Matter and Energy for Life
Unit 1

In this unit you will complete the following activities and send them as a package to your marker for evaluation.

Section 1 - The Cell Theory – 65 points

Activity 1 – 30 points
Activity 2 – 10 points
Activity 3 – Lab 1 – 25 points

Section 2 - The Microscope – 30 points

Activity 4 – Lab 1 – 30 points

Section 3 - The Cell – 50 points

Activity 5 – 10 points
Activity 6 – 20 points
Activity 7 – 20 points

Section 4 - The Cell Membrane – 40 points

Activity 8 – 20 points
Activity 9 – Lab 2 – 20 points

Section 5 - Cell Respiration and Photosynthesis – 50 points

Activity 10 – 30 points
Activity 11– Lab 1 – 15 points

Total Assignment Value – 235 points

The Cell Theory
Section 1

Specific Learning Outcomes:

- explain the importance of communicating the results of the development of the cell theory (114-9)
- explain the cell theory (314-5)
- analyse and describe examples where scientific understanding was enhanced or revised as a result of the invention of a technology (116-2)

Assigned Reading

Importance of the Cell Theory on text pages 20-21.
Emergence of Cell Theory on text page 28.

Biology is the branch of science that concentrates on living things. It is important to study biology and learn biological terms because of the tremendous impact it has on our daily lives. A knowledge of biology contributes to personal decisions with respect to health, nutrition, and reproduction.

Activity 1
Value 30 points

Using EBSCO, find five articles that emphasize the impact of biology on our lives. These articles can be collected any of the periodicals available on EBSCO, i.e., newspapers, magazines, and journals. For each article, respond to the following statements. Attach your response to a printed copy of each article before submitting.

1. How is the article connected to biology?
2. Does the topic of the article affect people's lives? Explain how.
3. How could the topic in this article affect your life now and in the future?
4. What are the pros and cons of the issue(s) presented in the article? Elaborate on the issues raised.

   For example, an article dealing with water pollution has con issues relating to environmental factors, such as water and wildlife. The topic may have pro issues, like a local industry, which would provide jobs and revenue.

Evaluation

The rubric on the next page will be used to evaluate each article in this activity. The article assignments will be averaged of 30 points.

Living Things

How do biologists know if something is alive? This seems like a simple question. People are living, trees and flowers are living; but what about things, such as bacteria and viruses, that cannot be seen with the naked eye? With the invention of the microscope, the microscopic world was discovered. The distinction between living and non-living became more difficult to discern. Through years of research, scientists have defined characteristics of living things.

Characteristics of Living Things

All living things display certain characteristics to classify them as living. The following is a summary of these characteristics.

	5 - 6 points	3 - 4 points	1 - 2 points	0	Score
Article Choice	Excellent connection to biology	Good connection to biology	Attempt was made to connect to biology	No connection to biology	
Topic's Affect on People	Excellent connection to people's lives	Good connection to people's lives	Attempt was made to connect to people's lives	No connection to people's lives	
Topic's Affect on You	Excellent connection to your life now and in the future	Good connection to your life now and in the future	Attempt was made to connect to your life now and in the future	No connection to your life now and in the future	
Pro and Con Issues	Excellent pro and con issues presented	Good pro and con issues presented	Attempt was made to present pro and con issues	No pro and con issues presented	
Elaboration of Issues	Excellent elaboration of issues presented	Good elaboration of issues presented	Attempt was made to elaborate on issues presented	No elaboration of issues presented	

LIVING THINGS:

1. need some form of energy from the environment to survive
2. reproduce
3. maintain a fairly constant internal environment
4. are highly organized
5. adapt to their environment
6. respond to stimuli
7. grow and develop

ACTIVITY 2

VALUE 10 POINTS

1. Select one living organism. Give examples of how this living organism displays the seven characteristics listed above.
2. Refer to pages 423-424 of your text. Is a virus a living thing? Explain.

EVALUATION

QUESTION 1

- worth six points.
- points awarded based on your choice of living thing and supporting evidence provided.

QUESTION 2

- worth four points.
- points awarded based on your decision supported with an explanation of why you made your choice.

THE CELL THEORY

What do a tree, a crab, an amoeba and a human have in common? The best way to answer this question is to break all the items down to their smallest component: the cell. All living organisms are made up of cells. In the 1600s, Robert Hooke coined the term "cell" to describe a structure

he observed under a microscope. This was the beginning of cell theory.

Cell theory was developed through the combined efforts of many scientists. This theory is the foundation for research and advancements in biology.

The Cell Theory

1. All living things are made up of cells.
2. Cells are the basic units of structure and function in living things.
3. All cells are created from pre-existing cells.

Scientists Contributing to the Cell Theory

Hans and Zacharias Janssen- (~1590)

Hans and Zacharias Janssen were eye-glass makers from Holland. The father and son team were credited with designing the first compound microscope in 1590. The design mounted two lenses in a tube and was used view minuscule objects.

Robert Hooke- (1635 - 1703)

Robert Hooke was born in England in 1635. He was a leading scientist in what is now called microbiology. His book *Micrographia* contained many illustrations of organisms viewed through a microscope. He observed holes in cork, the bark from the cork oak tree, then used for shipbuilding. He called these holes cells (1665). What Hooke actually saw were the cell walls of cork. To see a cork microscope slide, watch the video, *Using a Microscope*.

Anton van Leeuwenhoek- (1632 - 1723)

Anton van Leeuwenhoek, a Dutch fabric merchant and amateur scientist, was the first scientist to view living cells under a microscope. He examined blood, lake water and other living organisms. He observed what we now call bacteria (1680s).

Robert Brown - (1773 - 1858)

Robert Brown, a Scottish botanist and physician was the first to discover and observe the nucleus in living cells (1820).

Matthias Schleiden- (1804 - 1881)

Matthias Schleiden, a German botanist, investigated plants using a microscope. He determined plants were made up of cells and that plant cells come from other plant cells. His research drew scientific attention to living processes at the cellular level (1838).

Theodor Schwann - (1810 - 1882)

German born Schwann examined animal cells under a microscope. He applied Schleiden's cell theory and determined that cells can come from embryos. This reinforced the theory that animal parts are made up of cells (1839).

Rudolph Virchow - (1821-1902)

Virchow is considered the founder of cellular pathology. In the mid-1800s Virchow wrote *Cellular Pathology as Based on Histology*. Cellular pathology is the study of how disease changes the function and structure of an organism. In 1855, Virchow stated that all new cells are created from existing cells. He was also the first to demonstrate that cell theory applies to diseased tissue as well as healthy tissue, and that diseased cells are derived from healthy cells.

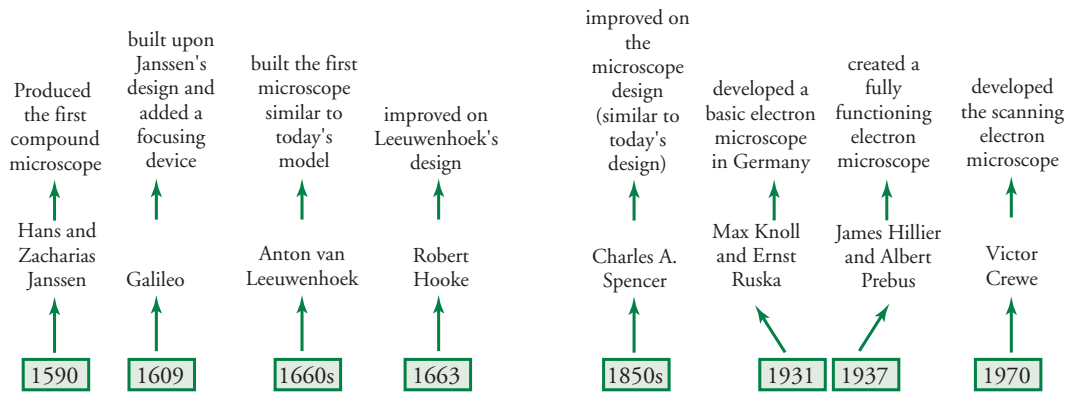
ACTIVITY 3

VALUE 25 POINTS

1. Copy and complete the table in the next column on cell theory. Be sure to include the year of any major contributions made by each scientist and your reasons for connecting each scientist to the discovery.
2. Use the table completed in question 1 to create a timeline of events leading up to the discovery of the cell theory. Fig 1-1 is a sample timeline, which displays the development of the microscope. Follow this model when creating your timeline.
3. Respond to the following questions or statements using your timeline as a reference.
   a) Explain the impact the development of the microscope had on the science of biology.
   b) Why is it important for scientists to share their research findings?
   c) Did Hooke and Leeuwenhoek influence one another's research?
   d) Before a scientist publishes a work, it undergoes "peer review" by other scientists. Why is a peer review an important process?
   e) List two technologies, other than the microscope, that have contributed to scientific understanding in bi0ology. Briefly explain aspects of their contribution.

THE CELL THEORY	YEAR	SCIENTIST	REASON
All living things are made up of cells			
Cells are the basic units of structure and function in living things			
All cells are created from pre-existing cells			

Fig 1-1



Timeline for the Microscope

Question		5 points	3 points	0	Score
1	Cell Theory statements with contributions	All statements and contributions included	Some statements and contributions included	No statements or contributions included	
2	Timeline in chronological order	All events in chronological order	Some events in chronological order	No events in chronological order	
	Scientists included with important dates and contributions	All scientists included with important dates and contributions	Some scientists included with important dates and contributions	No scientists included with important dates and contributions	
	Neatness and organization	Timeline very well organized and neat	Timeline somewhat organized and neat	Timeline very unorganized and messy	
3	Response to questions	Excellent response to questions	Good responses to questions	No response to questions	

EVALUATION

This rubric will be used to evaluate Activity 3.

The Microscope
Section 2

Specific Learning Outcomes:

- select and use microscopes effectively, safely, and accurately for collecting data (213-3, 213-8)
- compile, organize, and display evidence to facilitate the interpretation of data (213-5, 214-3)

Assigned Reading

A Window on the Invisible World, text pages 22-24.
The Second Technological Revolution, text pages 30-31.

The microscope timeline provided in Section 1 illustrates the importance of the microscope in the advancement of science. The microscopic world has been essential to the study and understanding of living things. To study the microscopic world, you must use a microscope and be familiar with the different types of microscopes.

Types of Microscopes

There are two main categories of microscopes developed and used and by scientists, *optical microscopes* and *electron microscopes*.

Optical Microscopes

Optical microscopes use light to produce an image. These are the kind usually found in homes, schools and hospitals.

Simple Microscope

The simple microscope uses only one lens to magnify an object by focusing light. This type of microscope is similar to using a magnifying glass. It has has limited magnification, enlarging an object up to 24 times the actual size.

Compound Microscope

The compound microscope uses two sets of lenses to magnify an object. One lens is called the ocular lens; the other is the objective lens. This type of microscope gives a higher magnification. The total magnification is found by multiplying the power of the occular lens by the power of the objective lens.

Example - 10X ocular and 4X objective will provide 40X larger viewing. This is the type of microscope used by scientists and researchers. You will examine this type of microscope in Biology 11. Generally, the magnification ranges from 40X to 2000X, depending on the power of the objective lenses.

Electron Microscopes

The electron microscope uses beams of electrons to produce an image. There are two main types of electron microscopes.

Transmission Electron Microscope

Beams of electrons pass through a thin slice of the specimen, which gives a cross-sectional view of a specimen. A transmission electron microscope can provide between 7000X and 2000000X magnification. A picture of a transmission electron microscope is shown in Figure 1.12 on page 31 of your text.

Scanning Electron Microscope

This microscope gives a three dimensional view of an organism by bouncing electrons off its surface. For the electrons to be refracted, the specimen must be coated in a very thin sheet of metal, usually gold. The image generated is a three dimensional view of a specimen at a very high power of magnification. Figure 1.13 on text page 31 shows an image taken with a scanning electron microscope.

MICROSCOPE COMPONENTS AND FUNCTIONS

Topic	Microscope Part	Function
Control Lighting	Mirror (some types) On switch (some types) Rheostat Iris diaphragm lever	Provides natural light Turns on light Controls brightness of light Controls amount of light let through from the light source
Pick a Slide	Clip Slide holder	Holds the slide in place Holds the other side of the slide
Switch Objectives	ocular housing (found on some types)	Place where the oculars are held (slides so oculars can be positioned correctly)
Reposition Slide Holder	XY controls (found on some types)	Moves the stage across and up and down
Adjust Focus	coarse focus knob fine focus knob	Moves slide table up and down by large amounts Moves slide table up and down by small amounts
Switching Views Adjust Oculars	oculars	look through these to view specimen
Adjust Focus	coarse focus	
Fine Tuning	fine focus XY controls iris diaphragm	
Switching Objectives	Revolving nose piece	Turns to change objective lenses

Activity 4

Value 30 points

Laboratory 1 - The Microscope

The video *The High School Biology Series* is provided with this course. The video has six segments: (1) *Microscopes*, (2) *Moss and Ferns*, (3) *Anatomy of Monocots and Dicots*, (4) *Anatomy of a Flowering Plant*, (5) *Dissections of Worm and Frog*, (6) *Human Anatomy*. View *Segment 1, Microscopes* to complete the following.

Segment 1 - Using Microscopes

- Hay Infusion Culture
- Cells of an Onion
- Cells of a Cork
- The Binocular or Stereoscopic Microscope
- The Fruit Fly

The microscope is an important biological tool. *Segment 1, Microscopes*, provides an overview of focusing techniques and contrasts the compound microscope with the dissecting (stereo) microscope. The video demonstrates the proper preparation and staining of dry and wet mount slides to minimize air bubbles and promote clarity in viewing. Weigh the benefits of a "dry" mount sample instead of a "wet" mount sample placed on a slide for viewing under a microscope. Iodine is used to stain samples. Iodine provides definition to a sample giving clarity to the cells of an onion including the cell wall, cytoplasm, nucleus and nucleoli.

1. From the video, make a drawing of an onion cell, use a pencil to draw and label the cell wall, cytoplasm, nucleus and nucleoli. Describe the role of each cellular structure you label.
2. Explain the proper procedure to "wet" mount a sample and to stain the sample.

While you view *Segment 1*, focus on the lens names, the meaning of lens power (low, mid- and high) and the purpose of the lamp and mirror. You usually find three objective lenses ranging in power and serving different functions. The scanning lens is 4×, the low power lens is 10× and high power lens is 40×. The video suggests beginning with a low magnification to view slides.

In the process of producing this segment a hay infusion culture was prepared. The culture provides a simple food chain consisting of the sun's energy through photosynthesis assisting in growing hay, hay providing energy to bacteria in the culture, and bacteria supplying energy to paramecium when pond water is added to the culture. The hay infusion culture was created by boiling hay and letting it stand to cool over a few days. Bacteria, in the culture, began to decompose the hay.

3. Contrast and compare the compound microscope with the stereoscopic (dissecting) microscope in terms of illumination, magnification, and specimen preparation.
4. Use EBSCO, the Internet, the public library or other resources to research career opportunities in laboratory technology. For example, cytology is the study of plant and animal cells.

Segment 2 - Mosses and Ferns

Mosses do not have a vascular system; they absorb water from the soil. Ferns are vascular plants; they absorb water through a root system. Ferns reproduce using spores while many vascular plants reproduce through seeds. A wet mount slide was produced to view a fern spore.

5. Draw, title, and label a view of the fern spore under the microscope. Explain how the "spore" slide was created.

6. Compare the use of microscopes to view the onion and cork cells with the use of the microscopes when viewing mosses and ferns. Provide drawings where appropriate to support your response.

Segment 3 - Anatomy of Monocots and Dicots

Segment 4 - Anatomy of a Flowering Plant

These segments provide information on the bean plant. Additional properties of the microscope become apparent when viewing a cross-section of a leaf.

7. Draw and label a cross-section of the leaf including the upper epidermis, the palisade layer, the spongy layer, the lower epidermis and stomata. Chloroplasts are contained in the palisade layer.

8. After viewing the video's cross-section of the bean under the compound microscope and the bean under a dissecting microscope prepare a paragraph to explain the strengths each microscopes provides to a research biologist.

Segment 5 - Dissections - Earthworm and Frog

The earthworm has an array of organ systems. It is composed of approximately 150 sections.

9. Notice, when dissecting, the biologist uses gloves. Why is this an important practice to follow?

The benefits of a dissecting microscope are noticeable when viewing this video segment. Use the information in this video segment to aid with your answer to question 8.

Evaluation

You will be evaluated on the completeness and accuracy of your responses.

The Cell
Section 3

Specific Learning Outcomes:

- compare and contrast different types of prokaryotic and eukaryotic cells (314-7)
- describe and apply classification systems and nomenclature used for the basis of cell grouping systems (214-1)
- describe cell organelles visible with the light and electron microscope (314-6)
- analyse and describe examples where the microscope enhanced or revised scientific understanding of cells (115-5, 116-6)

Assigned Reading

Overview of Cell Structure on text pages 29-30.
The Cytoplasic Organelles on text pages 33-37.

Studying Cells

The cell is the smallest unit of every living organism. The two main types of cells are *prokaryotes* and *eukaryotes*.

Prokaryotes

- have no membrane bound nucleus
- are grouped into the Monera Kingdom
- lack many of the membrane bound organelles (mitochondria, lysosomes, Golgi bodies, endoplasmic reticulum)
- bacteria and blue-green algae

See Figure 1.11 on text page 30.

Eukaryotes

- contain a membrane bound nucleus
- contain most membrane bound organelles
- are found in the Protist, Fungi, Plant and Animal Kingdoms

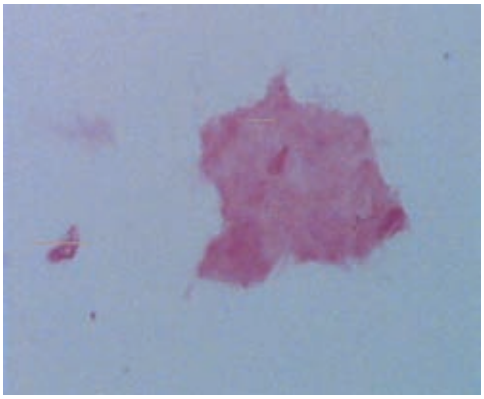
Activity 5
Value 10 points

Use the information provided on prokaryotic and eukaryotic cells in this section and on page 30 in the text to respond to the following.

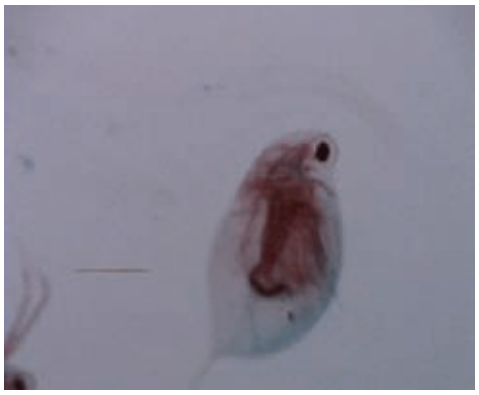
Identify each of the following organisms (1-5) as a prokaryote or eukaryote and include your reasons. Record the similarities and difference you see in the organisms in a chart.

Organism 1

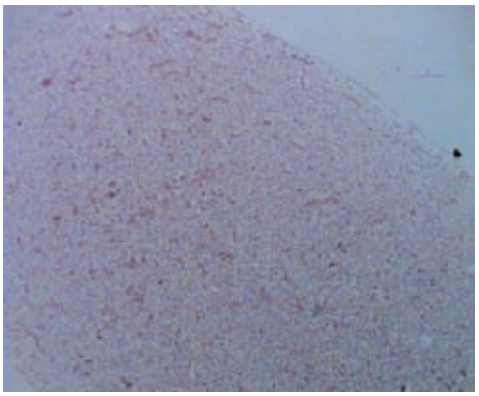
Organism 2



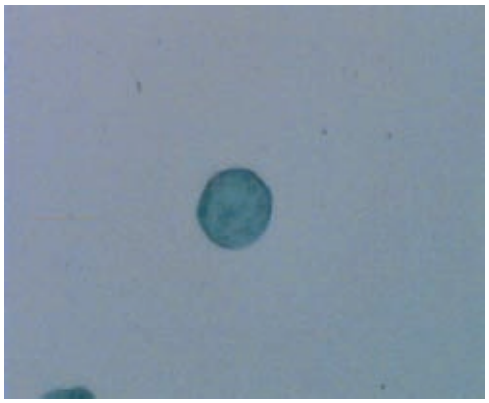
ORGANISM 3



ORGANISM 4



ORGANISM 5

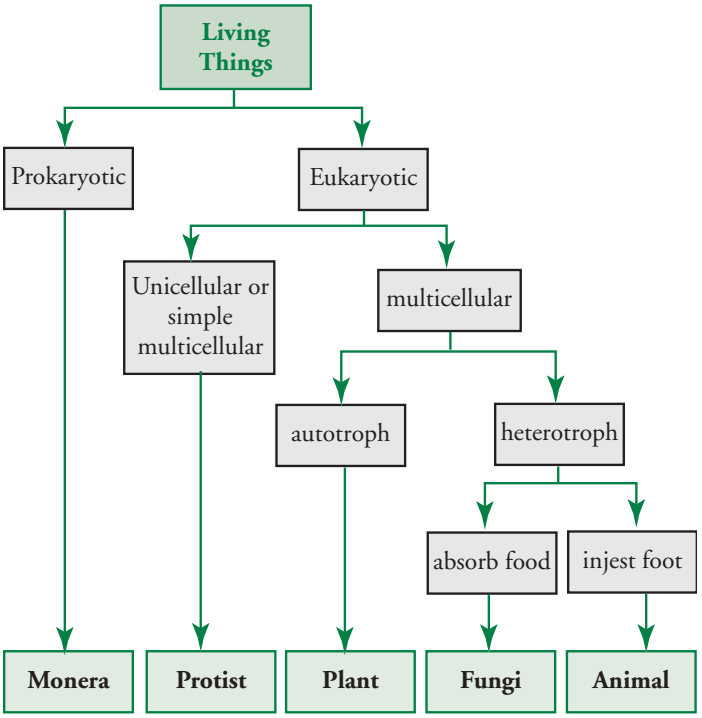


EVALUATION

You will be evaluated on your completed chart and reasons supporting your decisions. You may incorrectly decide one of the organisms is a prokaryote. This decision may still be marked as correct if you give good valid reasons why you made this choice.

CELL GROUPING SYSTEMS

This diagram shows how living things are grouped according to cell structure:



Cells can be grouped within an organism in the following way:

- *Cell* - the smallest division that can function (blood cells)
- *Tissue* - a group of cells that have the same structure and function (nerve tissue)
- *Organ* - many tissues working together to perform a certain function (stomach)
- *Organ System* - a group of organs working together (digestive system)

PARTS OF THE CELL

When exploring the cell, think about what the cell does, how the cell works and how the organelles (parts of the cell) function.

What Cells Do

Cells maintain a balance within an organism and carry out processes to help an organism stay alive. These processes were explored when you examined the characteristics of living things. Some examples include: blood cells carrying carbon dioxide to the lungs to be expelled from the body, intestinal cells absorbing amino acids from food to be used to create proteins, and plant cells producing sugar through photosynthesis, etc. To learn how cells work, look at the individual parts that make up a cell. These parts are called *organelles* and each has specific functions within a cell.

Cell Parts and Function

- *cell membrane* - a membrane surrounding an animal cell that determines what enters and leaves.
- *cell wall* - the thick coating surrounding plant cells; more rigid than the cell membrane
- *cytoplasm* - a gel-like solution in the cell where the organelles are located.
- *nucleus* - the control centre of the cell, holds the instructions for cellular processes (DNA).
- *endoplasmic reticulum* - a network of membranes that run from the nucleus to the cell membrane. If ribosomes are attached, it is called a *rough endoplasmic reticulum*. These function in the synthesis of proteins. If no ribosomes are attached, they are called *smooth endoplasmic reticulum*, which assist with lipid synthesis.
- *ribosomes* - small round bodies located in the cytoplasm or attached to the endoplasmic reticulum. They are the sites of protein synthesis (making proteins).
- *Golgi bodies* - look like a stack of pancake-like sacs. They process materials produced by the rough and smooth endoplasmic reticulum and prepare them for transport out of the cell (package or enclose them).
- *vacuole* - round bodies located throughout animal cells, which act as holding tanks. They carry materials out of the cell, or absorb materials into the cell. Plant cells generally have one large vacuole.
- *lysosome* - contain digestive enzymes that break down items contained in vacuoles. They fuse with the vacuole and release digestive enzymes to destroy and break down foreign materials. If a lysosome membrane ruptures within a cell, it can destroy that cell.
- *mitochondria* - a cylinder shaped organelle that produces energy within a cell (the power plant).
- *microfilaments and microtubules* - stringy protein molecules that form web-like material beside the cell membrane. They provide shape and movement for the cells.
- *centrioles* - a set of microtubules found in animal cells that appear during cell division.
- *cilia and flagella* - located on the exterior of some cells and assist with movement.
- *plastids* - bean-shaped organelles found in plants; involved in photosynthesis.

Further information about cellular organelles:

- Look at Figure 1.14, the plant cell, and Figure 1.15, the animal cell, on page 33 of your text.

OPTIONAL INTERNET RESOURCES:

Locate additional information on cells by using an Internet search engine. In the search window, type in search phrases like "virtual cell," "cellular organelles," or "plant cells."

ACTIVITY 6

VALUE 20 POINTS

Complete one of the following two options.

OPTION 1 - BROCHURE

Create a brochure that provides a tour of the various organelles within a cell. The main function and appearance of each organelle must be described along the journey. (Pretend you are a tour guide and write your script along the tour.)

The following terms must be featured in your final product:

plasma membrane
ribosomes
mitochondria
vacuoles
cytoplasm
ingestion
endoplasmic reticulum
digestion
Golgi bodies
transportation
lysosomes
excretion
nucleus
protein

OPTION 2 - ANALOGY

Create an analogy to represent the inner workings of a cell. Be sure to use the following words in your analogy.

plasma membrane
mitochondria
cytoplasm
endoplasmic reticulum
Golgi bodies
lysosomes
nucleus
ribosomes
vacuoles
ingestion
digestion
transportation
excretion
protein

EVALUATION

See the rubric below.

	5 - 6 points	3 - 4 points	1 - 2 points	0	Score
All Words Included		All words are included	Some words are included	No words are included	
Relationships described are accurate	Relationships made between included words and the product were excellent	Relationships made between included words and the product were good	Relationships made between included words and the product were attempted	No relationship between included words and the product	
Creativity	Excellent creativity used to create product	Good creativity used to create product	Some creativity used to create product	No connection creativity used to create product	
Neatness and Organization		Product is very neat and organized	Product is somewhat neat and organized	Product is not neat and organized	

Activity 7

Value 20 points

1. Which parts of the cell are responsible for the following processes and why?

    a) Bringing material into the cell? (ingestion)

    b) Providing nutrients? (digestion)

    c) Moving material through the cell? (transportation)

    d) Taking material out of the cell? (excretion)

Evaluation

You will be evaluated on the accuracy of your answer. Each statement is worth five points for a possible total of 20 points.

CELL MEMBRANES
SECTION 4

SPECIFIC LEARNING OUTCOMES:

- describe how organelles manage various processes such as ingestion, digestion, transportation, and excretion (314-8)
- compare and contrast matter and energy transformations associated with the process of photosynthesis and aerobic respiration (314-9)

ASSIGNED READINGS

Read *The Living Cell Membrane, Passive Transport,* and *Active Transport*, text pages 40-46.
Read *Carbohydrates, Lipids, Proteins,* and *Nucleic Acids*, text pages 58-69.

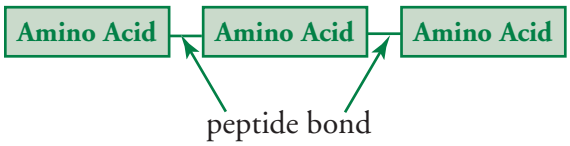
With an understanding of the components of a cell, it is time to investigate how cells work. How do they bring in certain molecules, and exclude others? How do cells produce energy and what do they do with this energy? These questions will be explored in this section. Remember, all cells are specialized and have different organelles and different numbers of organelles. For example, muscle cells require a lot of energy. Since mitochondria produce energy, these cells may have hundreds of mitochondria to enable the cell to do its job.

Before learning how cells work, look at the molecules that make up cells and living things. All living things contain carbon and are therefore organic molecules. There are four groups of organic molecules found in cells:

1. *Lipids* - fats that do not dissolve in water. They line the cell membrane and store energy within a cell.
2. *Carbohydrates* - provide and store energy within cells. They contain carbon, hydrogen and oxygen. The number of CH_2O molecules determines the name and function of the molecule.

   Examples: $C_5H_{10}O_5$ is ribose
   $C_6H_{12}O_6$ is glucose

   The carbohydrate molecules described above are monosaccharides. Two monosaccharides joining together will form a disaccharide, and many monosaccharides connected form polysaccharides. Starch is composed of hundreds of glucose molecules joined together in a line. Carbohydrates are usually stored as starch molecules.
3. *Proteins* - the main component of all living things. They are made up of chains of amino acids linked together with a peptide bond.



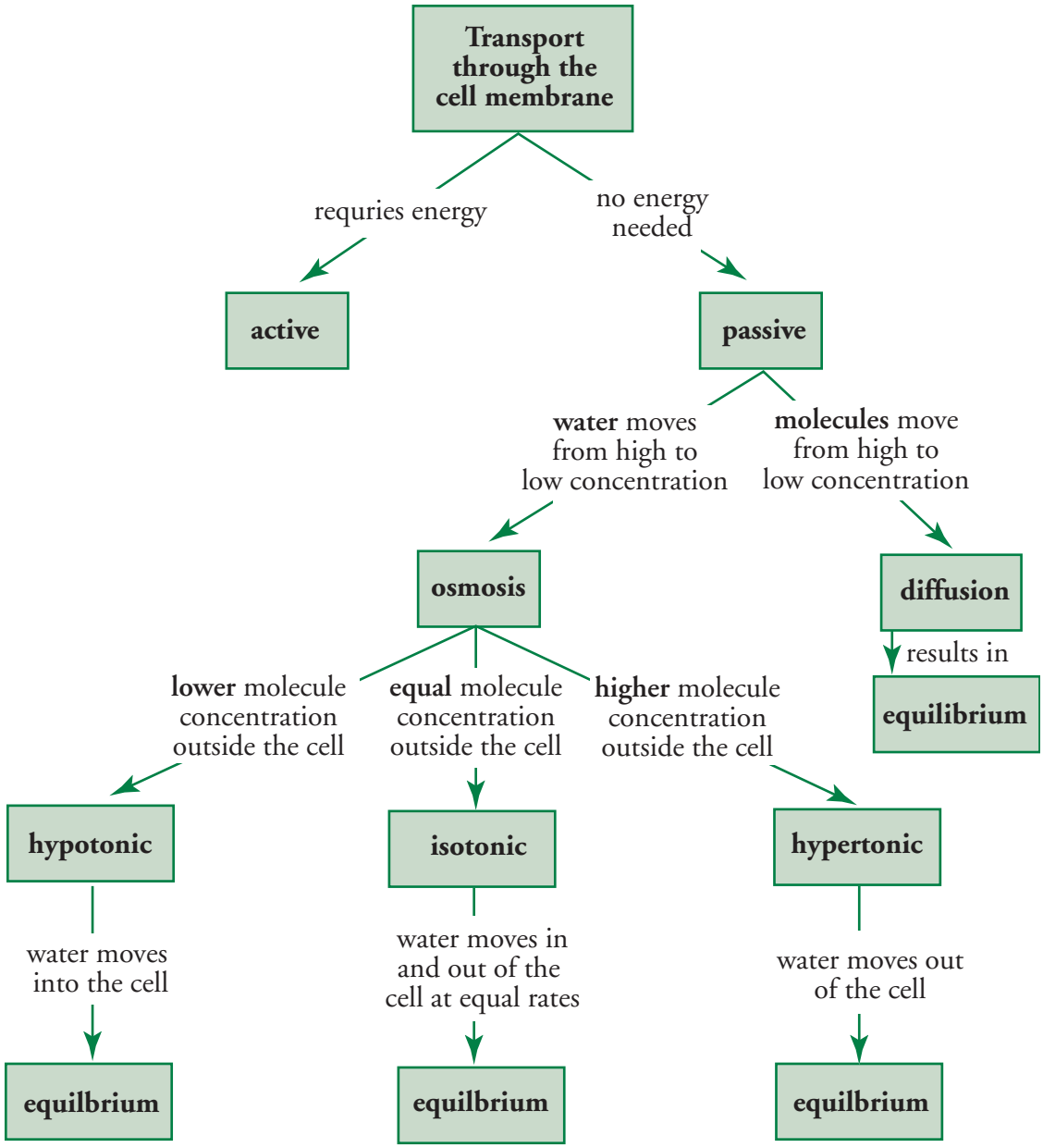
   Most enzymes are proteins. The outer layer of skin is composed of proteins.
4. *Nucleic Acids* - There are 20 amino acids used to build proteins. Cells can produce 12 of the amino acids. The other eight must be acquired through nutrition. Amino acids are obtained from food and used as building blocks to create proteins the body requires.

OPTIONAL INTERNET RESOURCES:

Locate additional information on cells by using an Internet search engine. In the search window, type in search phrases like “organic molecules,” “biological molecules,” or “cell biology.”

THE CELL MEMBRANE AND HOW IT WORKS

This concept map summarizes the workings of cell membranes:



Activity 8

Value 20 points

Write a story on a day in the life of a cell.
In your story, describe the following events occurring, including all cell organelles involved.

- Water entering the cell
- Oxygen entering the cell
- Amino acids entering the cell
- Hormones leaving the cell

Include the words diffusion, osmosis and active transport.

Your story should be a minimum of 700 words and include biological detail.

Evaluation

The rubric below will be used to evaluate your story.

	5 - 6 points	3 - 4 points	1 - 2 points	0	Score
Events		All cell events are included	Some cell events are included	No cell events are included	
Biological Detail	Excellent biological detail included in the story	Good biological detail included in your story	Some biological detail included in your story	No biological detail included in your story	
Creativity	Excellent creativity used to create product	Good creativity used to create product	Some creativity used to create product	No connection creativity used to create product	
Neatness and Organization		Story is very neat and organized	Story is somewhat neat and organized	Story is not neat and organized	

Activity 9

Value 20 points

Laboratory 2 - Exploring Osmosis

Follow the format in Appendix A at the back of this guide for writing a lab report. The rubric for lab evaluations is also in Appendix A.

Introduction:

Osmosis and diffusion are cellular processes that involve the cell membrane. To experience osmosis, you will use an egg as a model of a cell and observe what happens to the model cell in hypertonic, hypotonic and isotonic solutions.

Materials:

- egg
- three jars with covers (clean peanut butter or mayonnaise jars work well)
- paper and tape to label jars
- measuring cup
- white vinegar
- clear sugar syrup
- water

Procedure:

Day 1

1. Label the three jars: vinegar, syrup, and water.
2. Using the measuring cup, measure 200 mL of vinegar. Put it in the jar labelled "vinegar".
3. Put the egg in the jar. The vinegar should cover the egg. If the egg is not covered in vinegar, measure another 200 mL amount of vinegar

Data Table 1

Jar	Quantity of liquid when egg was added	Quantity of liquid when egg was removed	Observations
vinegar			
syrup			
water			

and add it to the jar. Be sure to record the total amount of vinegar used. Place the cover loosely on the jar. Wash your hands thoroughly.

4. Let the jar stand for 24 hours.

Day 2

5. Observe the egg. Record your observations in Data Table 1.
6. Using the measuring cup, measure 200 mL of syrup into the syrup jar. Record this amount in Data Table 1.
7. Remove the egg carefully from the vinegar. It will be fragile as the shell is dissolved.
8. Carefully rinse the egg in water and place it in the syrup jar. Place the cover loosely on the jar.
9. Using the measuring cup, measure the amount of vinegar left in the jar. Record this volume in Data Table 1. Wash your hands thoroughly.

Day 3

10. Add 200 mL of water to the water jar. Record this volume in Data table 1.
11. Remove the egg from the sugar solution. Record any observations in Data Table 1.
12. Place the egg in the water solution. Allow to stand for 24 hours.
13. Using the measuring cup, measure the amount of sugar solution left in the jar. Record this amount in Data Table 1. Wash your hands thoroughly.

Day 4

14. Remove the egg from the water. Record your observations in Data Table 1.
15. Using the measuring cup, measure the amount of water left in the jar. Record this volume in Data Table 1. Wash your hands thoroughly.

Observations:

Copy the completed Data Table 1 in your lab report.

Questions:

Answer the following questions as part of the lab report.

1. Why was the egg placed in vinegar?
2. What happened to the size of the egg after soaking in the vinegar? Why?

3. Describe the size of the egg after soaking in the syrup? Explain.
4. Describe the size of the egg after soaking in the water? Explain.
5. Which solutions (if any) were hypertonic, isotonic, or hypotonic? How do you know?
6. Draw a diagram of what happened to the egg in each solution.
7. Why are fresh fruits and vegetables sprinkled with water at the grocery store?
8. Salt is often spread on paved roads in the winter to melt ice. What does salt do to plants along the side of the road?
9. If a shipwrecked crew drinks sea water, they will most likely die. Why?
10. If a bowl of fresh strawberries is sprinkled with sugar, a few minutes later the berries will be covered with juice. Why?

Activity 10

Value 30 points

Create a concept map to describe the processes of photosynthesis and cellular respiration occurring within a cell. Use the following bulleted list of words in your concept map. You may add more words. All the words must be connected to at least one other word in your map. Connect the words with lines and arrows and include linking words on your lines. You can link words more than once. By creating more than one link to a word you are creating cross-connections, which show a greater understanding of the concept. Refer to sample the concept map of cell membranes on page 30.

- energy
- electron transport system
- photosynthesis
- glucose
- cellular respiration
- light dependent reactions
- light energy
- carbon-fixation reactions
- chemical energy
- chlorophyll
- ATP
- chloroplasts
- ADP
- thylakoid membranes
- NAD+
- photosystems
- NADP
- oxidation
- phosphorylation
- anaerobic respiration
- glycolosis
- aerobic respiration

Evaluation

The rubric on the next page will be used to evaluate your concept map.

	5 - 6 points	3 - 4 points	1 - 2 points	0	Score
Key Words		All key words are included	Some key words are included	No key words are included	
Links	Excellent links between key words	Good links between key words	Some links between key words	No links between key words	
Linking Words	Excellent linking words used	Good linking words used	Some linking words used	No linking words used	
Cross-Links		Good use of cross-links	Some use of cross-links	No use of cross-links	
Biological Detail	Excellent biological detail included in the concept map	Good biological detail included in the concept map	Some biological detail included in the concept map	No biological detail included in the concept map	

ACTIVITY 11

VALUE 20 POINTS

In this activity, you will analyse results obtained from a photosynthesis lab. You are to review the procedures that were completed and graph the results. Then you will analyse the results and answer questions. Write the lab report as if you performed the experiment yourself. Follow the format for writing labs in Appendix A.

LABORATORY 3 - PHOTOSYNTHESIS

INTRODUCTION:

This lab will investigate the rate of photosynthesis using the pond weed Elodea.

BACKGROUND:

In photosynthesis, plant cells convert light energy into chemical energy, which is stored in sugars and other organic compounds. Carbon dioxide is one of the reactants of this process and oxygen a product of the reaction. In this lab, you will measure the amount of oxygen created by counting bubbles produced by a Elodea plant.

PURPOSE:

To determine if the intensity of light affects the rate of photosynthesis.

MATERIALS:

- Elodea plant
- test tube rack
- razor blade
- timer or clock
- water (room temperature)
- test tube
- lamp (40 watt)
- tape
- metre stick

PROCEDURE:

1. Write a hypothesis (what you think will happen and why).
2. Obtain a sprig of Elodea. Cut a portion off the stem at an angle and lightly crush the cut end of the stem.
3. Place the plant in a test tube filled with water.
4. Place the test tube in the test-tube holder.
5. Count the number of oxygen bubbles rising from the stem for one minute. Record this information in your data table.

6. Place the 40 watt bulb 25 cm from the test tube. Turn on the bulb. Wait one minute and count the number of oxygen bubbles rising from the stem. Record your results.
7. Repeat Step 6 for the remaining distances.

OBSERVATIONS:

See the table below.

RESULTS:

Draw a graph to display the results. Average the trials to obtain one number to represent the amount of oxygen bubbles for each distance.

QUESTIONS:

1. This lab demonstrate that plants give off oxygen during photosynthesis. Explain how based on your observations and results.
2. The rate of photosynthesis changes when the light source is moved further from the plant. Explain the change in the rate of photosynthesis based on the data in the table.

Distance from Lamp	Oxygen Bubbles trial 1	Oxygen Bubbles Trial 2	Oxygen Bubbles Trial 3	Oxygen Bubbles Trial 4	Oxygen Bubbles Trial 5
0 cm	5	2	0	2	1
5 cm	12	4	5	8	7
10 cm	7	20	18	14	24
15 cm	42	25	31	14	38
20 cm	45	40	36	50	28
25 cm	65	54	72	58	36