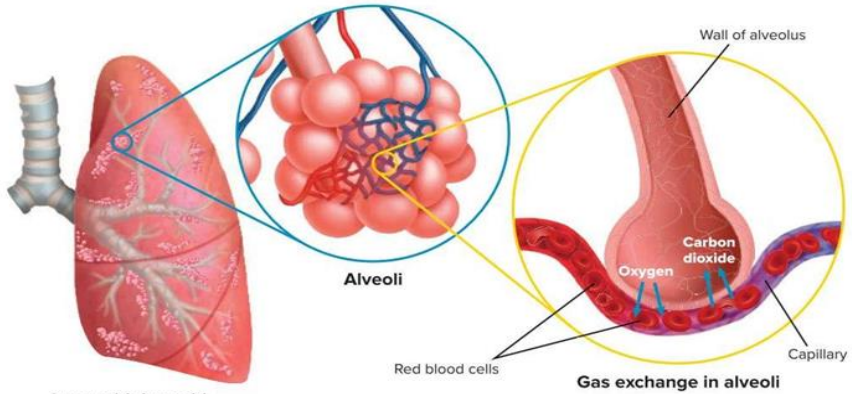


Exhalation

What happens to oxygen after it enters the lungs?

In the lungs, the bronchioles end in microscopic sacs, or pouches, called **alveoli** (al VEE uh li; singular, alveolus), where gas exchange occurs. During gas exchange, oxygen from the air you breathe moves into the blood, and carbon dioxide from your blood moves into the alveoli.

Alveoli look like bunches of grapes at the ends of the bronchioles. Like tiny balloons, the alveoli fill with air when you breathe in. They contract and expel air when you breathe out. Notice in the image below how blood vessels surround an alveolus.



Lung with bronchi

Gas exchange in alveoli

The walls of alveoli are only one cell thick. The thin walls and the large surface areas of the alveoli enable a high rate of gas exchange. Every time you breathe, your alveoli enable your body to take in billions of molecules of oxygen and get rid of billions of molecules of carbon dioxide.

THREE-DIMENSIONAL THINKING

WRITING Connection You friend says that blood has no role in breathing. Construct an **argument** to refute his claim. Provide **evidence** to support your **argument.**

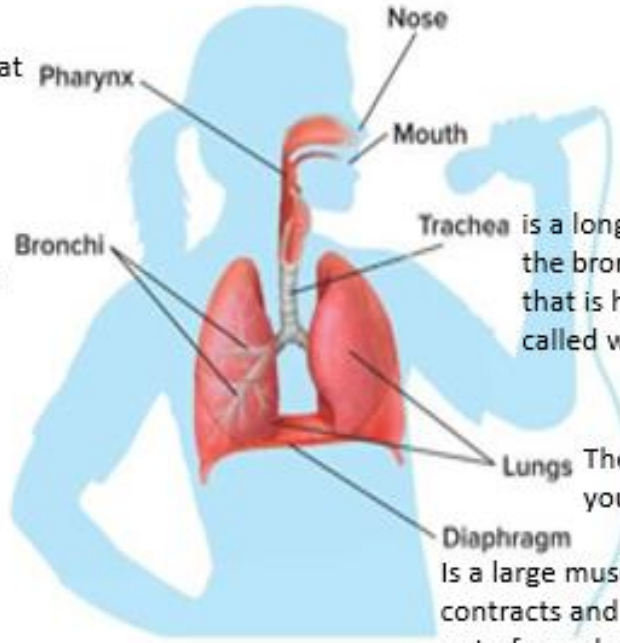
Answers may vary. Sample answer: Blood does have a role in breathing because after oxygen enters the lungs, it moves into the blood. Carbon dioxide from blood is released during breathing.

5	Explain how human's body transports material, and list the parts of the respiratory system and the function of each	textbook, figures, 3D	123, 124

Paper part - الأسئلة المقالية

is a tubelike structure at the top of the throat that receivesair, food, and liquids from the mouth or nose.

Are two narrower tubes that lead into the lungs. The bronchi continue to branch into smaller and narrower tubes called bronchioles.

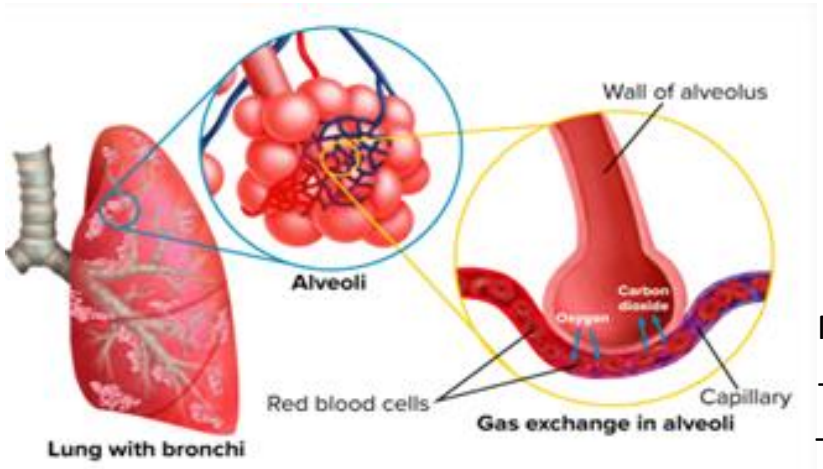


Trachea is a long tube-like structure that connects the pharynx to the bronchi and transports air to and from the lung. Tube that is held open by C-shaped rings of cartilage. Also called windpipe

Lungs The main organs of the respiratory system in your chest used for breathing

Diaphragm
Is a large muscle below the lungs that contracts and relaxes as air move into and out of your lungs.

Breathing occurs because of changes in air pressure.



alveolus (plural alveoli)

one cell thick (thin wall and large surface area) that enable a high rate of gas exchange.

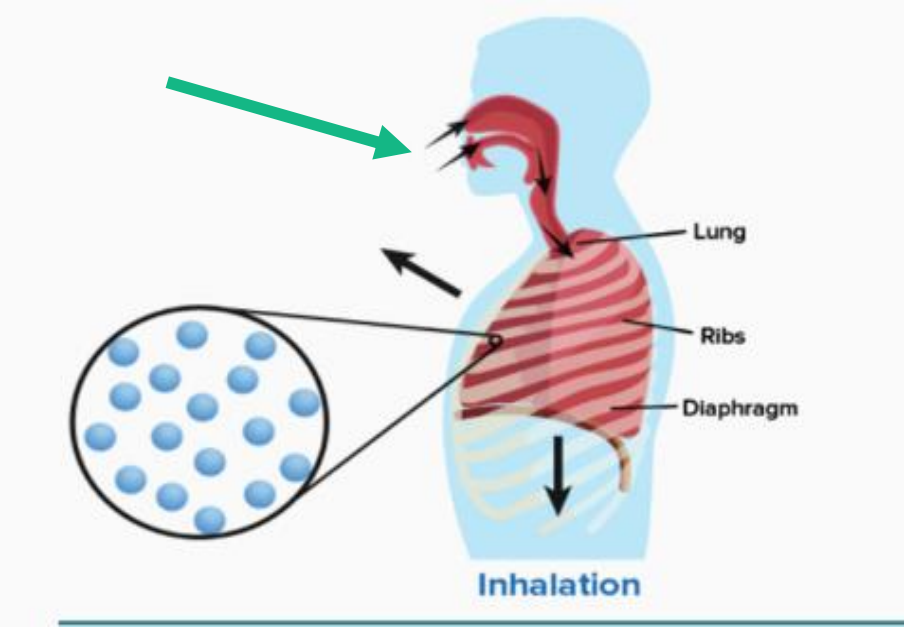
Microscopic sac or pouches structure inside the lung where gas exchange takes place.

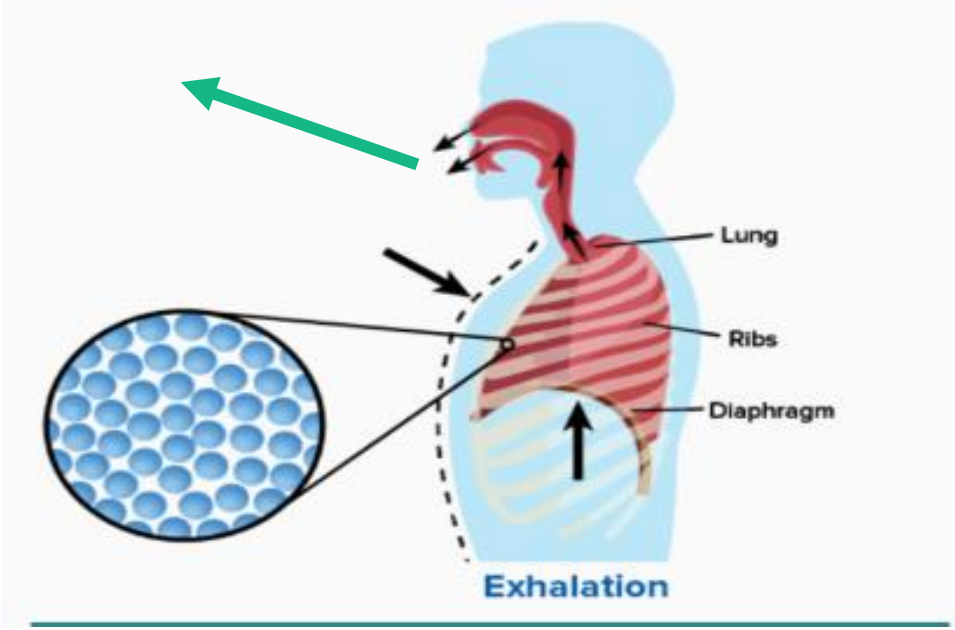
-Oxygen moves into blood.

-Carbon dioxide moves into alveoli.

5	Explain how human's body transports material, and list the parts of the respiratory system and the function of each	textbook, figures, 3D	123, 124

Paper part - الأسئلة المقالية





Inhale:

Diaphragm contracts and move down.

Air rushes in to equalize air pressure.

Exhale:

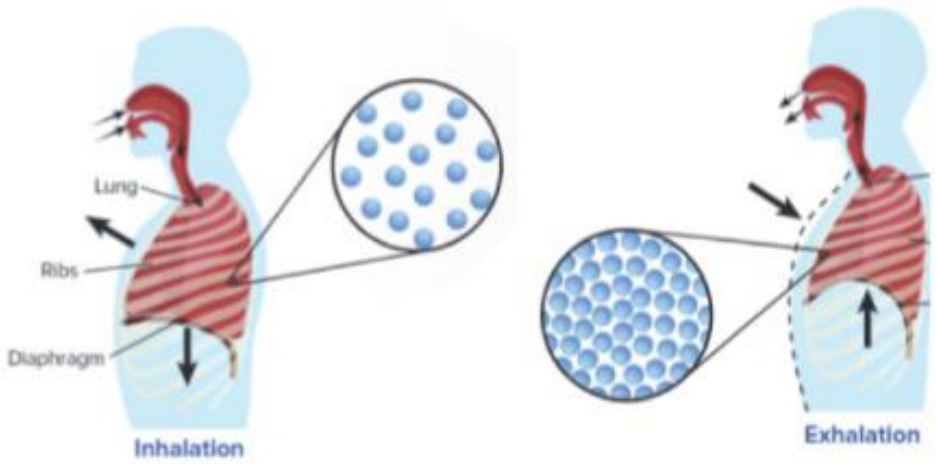
Diaphragm relaxes and move up.

Air then rushes out to equalize the pressure.

5	Explain how human's body transports material, and list the parts of the respiratory system and the function of each	textbook, figures, 3D	123, 124

Paper part - الأسئلة المقالية

16. The figure below represents the respiratory system and the diaphragm movement. Which of them explains the function of the diaphragm?



A. It provides a large surface area for absorbing carbon monoxide from the air and releasing
B. It provides a way for all the cells in the lungs to obtain nutrients from the bloodstream
ans C. It moves and causes changes in the air pressure inside your chest
D. It provides a large surface area for absorbing carbon dioxide from the air and releasing oxygen

Which best describes the function of a diaphragm?

- **A)** The diaphragm is the site where oxygen enters the capillaries.
ans - **B)** The diaphragm regulates air pressure inside the chest.
- **C)** The diaphragm receives air, food, and liquids from the mouth.
- **D)** The diaphragm vibrates when air passes through causing sound.

Where are the alveoli located in the respiratory system?

- **A)** outside the larynx
ans - **B)** inside the lungs
- **C)** in the trachea
- **D)** inside the mouth

Oxygen moves between the respiratory system and the circulatory system when it transfers from _____ to _____.

ans - **A)** alveoli, capillaries
- **B)** bronchi, trachea
- **C)** capillaries, veins
- **D)** bronchi, capillaries

MCQ part

MCQ - الأسئلة الموضوعية	6	Illustrate the difference between living and nonliving things and how to catagorize objects accordingly
	7	Compare prokaryotic and eukaryotic cells
	8	Calculate the surface area and volume if a cell were cube-shaped
	9	Relate between the shape of a cell and its function
	10	Order the levels of organization in the human body from cells to --> organisms
	11	Investigate the importance of organ systems working together and Give the name of the organ system in figures
	12	Describe how the muscles, bones, and joints work together to support a body and enables it to move
	13	Compare between skeletal muscles, cardiac muscle, and smooth muscles
	14	Relate the human support system to the plants', and compare and contrast between them
	15	Define Calorie and nutrients, and explain how energy from food powers the organisms body
	16	Explain how do plant bodies obtain energy and get rid of wastes
	17	Illustrate how plants transport the materials they need from their environment through their bodies (different parts)
	18	Explain how blood is transported throughout the body, and list the circulatory system parts and their function
	19	Compare open circulatory system with closed circulatory system
	20	Explain how the human eye sees and the parts in it and their function

6	Illustrate the difference between living and nonliving things and how to catagorize objects accordingly	Textbook, figure,	5, 20, 22

MCQ - الأسئلة الموضوعية

SCIENCE PROBES

LESSON 1 LAUNCH

Are seeds alive?

Four friends were planting flowers in the school garden. They began to question whether or not seeds are alive. Here are their thoughts:

Eli: I don't think seeds are alive until they are watered.
Tory: I think seeds are always alive.
Kelly: I don't think seeds are alive.
DeAndre: I don't think seeds are alive until they sprout.

Circle the friend you most agree with. Explain why you agree with that person.

You will revisit your response to the Science Probe at the end of the lesson.

Common Characteristics You now know that all living things are made of cells. What are the other six characteristics that all living things have in common? These include organization, growth and development, reproduction, response to stimuli, maintaining internal conditions, and using energy.

INVESTIGATION

Characteristics of Life

WRITING Connection Your teacher will assign one of the characteristics of life for you to research with your group. Use the graphic organizer for your characteristic to help guide your research. Your group will create a visual for your assigned characteristic and present it to the class. Fill in the graphic organizers for the rest of the characteristics as the other groups present.

1. Organization

Living things are organized by...
having different structures that perform different functions, such as digestion or movement.

Unicellular	Multicellular
organisms are less complex.	*organisms are more complex.*

2. Growth and development

Growth is...	*Development is...*
the process of increasing in size.	a series of changes that occur in an organism during its lifetime.

6	Illustrate the difference between living and nonliving things and how to catagorize objects accordingly	Textbook, figure,	5, 20, 22

MCQ - الأسئلة الموضوعية

6. Use of energy

Most organisms get their energy from the Sun.

Plants, algae, and some types of microorganisms use energy from the Sun to make food.

Other organisms obtain energy by eating plants or by eating other animals that have eaten plants.

Plan your visual and presentation below.

Answers may vary. Students should use this space to plan their visual and presentation. They may make a rough sketch of the visual or plan a script.

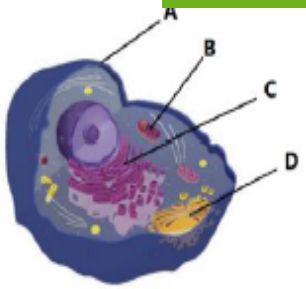
Characteristics of Life All living things are organized according to different structures that perform different functions. Living things grow and develop, meaning they increase in size and go through changes during their lifespans. Living things create new living things through the process of reproduction. They also respond to changes in their environments, called stimuli. Another characteristic of organisms is **homeostasis**, which is the ability to maintain steady internal conditions. All organisms require energy for everything they do. If something doesn't display each of these characteristics, it is not a living thing.

COLLECT EVIDENCE

What are the characteristics of living things that differentiate them from nonliving things, such as a flame? Record your evidence (B) in the chart at the beginning of the lesson.

Which of the following is **not** a characteristic that all living things have

A. Growth
B. Development
C. Moving
D. reproduction



2) All living things are made up of one or more cells.

Correct Answer

Blank 1: cells **or** cell

1) The smallest unit of life is the _____.

- **A)** cell
- **B)** homeostasis
- **C)** organism
- **D)** protein

Correct Answer

A) cell

6	Illustrate the difference between living and nonliving things and how to catagorize objects accordingly	Textbook, figure,	5, 20, 22

MCQ - الأسئلة الموضوعية

2) Which of the following is **NOT** a necessary characteristic of a living thing?

- **A)** It is made up of cells.
- **B)** It eats food to get energy.
- **C)** It grows and develops.
- **D)** It responds to stimuli.

Correct Answer

B) It eats food to get energy.

4) Which statement is true?

- **A)** Cells come in different shapes, but are all about the same size—very, very small.
- **B)** Cells come in different shapes and sizes.
- **C)** Cells all have the same shape, but come in different sizes.
- **D)** Cells are all the same shape and size—small and rounded.

Correct Answer

B) Cells come in different shapes and sizes.

3) In addition to being made up of cells, what are six characteristics shared by all living things?

Explanation

Living things are organized, they grow and develop, they reproduce, they respond to their environment, they maintain homeostasis, and they use energy.

7	Compare prokaryotic and eukaryotic cells	textbook, figures	23, 24

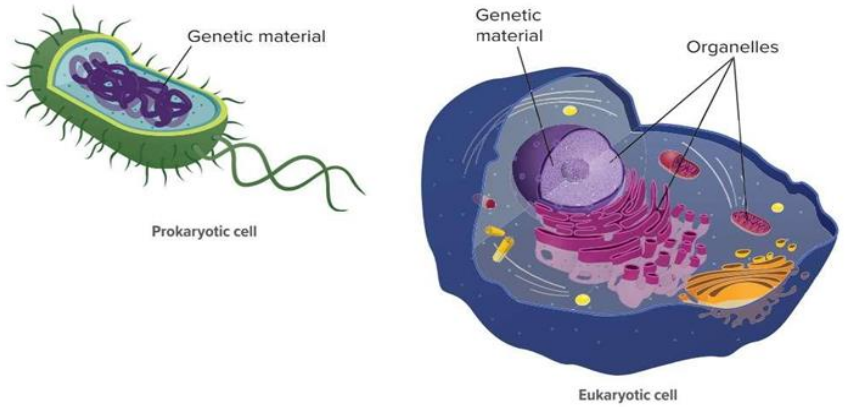
MCQ - الأسئلة الموضوعية

What are the different types of cells?

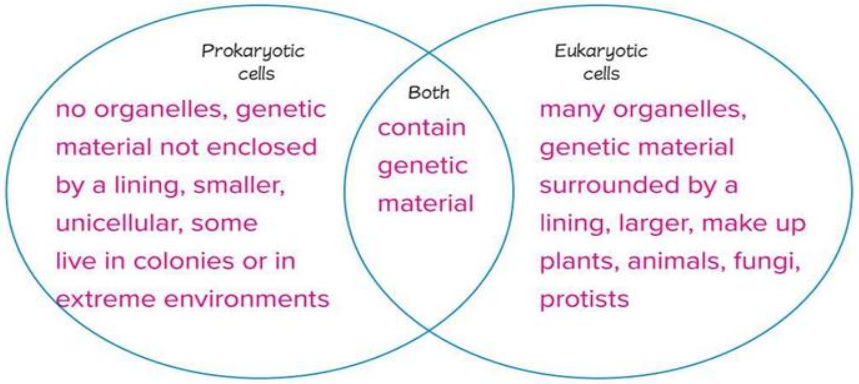
Recall that the use of microscopes enabled scientists to discover cells. With more advanced microscopes, scientists discovered that all cells can be grouped into two categories—prokaryotic (proh ka ree AH tihk) cells and eukaryotic (yew ker ee AH tihk) cells.

All cells contain genetic material—the means by which information is transmitted from one generation to the next. In some cells this genetic material is surrounded by a lining. In **prokaryotic** cells, the genetic material is not surrounded by a lining. This is the most important feature of a prokaryotic cell. In general, prokaryotic cells are smaller than eukaryotic cells and have fewer parts to their cells. Most prokaryotic cells are unicellular organisms and are called prokaryotes. Some prokaryotes live in small groups called colonies. Some can also live in extreme environments.

Plants, animals, fungi, and organisms called protists are all made of eukaryotic cells, and are called eukaryotes. With few exceptions, each **eukaryotic** cell has genetic material that is surrounded by a lining. Every eukaryotic cell also has other structures, called **organelles,** which have specialized functions. Most organelles are surrounded by linings. Eukaryotic cells are usually larger than prokaryotic cells. About ten prokaryotic cells would fit inside one eukaryotic cell.



Compare and contrast prokaryotic cells and eukaryotic cells by completing the Venn diagram on the next page.



Classification Organisms are classified according to their cell type—prokaryotic or eukaryotic, as well as other characteristics. All organisms are classified into one of three domains—Bacteria, Archaea, or Eukarya (yew KER ee uh)—and then into one of six kingdoms. Organisms in the Bacteria and Archaea domains are unicellular prokaryotes, while organisms in the Eukarya domain are eukaryotes. The classification system of living things is still changing. The current classification method uses all the evidence that is known about organisms to classify them. This evidence includes an organism's cell type, habitat, the way it obtains food and energy, the structure and function of its features, and its common ancestry.

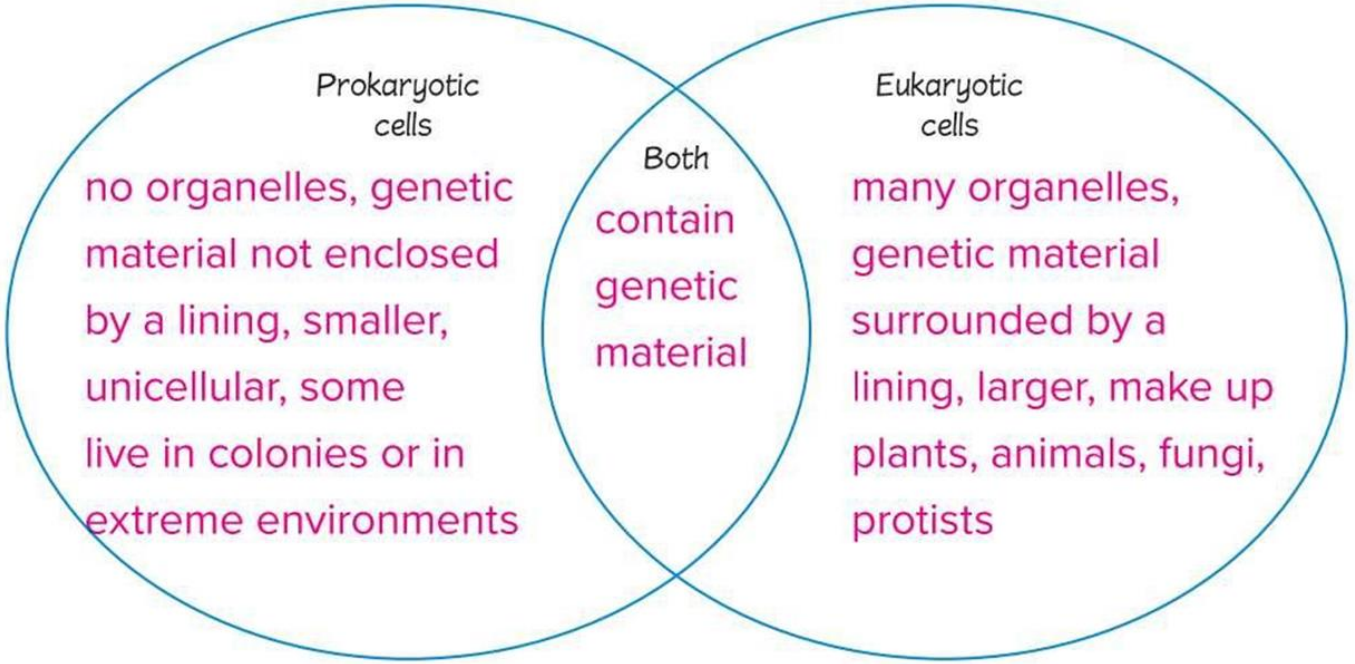
Domains and Kingdoms

Domain	Bacteria	Archaea	Eukarya			
Kingdom	Bacteria	Archaea	Protista	Fungi	Plantae	Animalia
Example						
Characteristics	Bacteria are simple unicellular organisms.	Archaea are simple unicellular organisms that often live in extreme environments.	Protists are unicellular or multicellular and are more complex than bacteria and archaea.	Fungi are unicellular or multicellular and absorb food.	Plants are multicellular and make their own food.	Animals are multicellular and take in their food.

What about viruses? Where do they fit into this classification system? Are they living things?

7	Compare prokaryotic and eukaryotic cells	textbook, figures	23, 24

MCQ - الأسئلة الموضوعية



6) _____ cells have genetic material that is not surrounded by a lining.

Correct Answer

Prokaryotic

9) Which correctly describes a difference between prokaryotic and eukaryotic cells?

- ○ **A)** Only prokaryotic cells have vacuoles.
- ○ **B)** Eukaryotic cells are smaller than prokaryotic cells.
- ○ **C)** Prokaryotic cells have many organelles, each with their own specialized functions.
- ○ **D)** Only eukaryotic cells have their genetic material surrounded by a lining.

Correct Answer

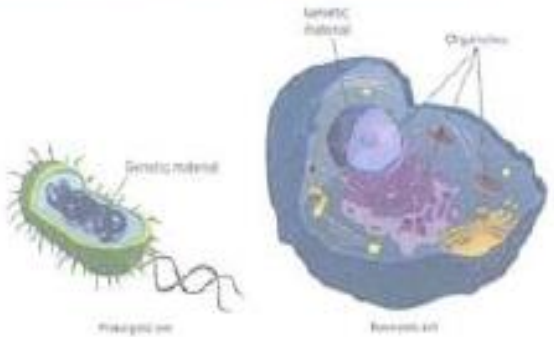
D) Only eukaryotic cells have their genetic material surrounded by a lining.

7	Compare prokaryotic and eukaryotic cells	textbook, figures	23, 24

MCQ - الأسئلة الموضوعية

Question	4

The figure below represents the Prokaryotic and Eukaryotic cells.
Use the table below to differentiate between the two cells.



Difference	Prokaryotic	Eukaryotic
Genetic material lining	No lining	Enclosed in a membrane
Cell size	Small	Large
Presence of cell structures	Less organelles	Many organelles

8) Which of these have prokaryotic cells?

- **A)** snails
- **B)** frogs
- **C)** bacteria
- **D)** mice

Correct Answer

C) bacteria

8	Calculate the surface area and volume if a cell were cube-shaped	textbook, figure, table	36, 37

MCQ - الأسئلة الموضوعية

How does cell size affect the transport of materials?

Nutrients, oxygen, and other materials enter and leave a cell through the cell membrane. Does the size of a cell affect the transport of these materials throughout the cell? Let's investigate!

INVESTIGATION

Cell Size and Transport of Materials

Watch the demonstration.

1. Use colored pencils to illustrate the two samples you observed in the demonstration. How does the depth of the color compare on the two cubes?

Answers may vary. Students should draw two different-sized cubes, preferably with measurements, and note how deeply the dye penetrates the egg white. The color should reach farther into the small cube than into the large cube.

2. Write a question you have about a variable that affects how far the dye travels through the cubes.

Answers may vary. Sample answer: Does the dye travel faster through smaller cubes?

MATH Connection A ratio is a comparison of two numbers, such as surface area and volume. If a cell were cube-shaped, you would calculate surface area by multiplying its length (ℓ) by its width (w) by the number of sides (6).

You would calculate the volume of the cell by multiplying its length (ℓ) by its width (w) by its height (h). To find the surface-area-to-volume ratio of the cell, divide its surface area by its volume.

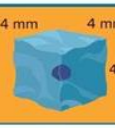
$$\text{Surface area} = \ell \times w \times 6$$

$$\text{Volume} = \ell \times w \times h$$

$$\frac{\text{Surface area}}{\text{Volume}}$$

In the table on the next page, surface-area-to-volume ratios are calculated for cells that are 1 mm and 4 mm per side. Notice how the ratios change as the cell's size increases.

3. Fill in the missing parts of the table in the blue boxes below.

		
Length	1 mm	4 mm
Width	1 mm	4 mm
Height	1 mm	4 mm
Number of Sides	6	6
Surface Area ($\ell \times w \times$ no. of sides)	1 mm × 1 mm × 6 = 6 mm^2	4 mm × 4 mm × 6 = 96 mm^2
Volume ($\ell \times w \times h$)	1 mm × 1 mm × 1 mm = 1 mm^3	4 mm × 4 mm × 4 mm = 64 mm^3
Surface-area-to-volume ratio	$\frac{6\ mm^2}{1\ mm^3} = \frac{6}{1}$ or 6 :1	$\frac{96\ mm^2}{64\ mm^3} = \frac{1.5}{1}$ or 1.5:1

4. Would a cell with a small surface-area-to-volume ratio be able to transport nutrients and waste through the cell as efficiently as a cell with a large surface-area-to-volume ratio? Explain why or why not.

Sample answer: The cell with a small surface-area-to-volume ratio would not be able to transport materials as efficiently as a cell with a large surface-area-to-volume ratio. In the demonstration, the dye moved farther into the smaller cube because it had a larger surface area to transport materials through compared to its volume.

Surface Area and Volume The movement of nutrients, waste material, and other substances into and out of a cell is important for survival. For this movement to happen, the area of the cell membrane must be large compared to its volume. The area of the cell membrane is the cell's surface area. The volume is the amount of space inside the cell. As a cell grows, both its volume and its surface area increase. The volume of a cell increases faster than its surface area. If a cell were to keep growing, it would need large amounts of nutrients and would produce large amounts of waste material. However, the surface area of the cell's membrane would be too small to move enough nutrients and wastes through it for the cell to survive.

8	Calculate the surface area and volume if a cell were cube-shaped	textbook, figure, table	36, 37

MCQ - الأسئلة الموضوعية

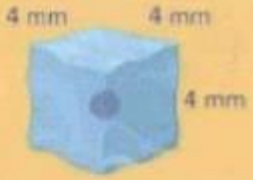
MATH Connection Which statement could you use to construct an explanation for why it is important for a cell's surface-area-to-volume ratio to not be too small?

A Wastes and nutrients need to move through the membrane.

B If a cell's surface-area-to-volume ratio was too small, the cell would starve.

C If a cell's surface-area-to-volume ratio was too small, the cell would not produce enough waste material.

D If a cell's surface-area-to-volume ratio was too small, the organelles would grow too large to fit within the cell.

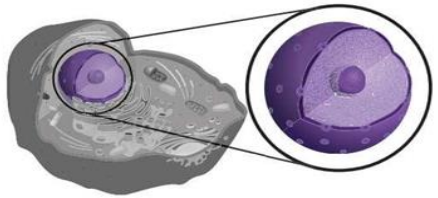
	
Length	4 mm
Width	4 mm
Height	4 mm
Number of Sides	6
Surface Area ($\ell \times w \times$ no. of sides)	4*4*6=96
Volume ($\ell \times w \times h$)	4*4*4= 64
Surface-area-to-volume ratio	96/64=1.5

9	Relate between the shape of a cell and its function	textbook, figures, 3D	41, 44

MCQ - الأسئلة الموضوعية

What controls all of this activity?

The largest organelle inside most eukaryotic cells is the nucleus. The **nucleus** is the part of a eukaryotic cell that directs cell activities and contains important cellular information stored in DNA. DNA is organized into structures called chromosomes. The DNA of each cell carries information that provides instructions for making all the proteins a cell requires.



In addition to chromosomes, the nucleus contains proteins and an organelle called the nucleolus (new KLEE uh lus). The nucleolus makes ribosomes, organelles that are involved in the production of proteins. The nucleus controls all cell activity by directing protein synthesis. Proteins are needed for almost every function in the body.

THREE-DIMENSIONAL THINKING

Can you think of some analogies for the nucleus? Use the space below to make a drawing, diagram, or other illustration to help you understand the **structure and function** of the nucleus.

Answers may vary. Students should illustrate analogies that depict the nucleus as the prime director of activity in the cell.

COLLECT EVIDENCE

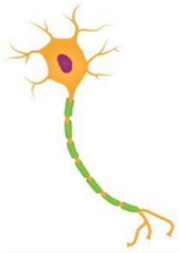
What controls a cell? Record your evidence (C) in the chart at the beginning of the lesson.

What can different cells do?

You might recall from Lesson 1 that all living things are made up of one or more cells. Multicellular organisms have different types of cells with different functions that enable the survival of the entire organism. Cells come in many shapes and sizes. Explore how the structure of a cell relates to what it does.

THREE-DIMENSIONAL THINKING

The **structure** of a cell relates to its job, or **function.** Use the table below to infer a cell's function based on its shape.

	Answers may vary. Sample answer: The red color, in addition to the small size and disk shape, leads me to believe that these cells are related to blood.
	Answers may vary. Sample answer: The tube shape makes me think that this cell carries something.
	Answers may vary. Sample answer: The net-like head has many tendrils, which may connect to other cells. This may carry information.

Types of Cells and Structures Cells in the body can be incredibly diverse, as you just saw. Red blood cells are disk-shaped, which helps them move through blood vessels so that they can carry oxygen throughout the body. Xylem cells are tubelike cells that transport water from the roots to the leaves of plants. The neuron is a cell found in many animals that transmits impulses from different parts of the body. Each cell is unique but works with other cells as body functions are carried out.

9	Relate between the shape of a cell and its function	textbook, figures, 3D	41, 44

MCQ - الأسئلة الموضوعية

Question	6

Use the table below to infer the cell function based on its shape.
Write in the table below the cell name and the correspondent function.

The cell shape	The name of the cell	Function
	Red blood cells	Carry oxygen in the blood.
	Xylem cells in the plants	Transport water and nutrients in the plants
	Neuron	Transmits information from and to brain.

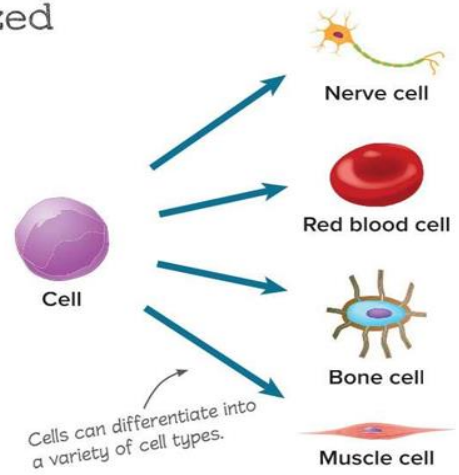
10	Order the levels of organization in the human body from cells to --> organisms	textbook, figures, 3Ds	62, 63, 64, 68, 73

MCQ - الأسئلة الموضوعية

How are cells organized in the body?

Organisms can be unicellular—made of one cell, or multicellular—made of more than one cell. You've learned that your own body has trillions of cells! Multicellular organisms have different types of cells that each perform a specific job.

As multicellular organisms grow, cells divide to produce new cells. The first cells made can become any type of cell, such as a muscle cell, a nerve cell, or a blood cell, through the process of **cell differentiation.** As the number of cells in an organism increases, similar types of cells are organized into groups.



INVESTIGATION

When Cells Get Together

1. Look at the cells provided by your teacher. What type of cell do you think each is? What do you think each cell does?

Answers may vary. Do not expect students to determine the correct answer. Students should be encouraged to speculate. Sample answer: The red cell is a blood cell. We think it transfers nutrients to parts of the body.

2. What larger part of the body do you think cells make up?

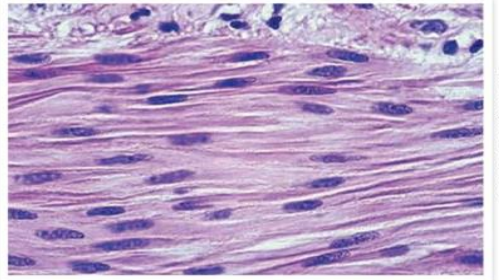
Answers will vary. Students may identify tissues or organs.

Want more information?
Go online to read more about levels of organization in organisms.

FOLDABLES
Go to the Foldables® library to make a Foldable® that will help you take notes while reading this lesson.

Tissues Cells group together to form tissues. **Tissues** are groups of similar types of cells that work together to carry out specific tasks. Humans, like most other animals, have four main types of tissue—muscle, connective, nervous, and epithelial (eh puh THEE lee ul). Muscle tissue, shown in the photo to the right, causes movement. Connective tissue provides structure and support and often connects other types of tissue together. Nervous tissue carries messages to and from the brain. Epithelial tissue forms the protective outer layer of the skin and the lining of major organs and internal body cavities.

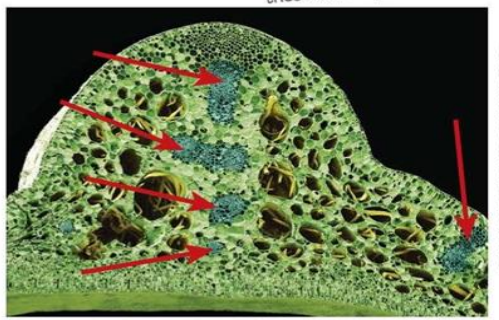
Plants also have different types of tissues. The three main types of plant tissue are dermal, vascular (VAS kyuh lur), and ground tissue. Dermal tissue provides protection and helps reduce water loss. Vascular tissue, shown in the photo to the right, transports water and nutrients from one part of a plant to another. Ground tissue provides storage and support and is where photosynthesis takes place.



LM Magnification: 250×

This muscle tissue contracts the stomach to help digestion.

What do you think these dark spots are?



Color-Enhanced SEM Magnification: 30×

Plant vascular tissue, indicated by arrows, moves water and nutrients throughout a plant.

THREE-DIMENSIONAL THINKING

WRITING Connection Write an **argument** that **explains** which human tissue is most similar in **function** to dermal tissue in plants.

Sample answer: Dermal tissue in plants is similar to epithelial tissue in humans because they both provide protection.

COLLECT EVIDENCE

How are cells grouped together in an organism to form a larger system within the body, similar to the way dots in pointillism art are organized? Record your evidence (A) in the chart at the beginning of the lesson.

10	Order the levels of organization in the human body from cells to --> organisms	textbook, figures, 3Ds	62, 63, 64, 68, 73

Match the description to the correct type of Plant Tissue

Description	Tissue Type
A tissue that provides storage and support and is where photosynthesis take place	Ground tissue
A tissue that transports water and nutrients from one part to another (phloem-xylem)	Vascular tissue
A tissue that provides protection and help reduce water loss	Dermal tissue

10	Order the levels of organization in the human body from cells to --> organisms	textbook, figures, 3Ds	62, 63, 64, 68, 73

MCQ - الأسئلة الموضوعية

SCIENCE & SOCIETY

Bone Marrow Transplants

Why might you need new bone marrow?

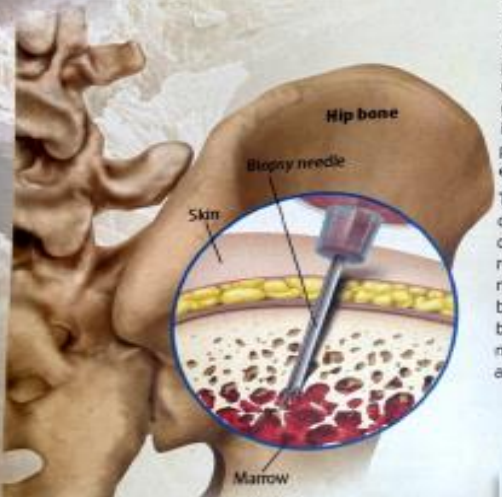
Healthy blood cells are essential to overall health. Red blood cells carry oxygen throughout the body. Some white blood cells fight infections. Platelets help stop bleeding. A bone marrow transplant is sometimes necessary when a disease interferes with the body's ability to produce healthy blood cells.

Bone marrow is a tissue found inside some of the bones in your body. Healthy bone marrow contains cells that can develop into white blood cells, red blood cells, or platelets. Some diseases, such as leukemia and sickle cell disease, affect bone marrow. Replacing malfunctioning bone marrow with healthy bone marrow can help treat these diseases.

▲ In healthy bone marrow, a stem cell can develop into different types of blood cells.

A bone marrow transplant involves several steps. The patient receiving the bone marrow must have treatments to destroy his or her unhealthy bone marrow. Healthy bone marrow must be obtained for the transplant. Sometimes, the patient's own bone marrow can be treated and used for transplant. This transplant has the greatest chance of success. Other transplants involve healthy bone marrow donated by another person. The bone marrow must be tested to ensure that it is a good match for the patient.

The bone marrow donor undergoes a procedure called harvesting. Bone marrow is taken from the donor's pelvic, or hip, bone. The donor's body replaces the harvested bone marrow, so there are no long-term effects for the donor. The donated bone marrow is introduced into the patient's bloodstream. If the transplant is successful, the new bone marrow moves into the bone cavities and begins producing healthy blood cells.



▲ Bone marrow is harvested from the pelvic bone. An anesthetic is used to keep the donor from feeling pain during the procedure.

It's Your Turn

Research and Report Find out more about bone marrow transplants. What other diseases can be treated using a bone marrow transplant? What is the National Marrow Donor Program? Present your findings to your class.

Organ Systems Usually organs do not function alone. Instead, **organ systems** are groups of different organs that work together to complete a series of tasks. For example, the human digestive system is made of many organs, including the stomach, the small intestine, the liver, and the large intestine. These organs and others all work together to break down food and take it into the body.

Plants have two major organ systems—the shoot system and the root system. The shoot system includes leaves, stems, and flowers. Food and water are transported throughout the plant by the shoot system. The root system anchors the plant and takes in water and nutrients.

COLLECT EVIDENCE

How are organs grouped together in an organism to form a larger system within the body, similar to the way dots in pointillism art are organized? Record your evidence (C) in the chart at the beginning of the lesson.

How are organ systems organized in the body?

In a multicellular organism, similar cells work together and make a tissue. Tissues are organized into organs, and organs are organized into organ systems which work together to keep an organism functioning. How can you model the levels of organization in an organism?

LAB Organism Organization

Safety

Materials

cardboard shape
permanent marker
tape
macaroni
glue

Procedure

1. Read and complete a lab safety form.
2. Your teacher will give you a cardboard shape, macaroni, and a permanent marker.

10	Order the levels of organization in the human body from cells to --> organisms	textbook, figures, 3Ds	62, 63, 64, 68, 73

MCQ - الأسئلة الموضوعية

Three-Dimensional Thinking

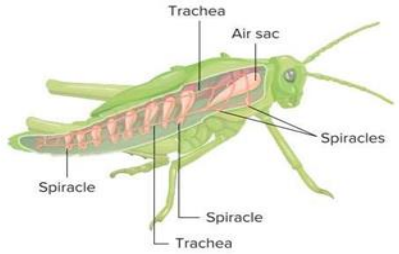
Cade is making a presentation on the way systems are organized in plants and animals for his science class. He prepared this flowchart to illustrate his presentation.

Organs → Tissues → Cells → Organ Systems → Organisms

2. After further study, Cade realized his flowchart was incorrect. Which change should he make to correct the flowchart?

A add the phrase *Cell Membranes*
B move *Organ Systems* to the beginning
C remove *Tissues* and *Cells*
switch *Organs* and *Cells*

The diagram shows the structures involved in respiration for a grasshopper.



3. These structures are an example of which level of organization within an organism?

A The structures make up an organelle.
The structures make up an organ system.
C The structures make up a specialized cell.
D The structures make up a tissue.

Picture	Term	Definition
	Tissue	Basic unit of structure and function in an organism
	Cell	Two or more tissue working together to perform a task
	Organ system	A group of cells that work together to perform a task
	Organ	A living thing
	Organism	Organs that work together to perform a task

MCQ - الأسئلة الموضوعية

Which of the following represents the right combination of a tissue and its function?

A. Muscle tissue, movement
B. Tendon connective tissue, digestion
C. Skin epithelial tissue, respiration
D. Nervous tissue, the lining of the internal body cavities

Which of the following represents a group of similar type of cells that work out together?

A. Tissue
B. Organ
C. Organ system
D. organism

Groups of cells work together as tissue. Groups of tissues form organ systems.

- True
- False

ans

A group of organs that work together to perform a specific task is called a(n) _____.

- **A)** cell system
- **B)** tissue system
- **C)** organ system
- **D)** organ vessel

ans

An organ _____ is a group of organs that work together to do a job.

system

What makes up tissue?

ans

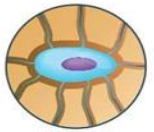
- **A)** a group of cells
- **B)** a group of muscles
- **C)** a group of organs
- **D)** a group of organ systems

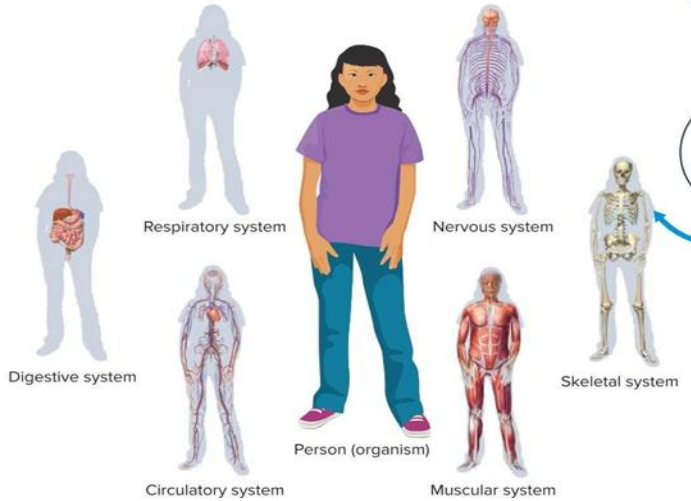
11	Investigate the importance of organ systems working together and Give the name of the organ system in figures	textbook, figures	70

MCQ - الأسئلة الموضوعية

Organisms Multicellular organisms usually have many organ systems. These systems work together to carry out all the jobs needed for the survival of the organisms. For example, the cells in the leaves and the stems of a plant need water to live. They cannot absorb water directly. Water diffuses into the roots and is transported through the stem to the leaves by the shoot, or transport, system.

In the human body, there are many major organ systems. Each organ system depends on the others and cannot work alone. For example, the cells in the muscle tissue of the stomach cannot survive without oxygen. The stomach cannot get oxygen without working together with the respiratory and circulatory systems.



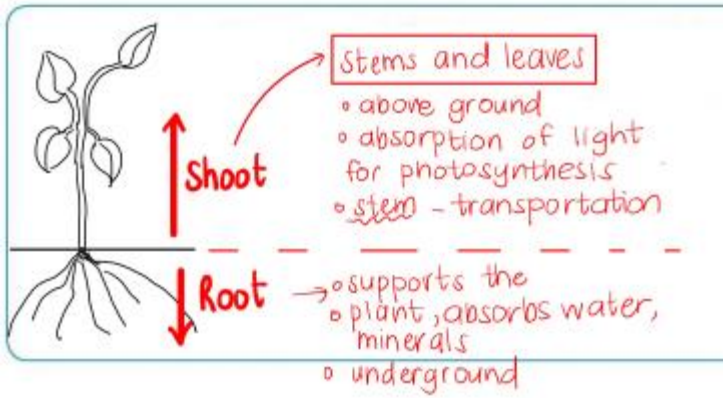


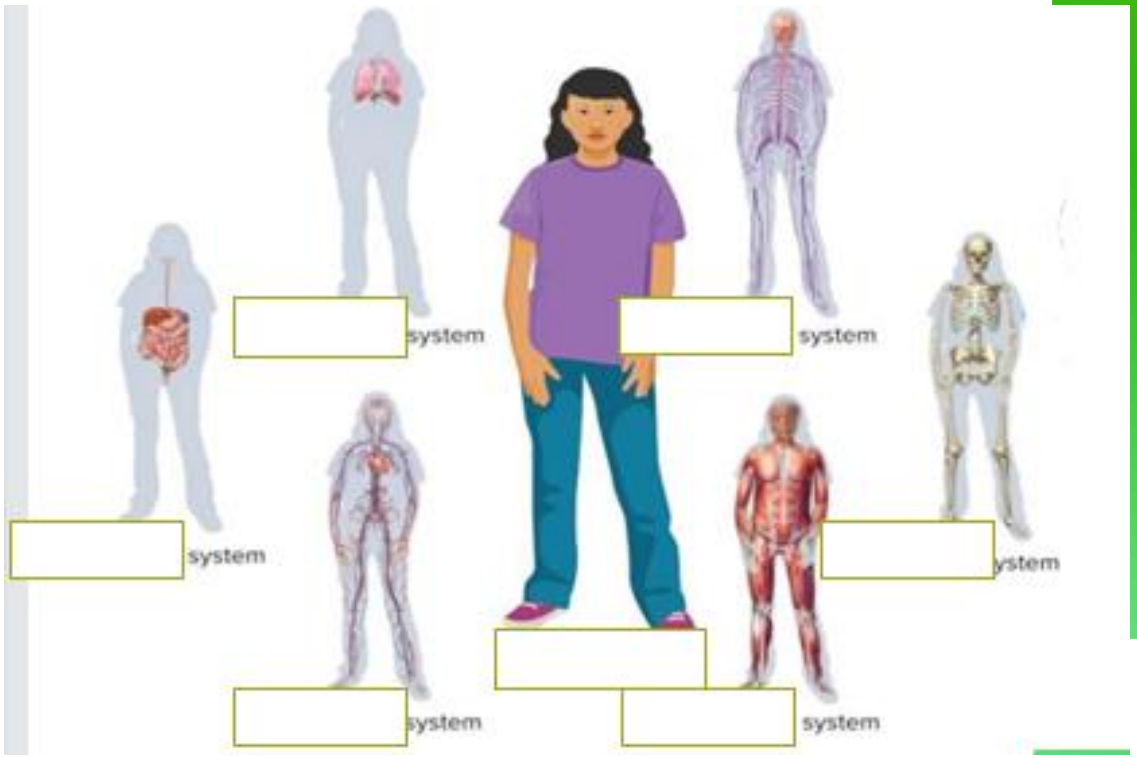
COLLECT EVIDENCE

How are organ systems grouped together to form a larger system, similar to the way dots in pointillism art are organized? Record your evidence (D) in the chart at the beginning of the lesson.

THREE-DIMENSIONAL THINKING

Explain the difference in **scale, proportion, and quantity** in the **systems** and subsystems that make up the levels of organization in organisms. Record your response in your Science Notebook.





12	Describe how the muscles, bones, and joints work together to support a body and enables it to move	textbook, figures, table, 3D	80, 81

MCQ - الأسئلة الموضوعية

What supports a body and enables it to move?

You probably have already learned that you need muscles in order to move. At the beginning of the lesson, you saw a girl support the weight of her body with just her arms by using her muscles. How do muscles work?

A **muscle** is made of strong tissue that can contract in an orderly way. When a muscle contracts, the cells of the muscle become shorter. When the muscle relaxes, the cells return to their original length.

You might recall that mitochondria are the main energy producers in a cell. Because so much energy is required for muscle function, muscle cells are packed with mitochondria.

Muscles allow for movement of the body, but they do not work alone. Brainstorm and write or illustrate what other systems help the body move.

THREE-DIMENSIONAL THINKING

Muscles allow for movement of the body, but they do not work alone. Brainstorm and write or illustrate to **explain** how other **systems** help the body move.

Answers may vary. Students do not need to have the correct answers at this point. Sample answer: When muscles move, they move the bones that are attached to them. The nervous system controls this movement and the circulatory system provides oxygen for energy.

Muscles enable the body to move, but cannot function without the support of bones. Bones can move because they are attached to muscles. The skeletal system and the muscular system work together and move your body.

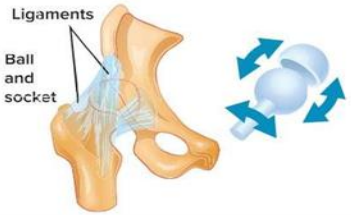
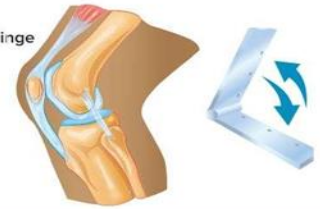
Want more information?
Go online to read more about body systems that provide structure and support.

FOLDABLES
Go to the Foldables® library to make a Foldable® that will help you take notes while reading this lesson.

Joints Your bones work together at places called joints. A **joint** is where two or more bones meet. Joints provide flexibility and movement, like you saw with the girl doing a handstand at the start of the lesson. Bones are connected to other bones by tissues called **ligaments.** When the bones in joints move, ligaments stretch and keep the bones from shifting away from each other.

PHYSICAL SCIENCE › Connection Your arms and legs may not seem like machines, but in fact they are. When muscles pull on bones they act like a simple machine called a lever. Levers rotate about a fixed point, which in your body are the joints. Three different types of joints enable movement—ball and socket, hinge, and pivot joints. Examine the different joints in the table.

Types of Movable Joints

Joint	Description	Example
	allows bones to move and rotate in nearly all directions	hips and shoulder
	allows bones to move back and forth in a single direction	fingers, elbows, knees
	allows bones to turn	neck, lower arm below the elbow

13	Compare between skeletal muscles, cardiac muscle, and smooth muscles	textbook, table	88, 89

MCQ - الأسئلة الموضوعية

Data and Observations

Observations of Three Types of Muscle Cells			
Cell Characteristics	Skeletal	Cardiac	Smooth
Shape and color	Students should use this space to record their observations.		
Nucleus location and number			
Arrangement patterns			

Analyze and Conclude

8. How do the characteristics of each cell type differ?

Answers may vary. Sample answer: Skeletal muscle cells are long and thin with multiple nuclei peripherally located and "stripes" (striations) in the tissue; smooth muscles cells are thin with single central nuclei; cardiac muscle cells are clustered with central nuclei.

9. Based on your observations of the structure of each type of cell, can you infer any of their functions?

Answers may vary. Sample answer: Multiple nuclei could help skeletal muscles contract faster.

You just examined three types of muscle cells. Read about each type to learn more!

Skeletal Muscle The type of muscle that attaches to bones is skeletal muscle. Skeletal muscles are also called voluntary muscles, which are muscles that you can consciously control. The contractions of skeletal muscles can be quick and powerful, such as when you run fast.

Cardiac Muscle Your heart is made of **cardiac muscles,** which are found only in the heart. A cardiac muscle is a type of involuntary muscle, which is muscle you cannot consciously control. When cardiac muscles contract and relax, they pump blood through your heart and through blood vessels throughout your body.

Smooth Muscle Blood vessels and many organs, such as the stomach, are lined with smooth muscles. **Smooth muscles** are involuntary muscles named for their smooth appearance.

What systems do plants have that give them structure and support?

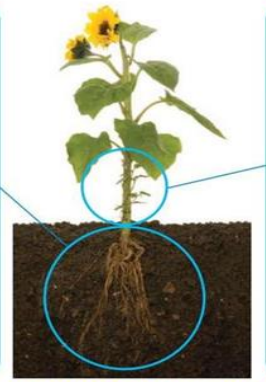
Many animals use muscles to move while bones offer support and structure. Do plants have similar structures that give them support?

INVESTIGATION

Plant Posture

Take a look at the image of plant structures below. Use what you know about animal bodies to infer how the indicated structures support the plant.

Answers may vary. Students should infer that the roots of the plant keep the plant in place.



Answers may vary. Students should infer that the stem is like the skeleton of the plant that holds it upright and gives it support.

13	Compare between skeletal muscles, cardiac muscle, and smooth muscles	textbook, table	88, 89

MCQ - الأسئلة الموضوعية

Question	1

The graph below represents the three types of muscles. Fill in the blanks with the correct name of each muscle.

Cardiac muscle

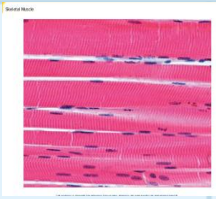
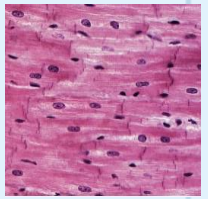
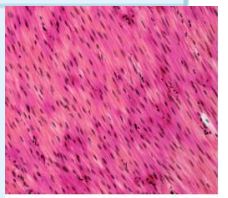
Skeletal muscle

Smooth muscle

13	Compare between skeletal muscles, cardiac muscle, and smooth muscles	textbook, table	88, 89

MCQ - الأسئلة الموضوعية

Observations of Three Types of Muscle Cells

Cell Characteristics	Skeletal 	Cardiac 	Smooth 
Shape	Pink and has a tubic shape	Pink and has a net shape	Pink and has an eye shape
Nucleus location and number	Found in every cell	found in every cell	found in every cell
Arrangement patterns	Layers	Topped on each other	sheet

14	Relate the human support system to the plants', and compare and contrast between them	textbook, figures, table, 3D	90, 91, 92

MCQ - الأسئلة الموضوعية

Roots Even though the roots of most plants are never seen, they are vital to a plant's survival. Roots anchor a plant, either in soil or onto another plant or an object such as a rock. All roots help a plant stay upright. Some plants have roots that spread out in all directions several meters from a plant's stem. All root systems help a plant absorb water and other substances from the soil.

Many plants have a large main root, called a taproot, with smaller roots growing from it. Some plants have additional small roots above ground, called prop roots, that help support the plant. Other plants have fibrous root systems that consist of many small branching roots.

Taproot

Prop Roots

Fibrous Roots

Plants such as radishes and carrots store food in their roots. This food can be used to grow new plant tissues after a dry period or a cold season. Sugar stored in the roots of sugar maple trees over the winter is converted to maple sap in the spring. Farmers drain some of the sap from these trees and boil it to make maple syrup.

INVESTIGATION

Putting Down Roots

Research a plant in your local environment and determine the type of root system it has. Write about how its root system benefits the whole plant.

Answers may vary. Students should find a local plant with one of the three root types covered. They should explain where the plant can be found and how the root system helps the plant survive by absorbing water and nutrients.

Stems Have you ever leaned against a tree? If so, you were leaning on a plant stem. In plants such as the tree, the stem is obvious. Other plants, such as the potato and the iris, have underground stems that are often mistaken for roots.

Stems support branches and leaves. Their tissues transport water, minerals, and food. The sugar produced during photosynthesis flows through the stem to all parts of a plant. Another important function of stems is the production of new cells for growth, but only certain regions of a stem produce new cells.

Plant stems usually are classified as either herbaceous or woody. Woody stems are stiff and typically not green. Trees and shrubs have woody stems. Herbaceous stems usually are soft and green.

THREE-DIMENSIONAL THINKING

Examine the image and determine which plant has a woody stem **structure** and which has an herbaceous stem **structure**. **Explain** your reasoning.

Answers may vary. Sample answer: The tree has a woody stem because it is rigid and not green. The vine has an herbaceous stem because it is green and flexible.

COLLECT EVIDENCE

How do systems provide plants with structure and support? Record your evidence (C) in the chart at the beginning of the lesson.

14	Relate the human support system to the plants', and compare and contrast between them	textbook, figures, table, 3D	90, 91, 92

MCQ - الأسئلة الموضوعية

THREE-DIMENSIONAL THINKING

Use the space below to compare and contrast the **systems** that provide **structure** and support in plants and animals.

Plant

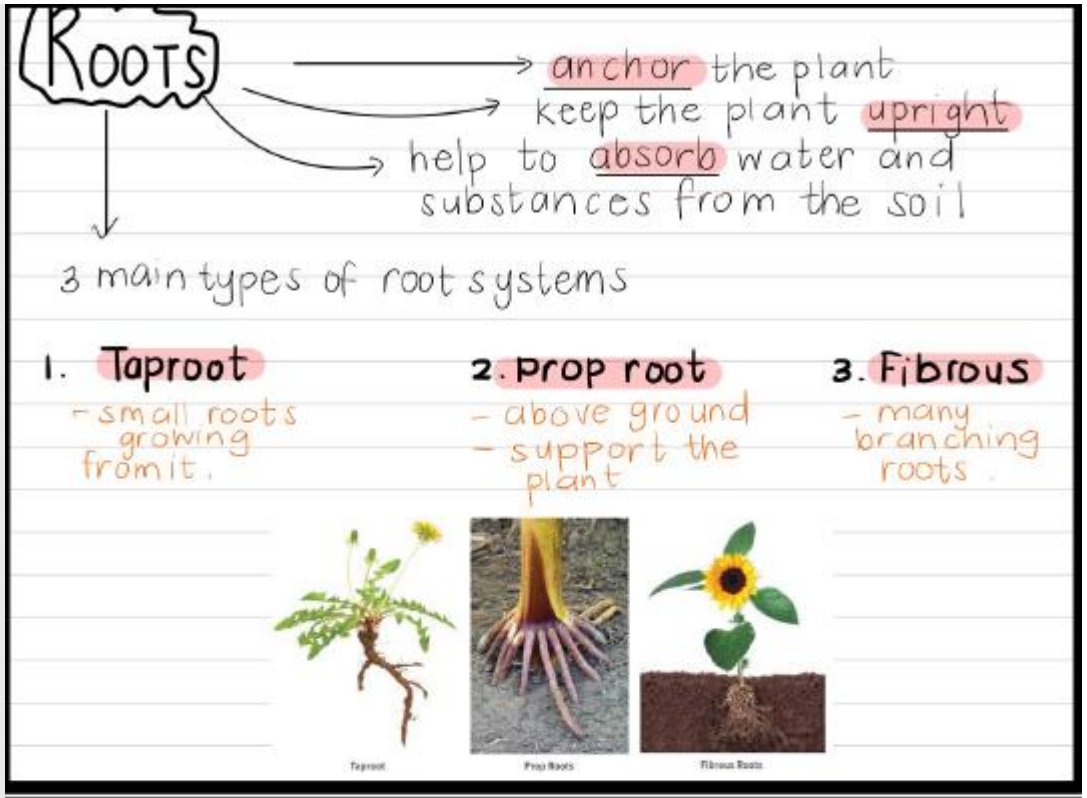
Plants have stems and roots that give them structure and support.

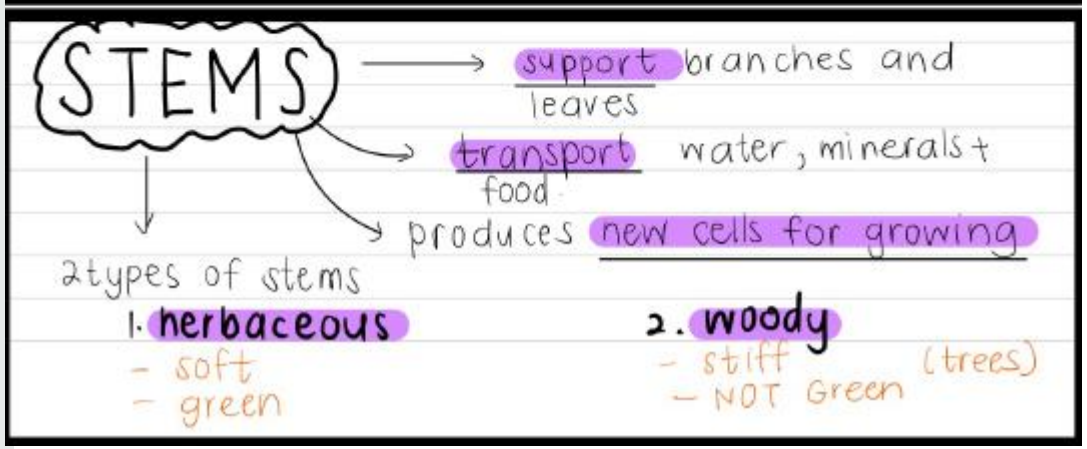
Both

Both plants and animals are made up of cells and tissues. They each have structures for support.

Animals have muscles and bones to keep them supported. Muscles and bones help animals move as well.

Animal





15	Define Calorie and nutrients, and explain how energy from food powers the organisms body	Textbook, investigations	102, 103, 104

MCQ - الأسئلة الموضوعية

Why do organisms eat?

How do you decide what to eat or when to eat? Although you can survive for weeks without food, you might become hungry within hours of your last meal. Hunger is your body's way of telling you that it needs food. Why does your body need food?

INVESTIGATION

Learning S'more About Science

Observe your teacher's demonstration.

1. What happened to the water? Why do you think this happened?

Do not expect students to determine the correct answer. Students should be encouraged to speculate. Sample answer: The water boiled because energy was released by the burning marshmallow.

2. What do you think happens to your body when you eat a marshmallow? Why?

Do not expect students to determine the correct answer. Students should be encouraged to speculate. Sample answer: Your body obtains energy by eating the marshmallow.

Energy from Food The amount of energy in food is measured in Calories. A **Calorie** (Cal) is the amount of energy it takes to raise the temperature of 1 kg of water by 1°C. How much energy do foods contain? Each food is different. One grape contains 2 Cal, but a slice of cheese pizza has 220 Cal. All foods give your body energy to use.

Want more information?
Go online to read more about body systems that enable organisms to obtain energy and remove waste.

FOLDABLES
Go to the Foldables® library to make a Foldable® that will help you take notes while reading this lesson.

What does energy from food power?

Every activity you do, such as riding a bike or even sleeping, requires energy. Your digestive system processes food and releases energy that is used for cellular processes and all the activities that you do.

The amount of energy a person needs depends on several factors, such as weight, age, activity level, and gender. Playing soccer, for example, requires more energy than playing a video game. How does the food you eat supply you with energy? The energy comes from nutrients.

INVESTIGATION

Using Energy

List some activities that use energy. Describe the activity and explain what body systems are involved. Then, rank the amount of energy needed for the activities as 1, 2, or 3, with 1 being the activity that requires the most energy.

Activity	Description	Energy Required
Sample answer: Swimming	Swimming involves lots of arm and leg movement, demanding energy to power the muscular system.	1
Walking	Walking requires use of muscles and bones in arms and legs.	2
Painting	You use the bones and muscles in your arms when you paint with a brush.	3

15	Define Calorie and nutrients, and explain how energy from food powers the organisms body	Textbook, investigations	102, 103, 104

MCQ - الأسئلة الموضوعية

What nutrients are in food?

Food provides your body with nutrients and Calories. **Nutrients** are the parts of food used by the body to grow and survive. Each nutrient is important and has its own function in the body.

INVESTIGATION

You Are What You Eat

1. Using the materials provided by your teacher, search for foods that contain a high amount of your assigned nutrient.
2. Your teacher will ask you to find a number of food items containing your nutrient. Find these items.
3. Once you have found the appropriate number of items, form a group with other students who were assigned the same nutrient.
4. As a group, make a chart listing your food items. Show the amount of your assigned nutrient present in each item. Share your chart with the class.
5. Research and explain the function your assigned nutrient has in the body.

Answers may vary. Sample answer: Calcium is a mineral that helps build strong bones and healthy teeth.

6. WRITING Connection Your classmate does not think that it is important to get your nutrient into your diet. Cite specific evidence to support the argument that the body requires your nutrient.

Answers may vary. Sample answer: A vitamin D deficiency could lead to osteoporosis, which makes bones porous and brittle. The American Heart Association thinks there is a link between vitamin D deficiency and heart disease.

Term	Definition	Picture
Calorie (Cal)	is the amount of energy it takes to raise the temperature of 1 kg of water by 1°C.	
Nutrients	Are the parts of food used by the body to grow and survive. There are **six major nutrients** which are: ✓ **Carbohydrates:** ✓ **Proteins** ✓ **Lipids** ✓ **Vitamins** ✓ **Minerals** ✓ **Water**	

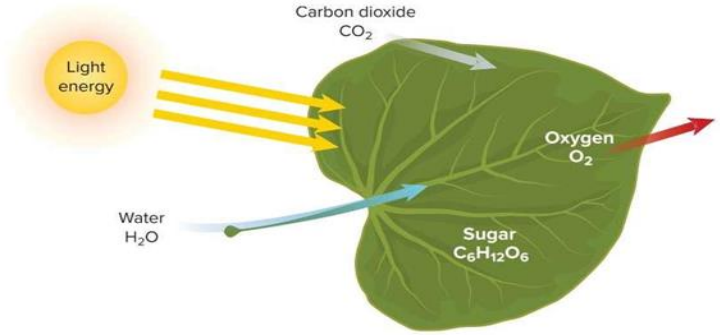
16	Explain how do plant bodies obtain energy and get rid of wastes	textbook, figures, 3D	111

MCQ - الأسئلة الموضوعية

How do plant bodies obtain energy and get rid of waste?

Food, water, and oxygen are three things you need to survive. Some of your organ systems process these materials, and others transport them throughout your body. Like you, plants need food, water, and oxygen to survive. Unlike you, plants do not take in food. Most of them make their own.

Leaves are the major food-producing organs of plants. This means that leaves are the site of photosynthesis (foh toh SIHN thuh sus). **Photosynthesis** is a series of chemical reactions that convert light energy, water, and carbon dioxide into the food-energy molecule glucose and give off oxygen. Glucose moves out of food-making cells, enters a tissue called phloem, and flows to all plant cells. Cells then break down the sugar and release energy.



Like animal bodies, plants also require water to survive. After water enters a plant's roots, it moves into a tissue called xylem. Water then flows inside xylem to all parts of a plant. Like you, plants produce water vapor as a waste product. Carbon dioxide, oxygen, and water vapor pass into and out of a plant through tiny openings in leaves.

THREE-DIMENSIONAL THINKING

In your Science Notebook write an **argument** supported by evidence to support or refute the following claim: I obtain energy in the same way that a plant obtains **energy.**

COLLECT EVIDENCE

How do plants obtain energy? Record your evidence (C) in the chart at the beginning of the lesson.

17	Illustrate how plants transport the materials they need from their environment through their bodies (different parts)	Textbook, figures	120, 121

MCQ - الأسئلة الموضوعية

How do plants transport materials?

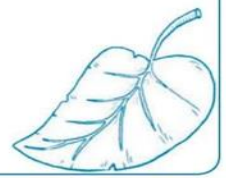
The flower you observed transported dyed water from the glass to its leaves. How do plants transport the materials they need from their environment through their bodies?

INVESTIGATION

Turning Over a New Leaf

Collect a fresh leaf, place it in a bowl of water, and place the bowl in sunlight. Wait 30 minutes, then observe the leaf. Describe or illustrate your observations below. Why do you think this is happening?

Answers may vary. Sample answer: The leaf is floating and small bubbles are forming on the leaf. I think this is happening because the plant is producing air.



Want more information?
Go online to read more about body systems that transport materials.

FOLDABLES
Go to the Foldables® library to make a Foldable® that will help you take notes while reading this lesson.

Moving Materials Inside Plants You just observed parts of plants transporting materials. How does an entire plant work together as a system to transport materials?

For a plant to survive, water and nutrients must move throughout its tissues. In some plants, these materials can move from cell to cell by the processes of osmosis and diffusion. This means that water and other materials move from areas of high concentration to areas of low concentration. However, most plants such as grasses and trees have specialized tissues in their stems called vascular tissue. **Vascular tissue** is specialized plant tissue composed of tubelike cells that transport water and nutrients in some plants.

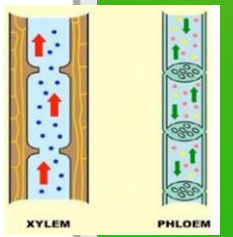
One type of vascular tissue—**xylem** (ZI lum)—carries water and dissolved nutrients from the roots to the stem and the leaves. Due to the thickened cell walls of some xylem cells, this tissue also provides support for a plant. Another type of vascular tissue—**phloem** (FLOH em)—carries dissolved sugars throughout a plant.

After water enters a plant's roots, it moves into xylem. Water then flows inside xylem to all parts of a plant. Most plants make their own food—a liquid sugar. The liquid sugar moves out of food-making cells, enters phloem, and flows to all plant cells.

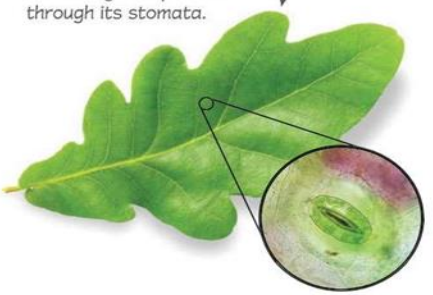
Carbon dioxide, oxygen, and water vapor pass into and out of a plant through small openings in the epidermis, or surface layer, of a leaf called **stomata** (STOH ma tah; singular, stoma). A stoma is shown in the figure to the right. Plants require oxygen and carbon dioxide to make food. Like you, plants produce water vapor as a waste product. This process is called transpiration.

Vascular tissue is found in the roots and stems of trees.

Xylem	Phloem
Carries water and dissolved nutrients	Carries dissolved sugars (glucose)
Move one way-from root to stem to leaves	Move two ways-from leaves to all plant cells



Bubbles formed on the leaf in the investigation on the previous page because gases passed through its stomata.



LM Magnification: Unavailable

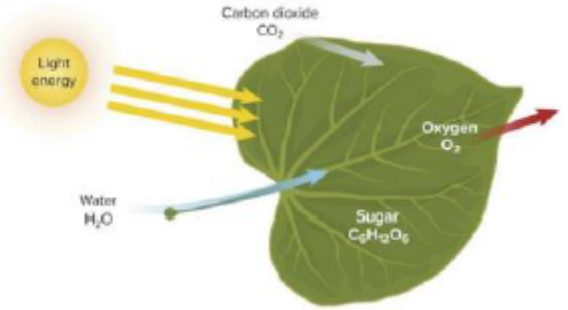
COLLECT EVIDENCE

How do plants, such as the flowers at the beginning of the lesson, transport materials? Record your evidence (A) in the chart at the beginning of the lesson.

17	Illustrate how plants transport the materials they need from their environment through their bodies (different parts)	Textbook, figures	120, 121

5. The diagram below models the process of photosynthesis in the plant leaves. Which of them takes glucose to all plant cells?

A. Phloem
B. Xylem
C. Ground tissue
D. Dermal tissue



18	Explain how blood is transported throughout the body, and list the circulatory system parts and their function	Textbook, figures, 3D	125, 126, 135

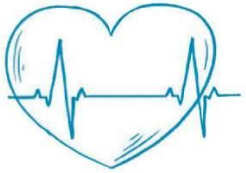
MCQ - الأسئلة الموضوعية

How is blood transported throughout the body?

Humans require oxygen to survive. All the cells in your body use oxygen to help process the energy in nutrients into energy that cells can use. You've learned that your lungs take in oxygen, and then oxygen moves into your blood. How does the oxygen in your blood get to the rest of your body?

INVESTIGATION

In a Heartbeat



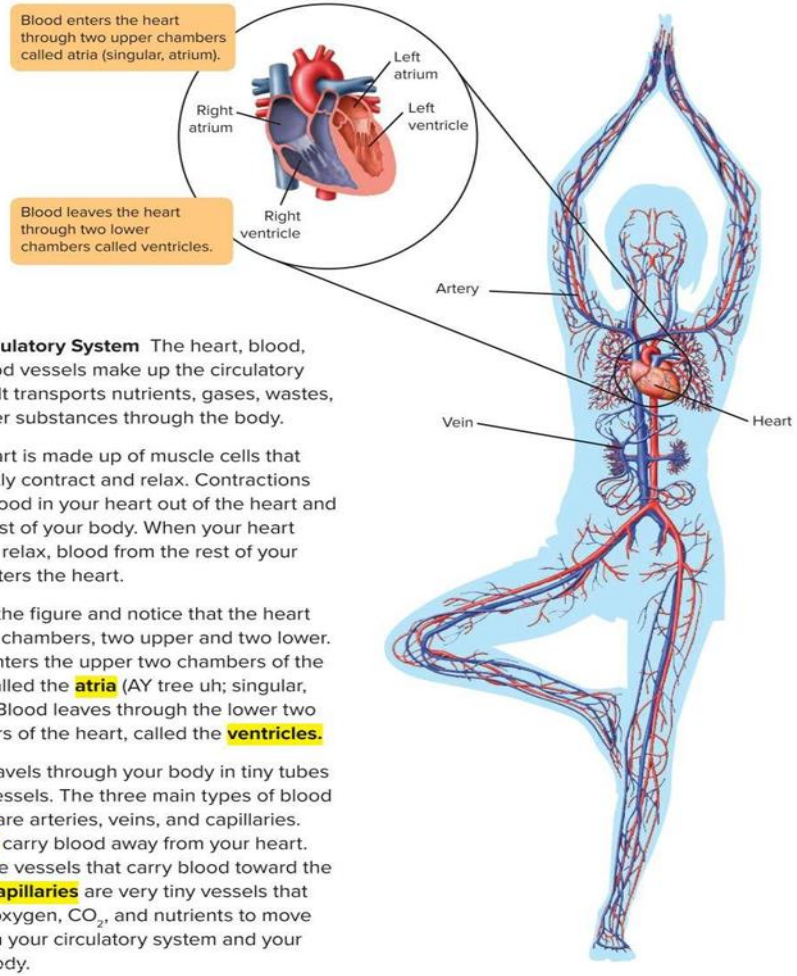
1. Sit quietly for 1 minute.
2. Feel your pulse by placing the middle and index fingers of one hand on an artery in your neck or an artery in your wrist.
3. While sitting quietly, count the number of heartbeats you feel in 30 seconds. Multiply this number by two to calculate your pulse.
4. Record your data in your Science Notebook.
5. Jog in place for 1 minute.
6. Immediately repeat steps 3 and 4.

7. How did your pulse after exercising compare to your resting pulse?

Answers may vary. Sample answer: My pulse rate increased with activity.

8. Why do you think your pulse changed when you exercised?

Answers may vary. Students should be encouraged to speculate. Sample answer: Greater activity requires the heart to pump more oxygen-rich blood to the muscles and to carry away carbon dioxide, which builds up in cells.



The Circulatory System The heart, blood, and blood vessels make up the circulatory system. It transports nutrients, gases, wastes, and other substances through the body.

Your heart is made up of muscle cells that constantly contract and relax. Contractions pump blood in your heart out of the heart and to the rest of your body. When your heart muscles relax, blood from the rest of your body enters the heart.

Look at the figure and notice that the heart has four chambers, two upper and two lower. Blood enters the upper two chambers of the heart, called the **atria** (AY tree uh; singular, atrium). Blood leaves through the lower two chambers of the heart, called the **ventricles.**

Blood travels through your body in tiny tubes called vessels. The three main types of blood vessels are arteries, veins, and capillaries. **Arteries** carry blood away from your heart. **Veins** are vessels that carry blood toward the heart. **Capillaries** are very tiny vessels that enable oxygen, CO_2, and nutrients to move between your circulatory system and your entire body.

COLLECT EVIDENCE

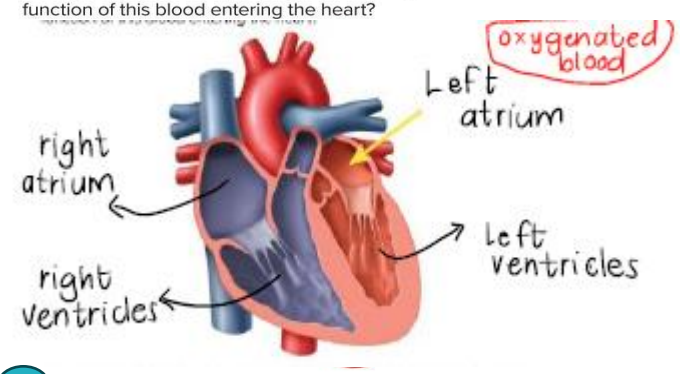
How do humans transport materials? Record your evidence (B) in the chart at the beginning of the lesson.

18	Explain how blood is transported throughout the body, and list the circulatory system parts and their function	Textbook, figures, 3D	125, 126, 135

MCQ - الأسئلة الموضوعية

Three-Dimensional Thinking

2. The arrow in the diagram below shows where blood enters the heart through the atrium after coming from the lungs. Which best describes the function of this blood entering the heart?



- The blood is carrying oxygen that it absorbed as it passed through the lungs.
- **B** The blood is carrying carbon dioxide that it absorbed as it passed through the lungs.
- **C** The blood is carrying nutrients that it absorbed as it passed through the small intestine.
- **D** The blood is carrying capillaries that it absorbed as it passed through the stomach.

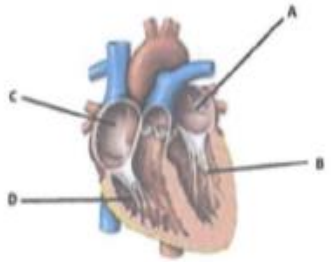
3. Which best explains the function of the alveoli in the respiratory system?

- **A** The alveoli help to keep the lungs healthy by providing a way for all the cells in the lungs to obtain nutrients from the bloodstream.
- **B** The alveoli help to keep the lungs inflated when you breathe out and make it possible to absorb oxygen when you breathe in.
- The alveoli provide a large surface area for absorbing oxygen from the air and releasing carbon dioxide wastes from the bloodstream.
- **D** The alveoli provide a large surface area for absorbing oxygen from the air when you breathe in and look like a bunch of grapes.

*****BONUS*****

Question	5

The figure below represents the heart chambers. Study it and answer the following questions:



- Which letter refers to the chamber that receives blood from the lungs?

  What is the function of the received blood?

  .....

  .....

- Which type of circulatory system does human have; Open or Closed system?

  Explain your answer. .....

  .....

  .....

Which of the parts of the circulatory system brings blood from a part of the body to the heart?

- **A)** arteriesa
- **B)** capillaries
- **C)** arterioles
- **D)** veins

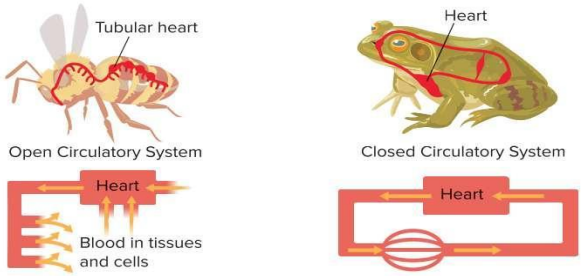
ans

19	Compare open circulatory system with closed circulatory system	textbook, investigation, graphs, 3D	132

MCQ - الأسئلة الموضوعية

How do other animals transport blood throughout their bodies?

Different animals have different circulatory systems. The type of circulatory system used often determines how quickly blood moves through the animal.



Open Circulatory Systems Many invertebrates such as the bee shown in the figure above have open circulatory systems. An **open circulatory system** is a system that transports blood and other fluids into open spaces that surround organs in the body. In an open circulatory system oxygen and nutrients in blood can enter all tissues and cells directly.

Closed Circulatory Systems Some animals transport materials through a system called a closed circulatory system. A **closed circulatory system** is a system that transports materials through blood using vessels. Vessels help animals with closed circulatory systems move blood and other substances through the body faster than an open circulartory system. Small blood vessels called capillaries surround organs and help oxygen and nutrients move from the circulatory system to cells in organs.

Chambered Hearts Different animals have hearts with different numbers of compartments called chambers. Fish have hearts with two chambers, whereas amphibian hearts consist of three chambers. Birds and mammals such as cats, dogs, and humans have hearts with four chambers. Almost all animals with three or four chambered hearts have lungs.

COLLECT EVIDENCE

How do other animals transport materials? Record your evidence (C) in the chart at the beginning of the lesson.

OPEN

- open spaces
- can enter all tissues and cells directly

CLOSED

- blood vessels
- moves faster through the body
- capillaries surround organs

20	Explain how the human eye sees and the parts in it and their function	textbook, investigation, tables, figure, 3D	155, 158, 163

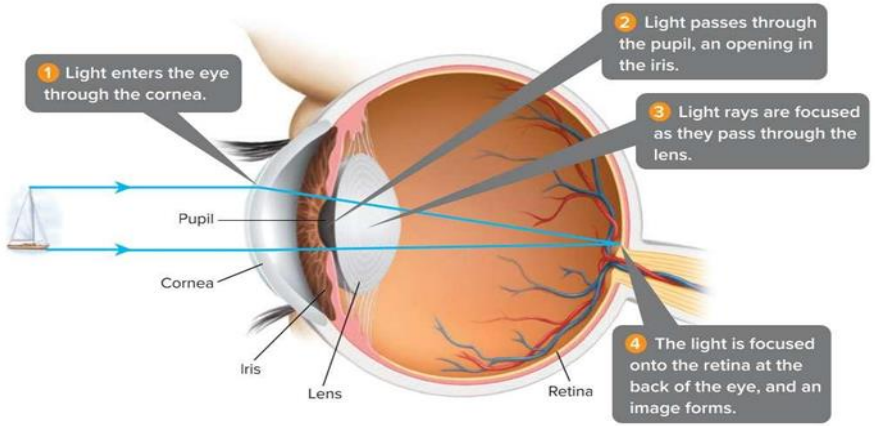
MCQ - الأسئلة الموضوعية

Part of the eye	Function
Cornea	protects the eye
Iris	controls the size of the pupil
Pupil	allows light to enter the eye
Lens	fine tunes the focus so an image forms on the back of the eye
Retina	changes images to electric signals
Optic nerve	carries electric signals from the rods and cones to the brain
Ciliary muscle	enables the lens to change shape

4. Decide as a group what materials you will use to build each part of your robot eye. Record your materials in the table below and provide reasoning to support your choices.

Part of the eye	Material	Reasoning
Cornea	Sample answer: plastic	light and durable
Iris	Sample answer: construction paper	durable
Pupil	Sample answer: paper towel roll	light can go through
Lens	Sample answer: magnifying lens	can see far and close distances
Retina	Sample answer: metal	conductive
Optic nerve	Sample answer: chenille stem	conductive, can be light and long
Ciliary muscle	Sample answer: rubber band	can tighten and loosen

Vision The visual system uses photoreceptors in the eye to detect electromagnetic signals—light—and create vision. Light enters the eye through the cornea (KOR nee uh), a thin membrane that protects the eye and changes the direction of light rays. The colored part of your eye is the iris (I rus). After light passes through the cornea, it goes through an opening formed by the iris called the pupil. The iris controls the amount of light that enters the eye by changing the size of the pupil. In bright light, the iris constricts, making the pupil smaller and letting in less light. In dim light, the iris relaxes, making the pupil larger and letting in more light.



Light then travels through a clear structure called the lens. The lens works with the cornea and focuses light. The retina (RET nuh) is an area at the back of the eye that has two types of cells—rod cells and cone cells—with photoreceptors. The retina then sends information as electric signals through the optic nerve to the brain. The brain uses the information and creates a picture of what you are seeing.

THREE-DIMENSIONAL THINKING

How does the **model** your group created show the **structure and function** of the eye?

Answers may vary. Sample answer: Our model uses materials that mimic the structure of a real eye, allowing it to function as a real eye would.

COLLECT EVIDENCE

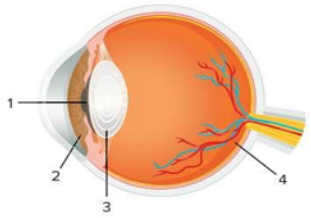
How do the senses enable a surfer to balance, move, and react?
Record your evidence (B) in the chart at the beginning of the lesson.

20	Explain how the human eye sees and the parts in it and their function	textbook, investigation, tables, figure, 3D	155, 158, 163

MCQ - الأسئلة الموضوعية

Three-Dimensional Thinking

Use the diagram below to answer question 2.



2. Which numbered structure focuses the light on the retina, where it is detected by photoreceptors?

A 1
B 2
ans **C** 3
D 4

3. A doctor sees a patient who has a loss of balance from an illness. The doctor thinks injury to the sense receptors for balance might be causing this effect. In which structure are they located?

ans **A** inner ear
B middle ear
C nasal cavity
D spinal cord

Cornea | Iris | Retina
Pupil | Lens | Optic Nerve