Cells

"All living things are made of cells."

Standard **Biology/Life Science**

CELL BIOLOGY

1. **Fundamental life processes of plants & animals depend on a variety of chemical reactions, that are carried out in specialized areas the organism's cells.** As a basis for understanding this concept, students know:

Concept

c. how prokaryotic and eukaryotic cells, and viruses, differ in complexity, and how plant and animal cells and bacteria differ in their general structure.

Cell Entry Rubric

Topic	Got It 12	Almost There 8	Start Again 1	Not Present 0
Compare and contrast prokaryotic and eukaryotic cells **Include:** major structures and where they are found.				
Discuss the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins.				
Describe photosynthesis by explaining how usable energy is captured by the chloroplasts as stored as sugar. **Include:** What is special about chloroplasts that lead people to think they were once a separate organism.				
Explain the process of cell respiration and the importance of ATP **Include:** what ATP is, how it is used, and what ADP is.				

Got it: Covers topic completely with thorough discussion of major points or ideas BUT does not overdo explanation. Show **solid understanding** of topic area.

Almost There: Mentions topic but does not go into enough depth to show complete understanding: Shows **basic understanding of topic area.**

Start Again: Either does not mention or cover topic in enough depth; Shows **limited understanding** of topic area.

D1

Essay Entry
Cellular Organization: parts and Functions

Prompt 1: **All cells are divided into one of two groups according to their cellular structure.** With this in mind, compare and contrast prokaryotic cells and eukaryotic cells.

Prompt 2: **Discuss the role of the endoplasmic reticulum and the golgi apparatus in the secretion of proteins.**

Prompt 3: **Photosynthesis is a complex process in which visible sunlight is converted into chemical energy in the form of carbohydrate molecules**. Describe photosynthesis by explaining how usable energy is captured from sunlight by chloroplasts and stored through the synthesis of sugar from carbon dioxide

Prompt 4: **The role of the mitochondria is to make stored chemical bond energy available to cells by completing the breakdown of glucose to carbon dioxide.** Explain the process of cell respiration and the importance of the product: ATP

Vocabulary: Cells

Word Part	Meaning	Vocabulary Word
chlor	green	chlorophyll
phyll	leaf	[redacted]
chondros	grain	mitochondria
endo	within	endoplasmic
oste	bone	osteocyte
logy	study of	cytology
cyte	cell	[redacted]
derm	skin	
Perm	Through, across	permeable
-itis	inflammation	dermatitis
eu	true, good, well	eukaryote
kary	nucleus	[redacted]
pro	original, primitive before	prokaryote
plasm-	to form	cytoplasm
intra	within	intracellular
inter	between	intercellular

Format

Word	Part of speech	Word parts
Definition		

chlorophyll		

Mitochondria		

Endoplasmic reticulum		

cytology		

Name ______________________

osteocyte		

dermatitis		

permeable		

eukaryote		

prokaryote		

cytoplasm		

intracellular		

intercellular		

D2

I AM JOE'S CELL

BY J.D. RATCLIFF

I am something like a big city. I have dozens of power stations, a transportation system, a sophisticated communications setup. I import raw materials, manufacture goods, operate a garbage-disposal system. I have an efficient government-- a rigid dictatorship, really-- and I police my precincts to keep out undesirables.

All this in something my size? It takes a good microscope to even see me, and a super microscope to peep inside my metropolis! I am a cell, one of the 60 trillion in Joe's body. The cell is often called the basic element of life. Actually, we're life itself. As a rod cell in Joe's right eye, I will speak for the vast population of which I am a member.

There is no such thing as a "typical" cell. We are as different in form and function as a giraffe and a mouse. We come in all sizes, the largest of all being an ostrich egg. From there we scale down to a point where a million of us could sit comfortably on the head of a pin. And we come in a variety of shapes- discs, rods, spheres.

We participate in everything Joe does. He lifts a suitcase and thinks his arm is doing the job. Actually, it's invisible muscle cells, contracting. Let him ponder which necktie to wear: it's brain cells that do the pondering. Or he shaves his face: nerve and muscle cells perform the entire operation. For that matter, the facial hairs he chops off were produced by other cells.

My task as a rod cell in the eye is to catch faint light--say the twinkle of a star--amplify and change it into an electrical signal which I then send to Joe's brain. If enough signals arrive, he "sees" the star.

Since each of us 250 million rod cells in Joe's eyes contains 30 million molecules of light-catching pigment, we naturally use a lot of electricity. To generate it, I have some thousand mitochondria-- super-minute, sausage-shaped power stations which burn fuel (sugar), produce electricity, and leave "ash" (water and carbon dioxide) behind. In this complex chemical process they synthesize a substance called adenosine triphosphate-ATP for short. It is the universal power source for every living thing, from rhubarb to clams to man.

When there is need for energy-- to make the heart beat, to expand the chest in breathing, to blink an eyelid--ATP breaks down into simple substances, releasing power as it does. As long as Joe lives, there will be this call for energy and ATP. Even in deepest sleep there is a torrent of activity--cellular furnaces burning to keep the body warm, brain cells discharging electricity to make dreams, heart cells pulsing to keep blood flowing. The breakdown and building up of ATP is constant.

All of us cells have mitochondria, with one notable exception: red blood cells. Since they do no manufacturing, and are swept along by the bloodstream, they have no need for power.

Perhaps the ultimate wonder among cells is the female egg, as in the body of Joe's mother. Once fertilized, this single cell divides over and over, until there are the two trillion cells of a baby. Phenomenal as such multiplication is in itself the truly striking thing is the enormous amount of information stored within the fertilized egg. That tiny fragment of life contains the blueprint for building that complex chemical plant, the liver. It stores coded information on hair color, skin texture, body size. It knows just when to shut off growth of a little finger. Even at the outset, it knows approximately how bright Joe may be years later, what diseases he might be susceptible to, his general appearance.

How does one tiny egg (they are all about the same size in the mammalian world) know to make a whale, another rabbit, another Joe? This gets us to that miracle stuff of creation, DNA--deoxyribonucleic acid. The dictator of all us cells, it tells our cellular components how to behave, what to manufacture, what to seek, what to avoid.

My DNA can be compared to an architect whose job is to draw up the grand design for living. But it hands the work of building over to contractors--RNA, or ribonucleic acid. In the form of molecules, all information is "printed" on the interlocking twin spirals of DNA. "Messenger" RNA snuggles up to DNA spirals, gets a blueprint of what is wanted. It then passes the word along to another form of RNA, "transfer" RNA. And the latter starts to work according to instructions most likely building one of the

hundreds of proteins in Joe's body. It take the 20-odd amino acids that proteins are made of, and strings them together like beads in a specified pattern. The result may be a pulsating muscle cell for Joe's heart, a contractile leg muscle that permits him to walk, or whatever the DNA ordered.

Curiously, the DNA in the rod cells of Joe's eyes contains all the information needed to produce a complete baby! The DNA in an ear cell could theoretically construct a foot. We don't do these nonsensical things because in each of us large portions of the DNA template are blocked out. My DNA makes rod cells, nothing else.

The cellular division that created Joe continues throughout life. Each second, millions of cells die-- and millions are born, by the process of old cells pulling apart, each to make two new ones, exact duplicates. Fat cells, largely storage bins, reproduce slowly. But skin cells reproduce every 10 hours. One notable exception to this constant replacement is the brain. The moment Joe was born he had his lifetime maximum number of brain cells. Worn-out, damaged ones keep dying; they are never replaced. Yet Joe's initial surplus was so great he scarcely notices the loss.

We cells manufacture upward of 600 enzymes-- most remarkable substances. On orders from RNA, these master chemists instantly and effortlessly synthesize proteins--taking protein from a piece of fish, breaking it down into its components, and rearranging the amino acids to make human proteins needed for, say, Joe's thumbnail. Cellular enzymes also build bafflingly complex hormones and perform many tasks beyond the capabilities of the world's most gifted chemists.

Just as remarkable as our internal structure is our external walls. My membrane is a bare .0000001 millimeter thick. Until very recently, scientists thought of this gossamer covering as little more than a kind of tight cellophane bag. Thanks to the electron microscope, they now realize it is one of my most interesting. Acting as gatekeeper, the cellular membrane decides what shall be admitted, what excluded. It controls the cell's internal environment--keeping in exact balance salts, organic materials, water and other substances. Life is absolutely dependent on this.

Which raw materials are wanted for protein manufacture? The membrane admits the right one, excludes others. Obviously it has a sophisticated recognition system.

Each of us carries an identification tag, recognized by other cell membranes. Any foreigner or intruder is simply chased away from our individual colonies. Imagine what would happen if we tolerated strangers. A hair cell might wander into my area, and hair would soon sprout from Joe's eyes. Warts might start growing in his kidneys, liver cells on his eyelids.

The membrane also seems to have a communications system to talk to other cells. How it functions, I don't know-- enzymes again maybe? Anyway if you take a heart apart, separation it into individual cells, those cells will pulse at random. But soon they will be beating in unison again! Somehow the word gets around.

Hormones are also part of the communications system, acting as chemical messengers. For example: Joe's blood sugar starts rising. His pancreas steps up production of insulin, the hormone which says, "Speed up burning of sugar." The bloodstream carries this work order around and the cells respond. Or, Joe may decide to chop some wood. He will need extra energy. In this case his thyroid sends the hormonal work order to cells: "Speed up production of ATP."

Our great enemies are the viruses. These pesky little parasites have no mitochondria--they are unable to produce their own power for living. From time to time, our membrane guardians fall down on the job and a virus penetrates a cell. With power now available, these terrors start reproducing. Overwhelmed by virus particles, the unfortunate cell perish. But for a variety of body defenses, the viruses would take over, and Joe wouldn't be long for this world.

Perhaps the story of cells can best be summed up by saying that we are where it takes place--everything from Joe's beginning to his end. How 60 trillion of us can live in such harmony--each minding his own business efficiently performing his own tasks--is something to contemplate. It is a wonder. Maybe it is the supreme wonder.

D3

Cell Videos

Name ______________________

I am Joe's Cell

Summarize 15 MAJOR points THROUGHOUT THE ARTICLE.
Use complete sentences.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

15.

D4

Cell Organelles

Organelle	
Cell Membrane	* separates cell from its ____________
	* semi-permeable
	* made of a ____________
	* ____________
Cytoplasm	* fluid encompassing everything ____________
	* The cell membrane and ____________ nucleus.
	* Jell-O-like
Vacuole	* storage sac containing ____________ or ____________.
	* Bigger in ____________.
Golgi apparatus (Golgi Body)	* package proteins & ____________
	and ____________ which arrive from
	______ ____________ and
	____________.
Smooth endoplasmic reticulum (E.R.)	* synthesizes ____________
	* ____________ molecules in the cell
	* like ____________.
Rough Endplasmic Reticulum	* ____________ attached to outer surface
	* involved in ____________ synthesis and
	____________ of molecules in the cell.
Ribosome	* site of protein ____________.
	* ____________
Lysosome	* site of ________ and ________ of digestive enzymes.
Vesicle	* moves ____________, ________ and
	____________ through cell or towards cell
	________ where the contents are ________.
Mitochondria	* release ____________ stored in food. Has its
	________ DNA from ________
Centrioles	* ________ structures; assist in cell ________.
Nuclear Envelope	* surrounding nucleus
	* separates nucleus from ____________.
Nucleus	* information center of cell
	* The "____________"
Nucleolus	* site of ____________ synthesis.
Chromatin	* ____________ mass of ________.
Microtubules	* ____________ rich rods
	* provide ____________ support.
Cell Wall	* provides ________ and ____________.
	* Located ____________ cell membrane.
	* Found ONLY in plants
Chloroplast	* site of photosynthesis.
	* ____________
Vacuoles	* extra large in plants
	* full of ____________.

D5

Cells: Structures and Functions

1. Robert ___________ (1635 - 1703) in Holland

   * First person to observe cells and made microscopes in Holland.

   * Observed ____________ _______________ cells.

2. Anton _____ ____________________________ (1632 - 1723)

   * First to observe ______________________ cells

3. Cell Theory:

   * cells are the basic unit of ______________ and ___________.

   * All ___________________ are composed of ______ or ____________ cells.

   * All ____.

4. Cells come in many _______________ and ______________.

5. Cells can be divided into 2 categories.

   * ____________________ : has _________________________ containing ____________________________ in ___________________________.

   * ___________________: Does not have _________________________ and __________________________ is ________________________.

6. Cells perform basic functions of life.

   * Cells ____.

   * Cells manufacture and release ________________________

   * Cells maintain ____________________________________

   * Cells contain __________ in __________________________

   * Cells are organized

     * Nucleus : ___________________________

     * _____________________________ which are specialized.

   * Compartments whose contents are separated from the ____________________

A

D6

A View of the Cell

In your textbook, read about the history of the cell theory.

For each statement in Column A, write the letter of the matching item in Column B.

	Column A	Column B
________	**1.** The first scientist to describe living cells as seen through a simple microscope	**a.** Schleiden
________	**2.** Uses two or more glass lenses to magnify either living cells or prepared slides	**b.** compound light microscope
________	**3.** A scientist who observed that cork was composed of tiny, hollow boxes that he called cells	**c.** electron microscope
________	**4.** A scientist who concluded that all plants are composed of cells	**d.** Schwann
________	**5.** A scientist who concluded that all animals are composed of cells	**e.** Hooke
________	**6.** The microscope that allowed scientists to view molecules	**f.** Leeuwenhoek

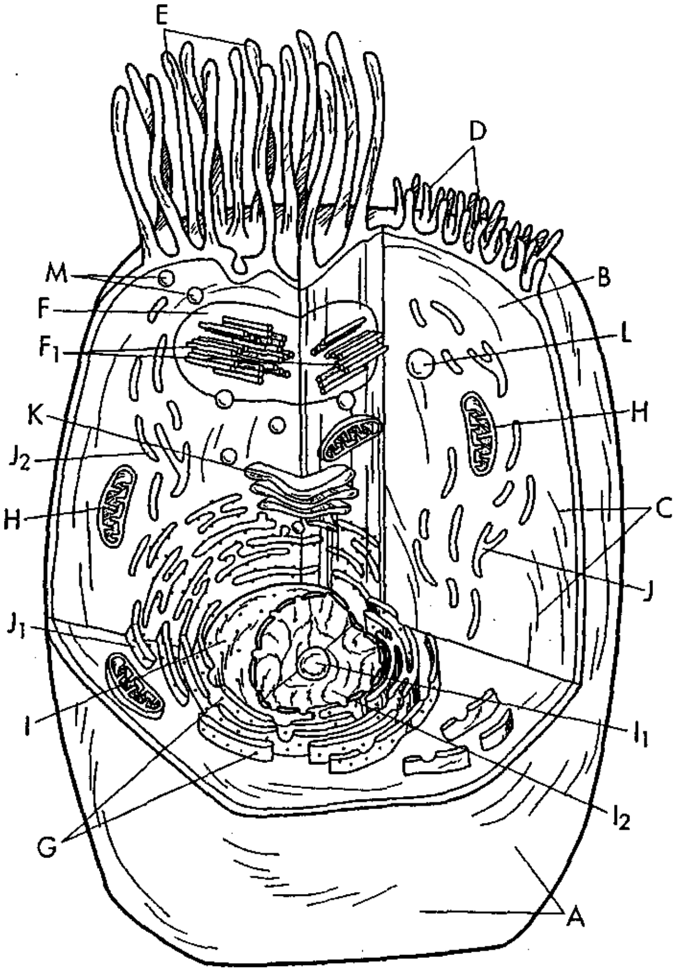
In your textbook, read about the two basic cell types.

Complete the table by checking the correct column for each statement.

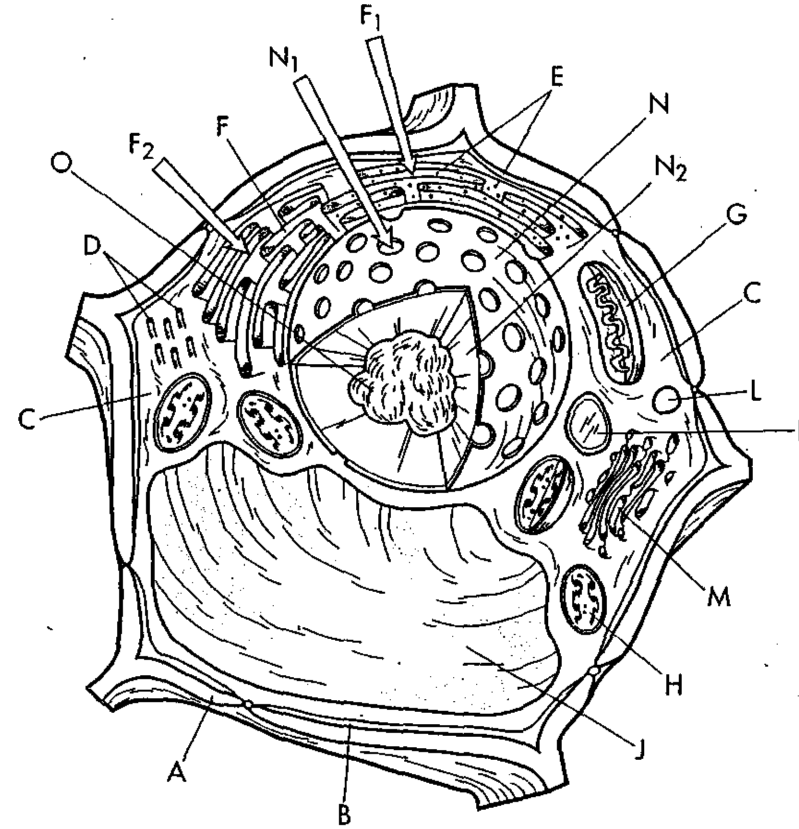
Statement	Prokaryotes	Eukary[illegible]
7. Organisms that have cells lacking internal membrane-bound structures		
8. Do not have a nucleus		
9. Are either single-celled or made up of many cells		
10. Generally are single-celled organisms		
11. Organisms that have cells containing organelles		

B

The Animal Cell



The Plant Cell



A

The Animal Cell

- ○ Cell Membrane..........A
- ○ Cytosol (Cytoplasm)....B
- ○ Cytoskeleton C
- ○ Microvilli ....D
- ○ Cilia..................E
- ○ Centrosome ....F
- ○ Centrioles ....F_1
- ○ Ribosomes..............G
- ○ Mitochondrion..........H
- ○ Nucleus................I
- ○ Nucleolus ....I_1
- ○ Nucleoplasm ....I_2
- ○ Endoplasmic Reticulum..J
- ○ Rough ER...............J_1
- ○ Smooth ER ....J_2
- ○ Golgi Body ....K
- ○ Lysosome L
- ○ Peroxisome ....M

B

The Plant Cell

- ○ Cell Wall ....A
- ○ Cell Membrane ....B
- ○ Cytoplasm..............C
- ○ Cytoskeleton ....D
- ○ Ribosomes..............E
- ○ Endoplasmic Reticulum..............F
- ○ Rough ER...............F_1
- ○ Smooth ER ....F_2
- ○ Mitochondrion..........G
- ○ Chloroplast............H
- ○ Plastid................I
- ○ Vacuole................J
- ○ Lysosome L
- ○ Golgi Body ....M
- ○ Nucleus................N
- ○ Nuclear Pore..........N_1
- ○ Nucleoplasm ....N_2
- ○ Nucleolus..............O

D7

Plant Cell

1. In a typical plant cell we see virtually all of the structures found in animal cells except for centrioles and certain protrusions used for locomotion or absorption. On the other hand, plate cells contain certain structures not found in animal cells at all.

2. The plant **cell membrane** is essentially the same as the animal cell membrane. Immediately outside the plant cell membrane, however, is a cell wall consisting mostly of fibers of cellulose, although other kinds of molecules also become incorporated into it. When a cell is first formed by division of its parent cell, the cell wall is relatively elastic and it is called a primary cell wall. As the cell grows, the wall is make thicker and more rigid and becomes known as a secondary cell wall. The **cell wall** is perforated by numerous small pores called pladmocesmata, which appear to allow a direct bridge of cytoplasm form one cell to the next.

3. Although animal cells often contain some small **vacuoles**, plant cells usually contain one or a few very large ones. As plant cells mature, the vacuoles tend to get larger and usually fuse to form a single very large vacuole that my comprise 90 percent of the cell's volume. These large vacuoles are sometimes called "water vacuoles" because they contain large quantities of water. However they also contain a wide variety of dissolved substances, including nutrients stored for later use and toxic substances which may be broken down into harmless subunits in the vacuole. It is because of the dissolved substances that water flows into the vacuole and created osmotic pressure, which is responsible for the rigidity (turgor) pressure of plants. When water is in short supply, the vacuoles lose their osmotic pressure, and the plant wilts. Sometimes substances are stored in vacuoles as solid crystals, and many flowers receive their coloring from the pigments dissolved or crystallized in their vacuoles. The membrane of the vacuole is often called the tonoplast.

4. Plants are also colored by their plastids, but chloroplasts, which are green, have a much more important function than merely making plants green. They trap light energy and convert it to chemical energy for manufacture of food in the process called photosynthesis. Leucoplasts are whitish in color and serve to store starch, lipids or protein. Chromoplasts are plastids that produce and store other pigments that impart color to particular parts of a plant, as when fruit ripens or leaves turn color in the fall. They are formed by modification of chloroplasts or leucoplasts.

5. **Golgi Apparatuses** or complexes in plant cells are usually called dictyosomes. They are very much like Golgi apparatuses in animal cells EXCEPT that they are usually smaller and more numerous. In addition to synthesizing various complex molecules needed within the cell, they appear to be responsible for manufacturing the components of the cell wall, which animal cells **never** have. All the remaining structures are virtually identical to those found in animal cells: **ribosomes**, synthesize proteins, and are found attached to the **endoplasmic reticulum** and free in the cytoplasm; **mitochondria** provide energy by oxidizing the carbohydrates made in the chloroplasts: **microtubules** and **microfilaments** seem to provide support and produce movement; **lysosomes** and microbodies contain enzymes; and the apparently structureless fluid making up the rest of the **cytoplasm** is called the hyaloplasm. **The nucleus** too, is virtually the same: for that reason, this plate shows only the exterior of the nuclear envelope with its numerous pores

Name ______________________________ Period ___

Summary Sentences

Paragraph 1	
Paragraph 2	
Paragraph 3	
Paragraph 4	
Paragraph 5	
Overall Summary	

Questions

1. EXPLAIN how the cell membrane is different between the plant cell and the animal cell.

2. Explain 2 ways that the vacuoles different in the animal and plant cells
a.
b.

3. What are the differences between plastids and chloroplasts.

4. What is the role of mitochondria in the plant cellll.

D8

Animal Cell

1. Although the earliest light microscopes showed the cell as hardly more than a mass of amorphous fluid enclosed within a membrane, modern research has shown that the cell is not only the structural unit of living organisms but also the functional unit: Each cell carries out all the physical and chemical reactions we associate with life. This plate is an artist's reconstruction of a typical animal cell as it might look with its upper half cut away. We see that the cell is organized into many distinct structures. These are called organelles, and each is specialized for a particular function. This plate gives you an overview of these organelles; the following plates will cover the details of structure and function.

2. The cell membrane (sometimes called the plasma membrane) is completely covers the entire cell and serves to hold it together. It also actively regulates what enters and leaves the cell. It is only about 10 nanometers thick, so it s thickness has to be greatly exaggerated in the drawing to give you something thick enough to color. This is also true of the membranes within the cell. Everything else is drawn to scale.

3. In animal cells (as well as ion plant, protist, and fungus cells), the nucleus is separated from the rest of the cell by the nuclear envelope. Such cells are called eukaryotic (Greek: eu - true, karyon - kernel or nucleus) to distinguish them from prokaryotic (Greek: pro - before), which lack a true membrane - enclosed nucleus and are more primitively organized. (Prokaryotic cells are found only among the bacteria and their close relative.) The nuclear envelope is made up of two layers of membrane. These are very similar to the cell membrane but have numerous pores. Within the nucleus is a prominent structure called a nucleolus - sometimes there are two or more nucleoli - and a network of thin threads called chromatin. The chromatin contains the heredity material of the cell. The fluid that fills the rest of the space in the nucleus is called the nuclear sap.

4. The term 'cytoplasm' is still used to designate all of the cell contents outside the nucleus but inside the cell membrane, although we realize that cytoplasm is not the homogeneous substance it was once thought to be. One of the prominent organelles in the cytoplasm is the mitochondria, often called the "powerhouse of the cell" because about 90 percent of the energy that **eukaryotic** cells get from oxidizing food molecules is developed there. The ***Glogi Complex*** or apparatus is a stack of membranous sac in which various molecules are manufactured and packaged for "export" from the cell. **Centrioles** are cylindrical bundles of microtubules that seem to five rise to the longer spindle microtubues that separate the two duplicate set of chromatin a t the time of dell division. Most animal cells have a pair of centrioles lined up at 90 degrees to each other. Additional **microtubules** are found singly or in groups else where in the cytoplasm. They appear to provide structural support to the cell and may be involved in movement. **Vacuoles** are fluid filled sacs of membrane that may contain anything from food being digested to oil droplets. **Lysosomes** look like small vacuoles but contain digestive enzymes. Microbodies look like small vacuoles as well but contain various enzymes not involved in digestion. Microfilaments are found in various places around the cytoplasm and are involved in movement and attachment to other cells.

5. Throughout the cytoplasm are many tiny structures called **ribosomes**, which manufacture proteins. Some are free in the fluid portion of the cytoplasm, but many others are attached tot he **endoplasmic reticulum** (ER), a system of membranes that strands throughout much of the cytoplasm. Some parts of the endoplasmic reticulum (known as the rough ER) have many ribosomes attached; other parts (known as the smooth ER) have none. The remaining portion of the cytoplasm, which seems to be a structureless fluid.

D9

Name ____________________

Summary Sentences

Paragraph 1
Paragraph 2
Paragraph 3
Paragraph 4
Paragraph 5
Overall Summary sentences

Questions

1. DESCRIBE 3 things about the cell membrane
   a.
   b.
   c.
2. How is the nuclear membrane the SAME and DIFFERENT from a cell membrane
   SAME
   DIFFERENT
3. Explain the two types of endoplasmic reticulum and in what ways they are different.

VIEW OF THE CELL

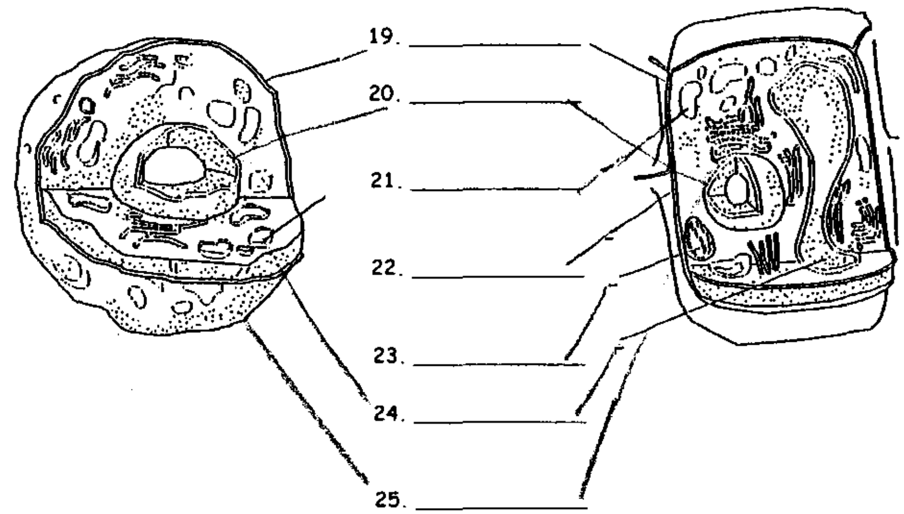
Completed after 7.3

Name ______________________________ Period ________

Complete the table by writing the name of the cell part beside the structure and/or function. A cell part may be used more than once.

Structure/Function	Cell part
1. A membrane-bound, fluid filled sac	
2. The site of protein synthesis.	
3. A folded membrane that forms a transport network around the cell	
4. The clear fluid inside the cell.	
5. Organelle that manages the functions in an eukaryotic cell.	
6. Contains chlorophyll, a green pigment that traps energy from sunlight and gives plants their green color.	
7. Digests worn out cell parts, food particles, and invading viruses and bacteria.	
8. Small bumps located on the Endoplasmic Reticulum.	
9. Provides temporary storage for food, enzyme, and waste products.	
10. Firm protective structure that fives a plant, (and fungus, and most bacteria) cell its shape.	
11. Produces usable form of energy for an animal and some plant cells.	
12. Modifies proteins from the ER and repackages them.	
13. Plant organelles that store lipids, pigments and starches.	
14. Structure found in animal cells but much larger in plant cells that gives structure and stores water.	
15. Numerous small structures that allow cells tomove.	
16. A much larger structure that also provides locomotion.	

17. ____________________ 18. ____________________



D10

7.1 The Discovery of Cells

Pgs 175-180

The History of the Cell Theory

Main Idea

Supporting Detail			

Cells:

Compound Light Microscope:

Cell theory:

Electron Microscope:

Two Basic Cell Types

Main Idea

Supporting Detail			

Prokaryotes:

Name ____________________

Eukaryotes:

Organelles:

Nucleus:

Section Assessment 1-5

1. Why was the development of microscopes necessary for the study of cells?

2. How does the cell theory describe the organization of living organisms?

3. Compare the light sources of the light microscope and electron microscope.

4. How are prokaryotic and eukaryotic cells different?

5. Suppose you discovered a new type of fern. Applying the cell theory, what can you say for certain about the organism?

D11

Chapter 7: View of the Cell

7.3 Eukaryotic Cell Structure

Pages 185-193

Cell Boundaries

Main Idea

Supporting Detail	Supporting Detail	Supporting Detail	Supporting Detail

Cell Wall:

Chromatin:

Nucleolus:

Ribosomes:

Cytoplasm:

Assembly, Transport, and Storage

Main Idea

Supporting Detail			

Name ______________________ Period______

Endoplasmic Reticulum:

Golgi Apparatus:

Vacuoles:

Lysosome:

Energy Transformers

Main Idea

Supporting Detail	Supporting Detail	Supporting Detail	Supporting Detail

Chloroplasts:

Plastids:

Chlorophyll:

Mitochondria:

D12

Structures for Support and Locomotion

Main Idea

Supporting Detail			

Cytoskeleton:

Microtubules:

Microfilaments:

Cilia:

Flagella:

Word Origin: cytoskeleton

Section Assessment 1-5

1. What is the advantage of highly folded membranes in a cell?

2. Name an organelle that uses this strategy.

3. What organelles would be especially numerous in a cell that produces large amounts of a protein product?

4. Why are digestive enzymes in a cell enclosed in a membrane bound organelle?

5. Why might a cell need a cell wall and a plasma membrane?

D13

Name ____________________

Vocabulary: Microscope

Word Part	Meaning	Vocabulary Word
micro-	small	microscope
-scope	to see, look, watch	
magni-	large	magnify
-tion	act of	magnification
foc	a point	focus
par	equal	par
-opt (i)	to see	diopter
illumin-	to light up	illuminate
ob-	in the way	obscure
-scure	to hide or conceal	
bi-	two	bifocal
ocul	an eye	binocular
opt-	the best	optimal

Format

Word	Part of speech	Word parts/meanings
Definition		

microscope		

magnify		

magnification		

focus		

par		

diameter		

illuminate		

obscure		

bifocal		

binocular		

optimal		

Video: Microscopes

D14

Microscope

Magnification

TERMS

Lens	________ X eye piece	= total magnification
4		
10		
40		
Oil (100)		

Resolution

Types of Microscopes

Type of scope	Magnification	Resolution	Advantages	Disadvantages
Overview				
Light				
Transmission Electron (TEM)				
Scanning Electron (SEM)				
Scanning Tunneling (STM)				

D15

Leeuwenhoek
First of the Microbe Hunters

Two hundred and fifty years ago an obscure man named Leeuwenhoek looked for the first time into a mysterious new world peopled with a thousand different kinds of tiny beings, some ferocious and deadly, others friendly and useful, many of them more important to mankind than any continent or archipelago.
Leeuwenhoek, unsung and scarce remembered, is now almost as unknown as his strange little animals and plants were at the time he discovered them. This is the story of Leeuwenhoek.

Today it is respectable to be a man of science. Those who go by the name of scientist form an important element of the population, their laboratories are in every city, their achievements are on the front page of the newspapers, often before they are fully achieved. Almost any young university student can go in for research and by and by become a comfortable science professor at a tidy little salary in a cozy college. But take yourself back to Leeuwenhoek's day, two hundred and fifty years ago, and imagine yourself just through high school, getting ready to choose a career.

You have lately recovered from an attack of mumps, you ask your father what is the cause of mumps and he tells you a mumpish evil spirit has got into you. His theory may not impress you much, but you decide to make believe you believe him and not to wonder any more about what is mumps- because if you publicly don't believe him you could be in for a beating and may be even turned out of the house. Your father is Authority. That was what the world about three hundred years ago, when Leeuwenhoek was born.

It was a world where Servetus was burned to death for daring to cut up and examine the body of a dead man, where Galileo was shut up for life for daring to prove the Earth moved around the sun.

Antony Leeuwenhoek was born in 1632 amid the blue windmills and the low streets and the high canals of the Delft, in Holland. His family was basket makers and brewers. Brewers are respected and highly honored in Holland. Leeuwenhoek's father died early and his mother sent him to school to learn how to be a government official, but he left school at sixteen to be an apprentice at a dry goods store in Amsterdam.

At the age of twenty one he left the dry goods store, went back to Delft, married, set up a dry goods store of his own there. For twenty years after that very little is known about him, except he had two wives and several children most of whom died, but there is no doubt that during that time he was appointed janitor of the city hall of Delft, and that he had developed a most idiotic love for grinding lenses. He had heard that if you carefully grind little lenses out of clear glass it could make things bigger than they actually were. It would be great fun to look trough the lens and see things bigger than the naked eye showed to you. But buy lenses? Not Leeuwenhoek! There never was a more suspicious man. He would make them himself! During these twenty years of his obscurity he went to spectacle (eyeglass) makers and got the rudiments for lenses grinding. He began to learn the secret ways of getting metals form ores and gradually began to learn the craft of the gold and silversmiths. He was the most pernickety (fussy about details) man and was not satisfied with grinding lenses as good as the best lens grinders in Holland; he had to have the best of the best. And yet still he fussed over them for hours. He mounted the lenses on copper oblongs.

Now this self-satisfied dry-goods dealer began to turn his lenses onto everything he could get a hold of. He looked through them at the muscle fibers of a whale and the scales of his own skin. He went to the butcher shop and begged or bought ox eye and was amazed at how prettily the crystalline lens of the eye of the ox is put together. He peered for hours at the build of the hairs of a sheep, of a beaver, of an elk, that were transformed from their fineness into great rough logs under his bit of glass. He delicately dissected the head of a fly; he stuck its brain on the fine needle of his microscope-how he admired the clear details of the marvelous big brain of that fly! He examined the cross-sections of the wood of a dozen different trees and squinted at the seeds of plants. He grunted "Impossible!" when he first spied the outlandish large perfection of the sting of a flea and the legs of a louse. That man Leeuwenhoek was like a puppy who sniffs-with a totally impolite disregard of discrimination-at every object of the world around him!

There never was a less sure man than Leeuwenhoek. He looked at the bee's sting or that louse's leg again and again and again. He left his specimens sticking on the point of his strange microscope for months-in order to look at other things he made more microscopes till he had hundreds of them!-them he came back to those first specimens to correct his first mistakes. He never down a word about anything he peeped at, he never made a drawing until hundreds of peeps showed him that, under given conditions, he would always see exactly the same thing. And then he was not sure! He said:

"People who look for the first time through a microscope say now I see this and then I see that-and even a skilled observer can be fooled. On these observations I have spent more time than many will believe, but I have done them with joy, and I have taken no notice of those who have said why take so much trouble and what good is it?-but I do not write for such people but only for the philosophical!" He worked for twenty years that way, without an audience.

When you look back at them, many of the fundamental discoveries of science seem so simple, too absurdly simple. How was it men groped and fumbled for so many thousands of years without seeing things that lay right under their noses? So with microbes. Now all the world has seen them cavorting on movie screens, many people of little learning have peeped at them swimming about under lenses of microscopes, the greenest medical student is able to show you the germs of I don't know how many diseases-what was so hard about seeing microbes for the first time?

Let us remember that when Leeuwenhoek was born there were no microscopes but only crude hand lenses that would hardly make a ten-cent piece look as large as a quarter. Through these-without his incessant grinding of his own marvelous lenses-that Dutchman might have looked till he grew old without discovering any creature smaller than a cheese mite.

What he saw that day starts this history. Leeuwenhoek was a maniac observer, and who but such a strange man would have thought to turn his lens on clear, pure water, just come down from the sky? What could there be in water but just-water? You can imagine his daughter Maria-she was nineteen and she took such care of her slightly insane father!-watching him take a little tube of glass, hear it red-hot in a flame, draw it out to the thinness of a hair...Maria was devoted to her father-let any of those stupid neighbors dare to snigger at him!-but what in the world was he up to?

He squints through his lens. He mutters guttural words under his breath...

Then suddenly the excited voice of Leeuwenhoek: "Come Here! Hurry! There are little animals in this rainwater...They swim! They play around! They are a thousand times smaller than any creatures we can see with our eyes alone,... Look! See what I have discovered!"

Those little animals were everywhere! He told the Royal Society of finding swarms of those sub-visible beings in his mouth-of all places: "Although I am now fifty years old," he wrote, "I have uncommonly well-preserved teeth, because it is my custom every morning to rub my teeth very hard with salt, and after cleaning my large teeth with a quill, to rub them vigorously with a cloth..."But there still were little bits of white stuff between his teeth, when he looked at them with a magnifying mirror...

What was this white stuff made of?

There was a menagerie in his mouth! There were creatures shaped like flexible rods that went to and fro with the stately carriage of bishops in procession, there were spirals that whirled through the water like violently animated corkscrews...

I drinkin the morning a large number of cups of coffee, and that as hot as I can drink it, so that the sweat breaks out on me.

Years after his discovery of the microbes in his mouth one morning in the midst of his sweating from his vast curative coffee drinking he looked once more at the stuff between his teeth-

What was this? There was not a single little animal to be found. Or there were no living animals rather, for he thought he could make out the bodies of myriads of dead ones-and maybe one or two that moved feebly, as if they were sick. "Blessed Saints!" he growled: "I hope some great Lord of the Royal Society doesn't try to find those creatures in his mouth, and fail, and then deny my observations..."

Leeuwenhoek: First of the Microbe Hunters

Summarize 15 MAJOR points THROUGHOUT the article:

Use complete sentences.

Name ______________________

Microscope Videos

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11.

12.

13.

14.

15.

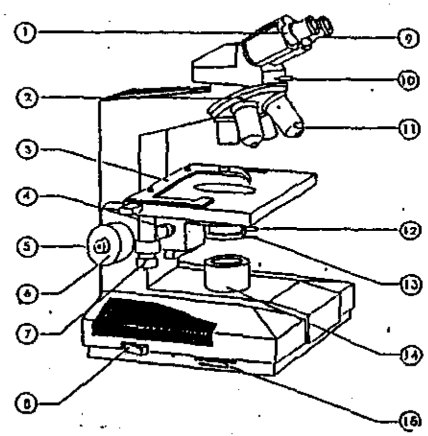
DM

Name ____________________

Microscope Lab Data

I. Microscope Parts:

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________
11. ____________________
12. ____________________
13. ____________________
14. ____________________
15. ____________________



II. Microscope Parts' Functions Questions:

1.

2.

3.

4.

5.

III. Powers of Magnification:

6.

IV. Microscope Viewing

7.

8. e' low

9. 'e' medium

10 e' high

11

12.

V. Wet Mount Slides and Magnification:

13 . title: Micrograph (_____x)

14. title: Micrograph (_____x)

15.

16. title: Micrograph (_____x)

VI. Independent Practice

Onion Cell

17.

Label: cell Wall, cell membrane, nucleus, cytoplasm **title:** ___________ (_____x)

Cheek Cell

18.

Label: Cell Membrane, nucleus, cytoplasm title: ___________ (_____x)

Elodea Cell

19

Label: cell Wall, nucleus, cytoplasm, chloroplast **title:** ________ (_____x)

D18

ATP in a Molecule

__________- is a very broad term used every day but means very __________________ depending on what you are talking about.

__________ take the sun's ________, light, some ____________ and ______________ and turn that into energy in the form of glucose. Animals eat __________________ and turn that into __________ or store it as ______________.

Animals

______________ for __________, __________ and ________ of the cilia or flagella. ______________ use it to ____________, __________ or ____________. We think that we eat ______ and that ________ but in ______________

ATP Adenosine Tri Phosphate - This is made of the ______________ with __________________. ATP ______________ when the ____________________ from ATP to ADP (adenosine diphosphate). When ______________is ____________ energy is release much like a __________________. ______________ __________ is used to ____________________ thus restoring the ________________________. Oxygen is an important part of the system.

It starts when ________________________. The glucose (plant sugar) is __________________________ - animal sugar.

The entire process is called CELLULAR RESPIRATION

This is the process that ______________ use to make ________.
There are ______________- to Respiration

______________ (Glyco - glycogen - animal starch) (lysis - to break apart) This process __________________.
It is ______________and not __________. Only __________ molecules are formed.

Citric Acid Cycle (Kreb's Cycle) This is ____________________

Electron Transport chain. This happens on the ______________ of ______________ and produces ______________.
All three steps produce ____________________.

This process goes ______________, unlike ____________ which is only a __________that can occur in ______________.

Lactic Acid production

Often, when people work out their ____________________. Some of this is due to the ____________________. It is the result of - ________________________________. Very little ________ is formed and the result is ____________________

Remember:

When you have ______________ to the point where your muscles do not work any longer it is ____________________ and you must ______________your supply.

Plants

Light-dependent reaction: Photosynthesis is the process that plants use to convert ________________________________ $C_6H_{12}O_6$

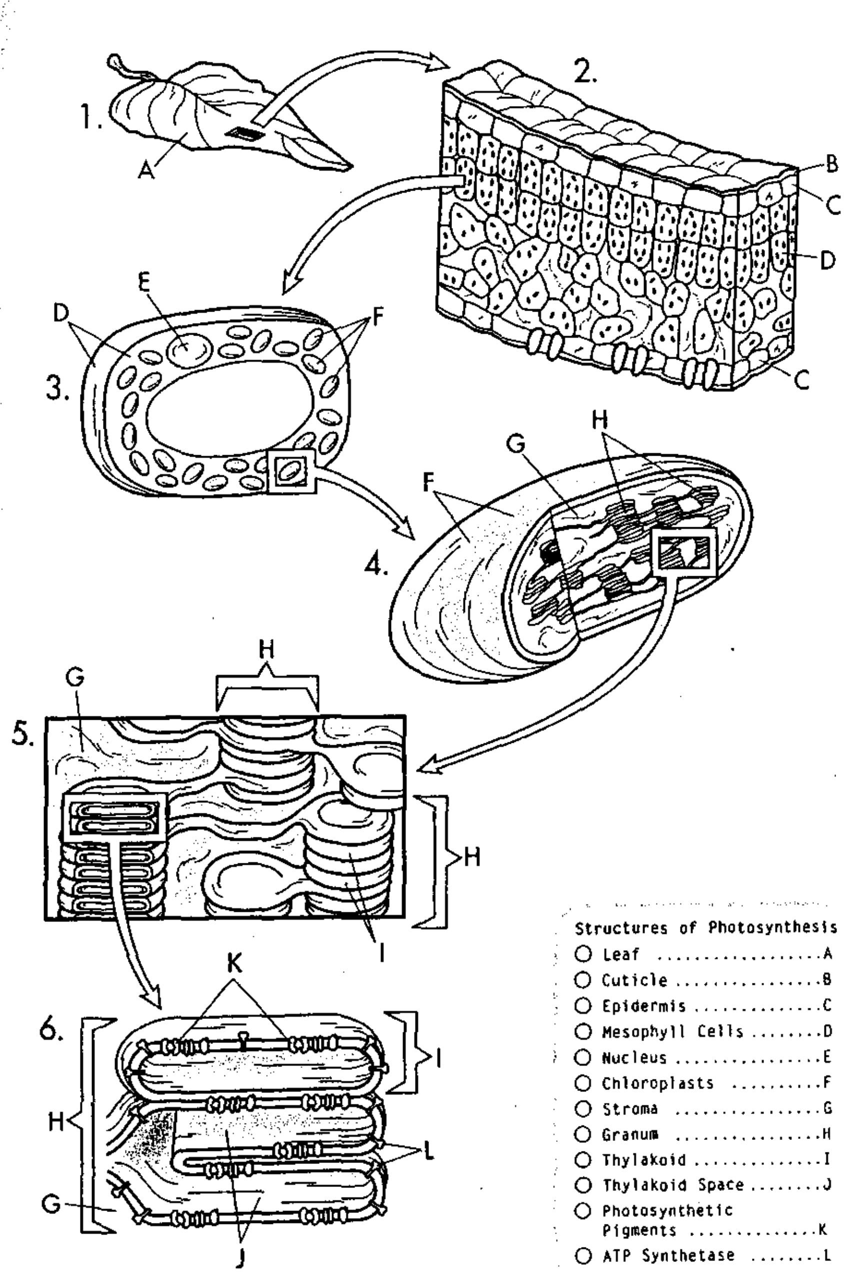
____ CO_2 + ____ $H_2O \rightarrow C_6H_{12}O_6$ + ______ O_2

Electrons are passed down the ________________ through a series of proteins embedded in the thykaloid membrane ______________. This is a __________________ and forms ____________ ________ to use when there is ______________.

The Light-independent reaction (Dark reaction) is occurs in the ________ ________________ and results in the production of a ________ ____________________ in the plant in the ________ of light.

D19

Structures of Photosynthesis

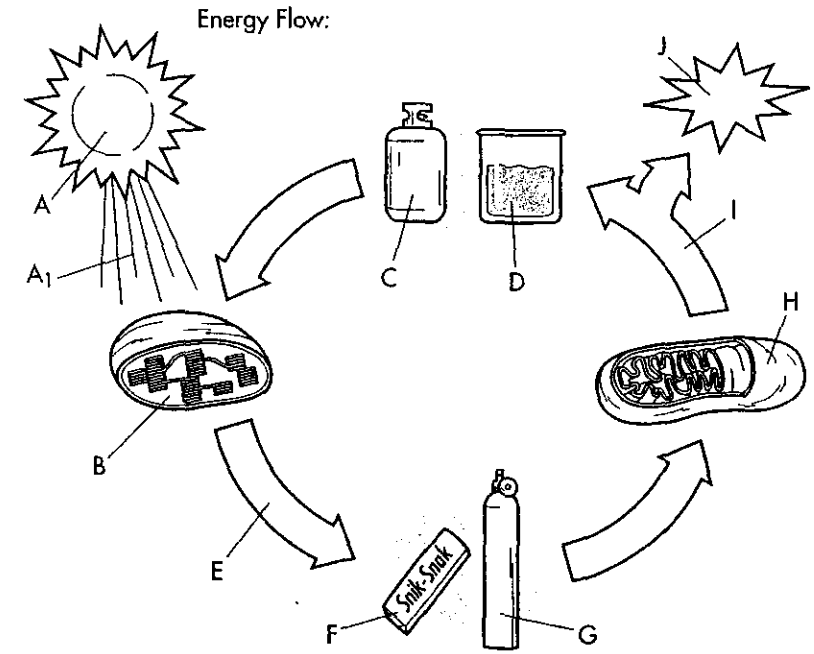


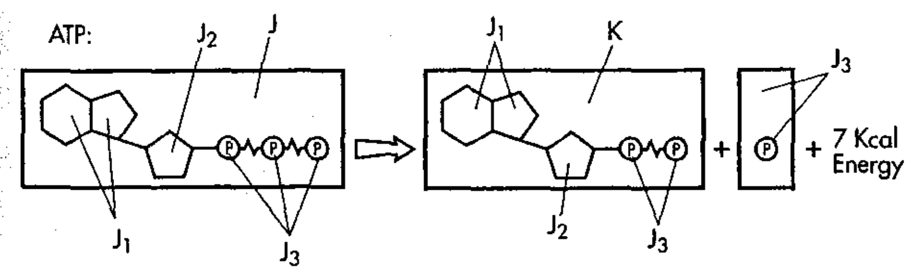
Structures of Photosynthesis

- O Leaf ....A
- O Cuticle ....B
- O Epidermis C
- O Mesophyll Cells ....D
- O Nucleus ....E
- O Chloroplasts ....F
- O Stroma ....G
- O Granum ....H
- O Thylakoid I
- O Thylakoid Space ....J
- O Photosynthetic Pigments ....K
- O ATP Synthetase L

A

Energy Flow in Living Things





Energy Flow in Living Things

- O Sun ....A
- O Sun's Energy..........A_1
- O Chloroplast ....B
- O Carbon Dioxide........C
- O Water ....D
- O Photosynthesis........E
- O Carbohydrates ....F
- O Oxygen...............G
- O Mitochondrion ....H
- O Respiration I
- O Adenosine Triphosphate..........J
  - O Adenine ....J_1
  - O Ribose ....J_2
  - O Phosphate Groups ..J_3
- O Adenosine Diphosphate ....K

B

D20

Structures of Photosynthesis

1. Photosynthesis is the process through which plants convert the sun's energy into a usable chemical form. During photosynthesis, a plant produces carbohydrates that provide energy for the plant and are modified in numerous ways to serve as important cellular components. Photosynthesis is also essential to animals, including humans, who obtain all of their food either directly or indirectly from plants. In addition, photosynthesis replenishes the atmospheric oxygen used in animal metabolism.

2. The reactions of photosynthesis take place within the chloroplasts of plant cells and in the cytoplasm of cyanobacteria. This plate focuses on chloroplasts and describe their structure and function in photosynthesis. We will begin with a survey of the main photosynthetic structure of the plant, the **leaf (A)**. Although the leaf is considered the center of photosynthesis, this process also occurs in the cells of the plant stem.

3. In diagram 2, we show a cross section of the leaf. The surface of the leaf is covered by a thin waxy layer called the **cuticle (B)**, under which lie the cells of the **epidermis (C)**. Beneath the epidermis are several layers of cells called **mesophyll cells (D)**. Some of these cells are tall and stacked against each other; while others are more cubical and loosely packed; these comprise the spongy layer. These cells contain the main structures that carry on photosynthesis. At the lower portion of diagram 2 are stomates, where carbon dioxide is necessary for photosynthesis enters a leaf.

4. Take a look at the single plant cell in diagram in diagram 3. This cell is rectangular compared to an animal cell, because plant cells have cell walls that maintain their box-like rigidity. In diagram 3, we show a single mesophyll cell (D) and some of its major features. For example, the **nucleus (E)** is situated along the edge of the cell because the large central vacuole has pushed it to the side, and within the cytoplasm are a number of **chloroplasts (F)**. These bodies can be seen with a light microscope, but the smaller structures we will mention in this plate contains numerous chloroplasts, which are where the photosynthetic structures are found.

5. The next view is of a single chloroplasts (F) in diagram 4. The fluid-fixed space within the chloroplasts is known as **stroma (G)**, which is a matrix that holds the functional components of photosynthesis. We now move to diagram 5, in which the chloroplast has been further magnified. You can see stacks of membrabous, sac-like vesicles called **thylakoid (I)**. Thylakoids are disc-shaped, and a stack of them composes what is called a **granum (H)**.

6. We complete the plate with a study of view 6, in which a granum (H) is enclosed by a bracket. The region between the thylakoid membranes is the **thylakoid space (J)**, and this space is also called the lumen. The space around the thylakoids is the stroma of the chloroplasts.In the thylakoid membranes themselves we see a number of **photosynthetic pigments (K)** embedded in the thylakoid membrane. These pigments, which include chlorophyll, are the biochemical substance involved in photosynthesis. Also embedded in the membrane is a chemical complex called **ATP synthetase (L)**, at which energy from the sun is converted to the energy of ATP molecules. We will explain how this takes place in the next plate.

Name ______________________

Summary sentences of each paragraph.

Paragraph 1
Paragraph 2
Paragraph 3
Paragraph 4
Paragraph 5
Paragraph 6
Overall summary of reading

D21

Energy Flow in Living Things

Name ______________________

1. The total amount of energy that exists in the universe remains constant, but energy can change from one form to another. For example, the chemical energy in gasoline can be released and transformed into heat energy and the energy of motion.

2. This type of transformation of energy occurs in many of the process that take place in living things. In this plate, we will examine the flow of energy through living things and identify the molecule that serves as the main energy source in all life processes.

3. All of the energy on the Earth comes from the **sun (A)**; the **sun's energy (A)**, is what drives chemical reactions and the processes of life. This solar energy is trapped in a photosynthesizing organelle of the plant called the **chloroplast** (B); we discuss this organelle in detail later in the book.

4. A number of chemical reactions take place in the chloroplast to transform solar energy into chemical energy. **Carbon dioxide** (C) and **water** (D) are necessary for the process of **photosynthesis** (E), and the products of photosynthesis include **carbohydrates** (F), which are represented by a candy bar, and molecular **oxygen** (G). The bonds of the carbohydrates now contain some of the sun's energy; photosynthesis has transformed the sun's energy into the chemical energy of the carbohydrates. Oxygen is given off as a waste product of photosynthesis, and is expelled from the plant cell into the atmosphere.

5. Plants, humans, and many other living things use carbohydrates as their essential source of energy. Carbohydrates are transported to an organelle called the **mitochondria** (H), where they are combined with oxygen molecules in the process of **cellular respiration(I)**, illustrated by the arrow. During chemical reactions in the mitochondria, the energy from carbohydrates is released in and used to form the energy-rich molecule **adenosine triphosphate (J)**. (Adenosine triphosphate is commonly abbreviated as **ATP**.) Carbon dioxide and water are byproducts of respiration; notice that they are both essential for photosynthesis. <u>To summarize, the energy of the sun is first transformed into the energy of carbohydrates and then into the energy in the ATP.</u>

6. The adenosine triphosphate (ATP) molecule (J) is shown at the bottom of the plate. You should use a light shade to color the interior of the box, and darker colors should be used for the components of ATP. These components include an **adenine molecule** (J_1) and a **ribose molecule** (J_2). Adenine is one of the four nitrogenous bases found in DNA and RNA, and ribose is a five carbon carbonate. Attached to the ribose molecule are three **phosphate groups** (J_3).

7. Living things use energy in the form of ATP, breaking it down into **adenosine diphosphate** (K) and an inorganic phosphate group. Adenosine diphosphate (ADP) contains adenine (J_1) and a ribose molecule (J_2), but only two phosphate groups (J_3). During this breakdown, seven kilocalories of energy are given off for use by the cell.

<u>Summary sentences of each paragraph.</u>

Paragraph 1
Paragraph 2
Paragraph 3
Paragraph 4
Paragraph 5
Paragraph 6
Paragraph 7
Overall summary of reading

D22

Chapter 9: Energy in a Cell

9.1 ATP in a Molecule

(pgs. 227-230)

Cell Energy

Main Idea

Supporting Detail			

ATP -

Forming and Breaking down ATP

Main Idea

Supporting Detail			

ADP -

Name ______________________

Use of Cell Energy

Main Idea

Supporting Detail			

Section Assessment

1. What processes in the cell need energy from ATP?

2. How does ATP store energy?

3. How can ADP be recycled to from ATP again?

4. How do proteins in you cells access the energy stored in ATP?

5. Phosphate groups in ATP repel each other because they have negative charges. What charge might be present in ATP binding site of proteins to attract another ATP molecule?

D23

Name ____________________

Chapter 9: Energy in a Cell

9.2 Photosynthesis: Trapping the Sun's Energy
(pgs. 231-236)

Main Idea

Main Idea

Supporting Detail			

Photosynthesis

Light dependent reactions

Light independent reactions

Pigments

Chlorophyll

Light-Dependent Reactions

Main Idea

Supporting Detail			

Light-Independent Reactions

Main Idea

Supporting Detail			

Section Assessment

1. Why do you see green when you look at a leaf on a tree? Why do you see other colors in the fall?

3. What is the function of water in photosynthesis?

5. In photosynthesis, is chlorophyll considered a reactant, a product, or neither.________
How does the role of chlorophyll compare with those of CO_2 and H_2O

9.3 Getting Energy to make ATP (pgs. 237-243)

Trapping Energy from Sunlight

Main Idea

Supporting Detail			

Cellular Respiration

Aerobic

Anaerobic

Comparing Photosynthesis and Cellular Respiration

Main Idea

Supporting Detail			

Section Assessment 1-4

3. How is most of the ATP from aerobic respiration produced.

4. When is lactic acid fermentation important to the cell?

D24