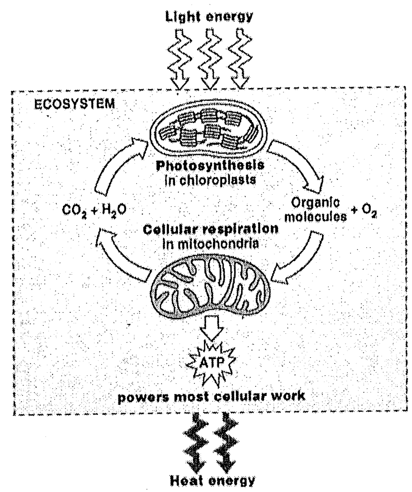
Unit 2 - ENERGY TRANSFER.............................CHAPTERS 8&9

Name Filled In Notes Hour ______

LEARNING GOALS



1. **I can describe where a plant gets the materials it needs to grow.**
   Photosynthesis Notes, p.11, & Graphic Organizer, p.15
2. **I can identify the cell part in which photosynthesis & cellular respiration take place inside the cell.**
   Cellular Respiration Notes, p.7, Photosynthesis Notes, p.11, Compare and Contrast Table, p.14, & Graphic Organizer, p.15
3. **I can name the pigment necessary for photosynthesis.**
   Photosynthesis Notes, p.11
4. **I can describe how and why leaves change color.**
   Leaf Article
5. **I can list the types of cells that would carry out photosynthesis & cellular respiration.**
   Cellular Respiration Notes, p.7, Seed Germination Demo, p.9, Photosynthesis Notes, p.11, Compare and Contrast Table, p.14, & Graphic Organizer, p.15
6. **I can write the balanced chemical equations for photosynthesis & cellular respiration, identify the reactants and products of the reactions, and describe the reactions in words.**
   Cellular Respiration Notes, p.7, Exercise and Cellular Respiration Demo, p.8, Photosynthesis Notes, p.11, Elodea Inquiry Demo, p.12, Compare and Contrast Table, p.14, & Graphic Organizer, p.15
7. **I can describe the change in energy forms from the beginning of photosynthesis to the end of cellular respiration.**
   Cellular Respiration Notes, p.7, & Photosynthesis Notes, p.11, Graphic Organizer, p.15
8. **I can describe the relationship between photosynthesis & cellular respiration.**
   Compare and Contrast Table, p.14, & Graphic Organizer, p.15
9. **I can list the elements in a carbohydrate.**
   Carbohydrate Notes, p.4, & Graphic Organizer, p.15
10. **I can identify the main chemical formula of a carbohydrate.**
    Carbohydrate Notes, p.4, & Graphic Organizer, p.15
11. **I can describe the structure and function of a carbohydrate using my own words.**
    Carbohydrate Notes, p.4, & Cellulose Overview Article, p.5, Graphic Organizer, p.15
12. **I can explain when a cell would perform cellular respiration or fermentation and why.**
    Fermentation Notes, p.10, & Graphic Organizer, p.15
13. **I can name the two types of fermentation as well as the reactants, products and cell types of each.**
    Fermentation Notes, p.10, Graphic Organizer, p.15
14. **I can identify the molecules of ATP and ADP.**
    Cellular Respiration Notes, p.7
15. **I can describe how energy is released from ATP and what the energy is used for.**
    Cellular Respiration Notes, p.7, & Graphic Organizer, p.15

VOCABULARY (I can define/describe the following terms in my own words) *Flashcards*

- Aerobic
- Alcoholic Fermentation
- Anaerobic
- ADP
- ATP
- Calorie
- Carbohydrate
- Cellular Respiration
- Chlorophyll
- Chloroplast
- Disaccharide
- Lactic Acid Fermentation
- Mitochondria
- Monomer
- Monosaccharide
- Photosynthesis
- Pigment
- Polymer
- Polysaccharide
- Product
- Reactant

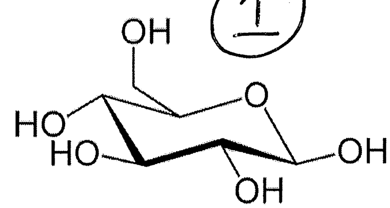
Notes: Carbohydrates

LG #9 – I can list the elements in a carbohydrate.
LG #10 – I can identify the main chemical formula of a carbohydrate.
LG #11 – I can describe the structure and function of a carbohydrate using my own words.

Monomer (single unit): Monosaccharide

- means "one" sugar
- ends in "ose"
  - Examples: glucose, galactose, fructose, ribose

(1)

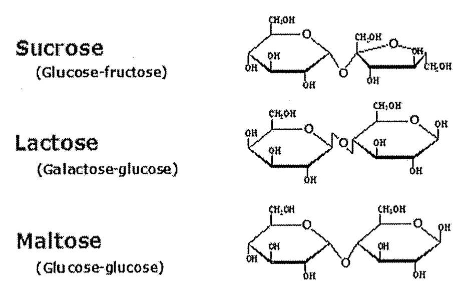


Two single sugars bonded together: Disaccharide

- Examples:
  - Sucrose (table sugar)
  - lactose (milk sugar)

(2)

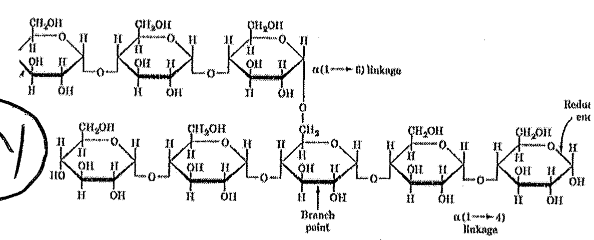
Digestible Disaccharides in Food



Polymer (chain of monomers): Polysaccharide

- Examples:
  - glycogen (animals)
  - starch (plants)
  - cellulose (plants)

MANY

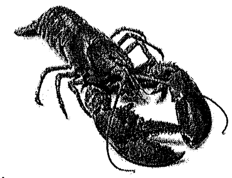


Structure:

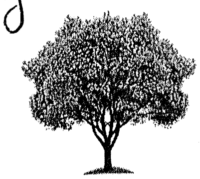
- Contains: Carbon (C), Hydrogen (H), + Oxygen (O)
- Chemical formula (typically): C_1H_2O (Ratio 1:2:1) → glucose is $C_6H_{12}O_6$
- Shape: ring of carbon linked together.

Functions:

- Energy!
  - Gummy Bear Demo: *Write down your observations in the space below.*



- Structural Support – (Not in Humans)
  - Cellulose – cell wall of plants allowing them to grow tall.
  - Chitin – Exoskeleton of sea creatures and some insects, also found in fugi.



Article: Cellulose Overview

Source: Virtual ChemBook, Elmhurst College (http://www.elmhurst.edu/~chm/vchembook/547cellulose.html)

LG: #11 – I can describe the structure and function of a carbohydrate using my own words.

After each paragraph below, write one sentence that summarizes the information in the paragraph. Remember, a summary sentence will have the most important information and will not include details.

Polysaccharides are carbohydrate polymers consisting of tens to hundreds to several thousand monosaccharide units (or monomers). All of the common polysaccharides contain glucose as the monosaccharide unit. Polysaccharides are synthesized for use as an energy source or for structural support.

Summarize:

Polysaccharides can vary in size and are used for energy and structural support.

However, not all types of polysaccharides can be synthesized by both plants and animals. For example, animals create a substances known as glycogen out of the extra glucose found in the blood stream. Glycogen is stored in the liver and muscle cells for later use. Plants create a substance called starch with any extra glucose. Starch is most commonly stored in a plant's roots.

Summarize:

Organisms take their glucose and store it in glycogen (a polysaccharide) for later use.

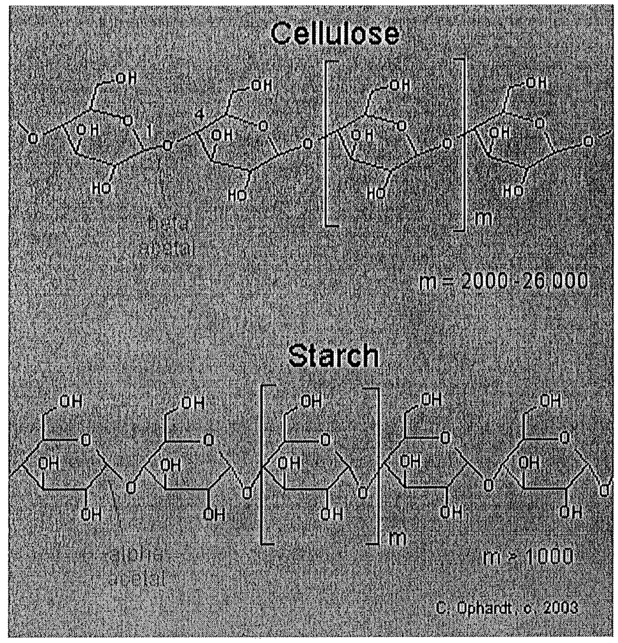
Cellulose:

The major component in the rigid cell walls in plants is cellulose. Cellulose is a linear polysaccharide polymer with many glucose monosaccharide units, just like starch. However, the bond between two glucose molecules in cellulose is shaped differently from the corresponding bond in starch (See picture below). This peculiar difference in linkages results in a major difference in digestibility in humans. Humans are unable to digest cellulose because they do not have the appropriate enzymes to breakdown the different bond formation. (More on enzyme digestion in a later chapter.)

Indigestible cellulose is the fiber that aids in the smooth working of the gastrointestinal (GI) tract.
Summarize:

Humans cannot digest cellulose, which is found in plant cells. So it helps things move along your GI tract.

Compare Cellulose and Starch Structures:



Animals such as cows, horses, sheep, goats, and termites have bacteria in their intestinal tract. These bacteria possess the necessary enzymes to digest cellulose in the GI tract. They have the required enzymes for the breakdown or hydrolysis of the cellulose; the animals, however, do not. Not even termites! No vertebrate can digest cellulose directly.
Summarize

No vertebrates can digest cellulose directly, but some carry bacteria that can help in their GI tract.

Fiber in the Diet:
Dietary fiber is the component in food not broken down by digestive enzymes and secretions of the gastrointestinal tract. This fiber includes hemicelluloses, pectins, gums, mucilages, cellulose, (all of which are carbohydrates) and lignin, the only non-carbohydrate component of dietary fiber.
Summarize:

Dietary fiber is the part of food that is NOT broken down.

High fiber diets cause increased stool size and may help prevent or cure constipation. Cereal fiber, especially bran, is most effective at increasing stool size while pectin has little effect. Lignin can be constipating.
Summarize:

High fiber foods/diets affect stool size + prevent constipation.

Fiber may protect against the development of colon cancer, for populations consuming high fiber diets have a low incidence of this disease. The slow transit time (between eating and elimination) associated with a low fiber intake would allow more time for carcinogens present in the colon to initiate cancer. But constipated people do not have a higher incidence of colon cancer than fast eliminators, so fiber's role in colon cancer remains unclear.
Summarize:

Fiber may protect against colon cancer

Dietary fiber may limit cholesterol absorption by binding bile acids. High fiber diets lower serum cholesterol and may prevent cardiovascular disease. Some fibers, such as pectin and rolled oats, are more effective than others, such as wheat, at lowering serum cholesterol.
Dietary fiber is found only in plant foods such as fruits, vegetables, nuts, and grains. Whole wheat bread contains more fiber than white bread and apples contain more fiber than apple juice, which shows that processing food generally removes fiber.
Summarize:

Dietary fiber is found only in plant foods, which, if processed lose fiber content.

Demo: Bromothymol Blue (BTB) Indicator

Bromothymol blue is used as a qualitative indicator of carbon dioxide as it changes colors from yellow to green to blue.

Add carbon dioxide (dry ice) to 20mL of BTB solution. Record observations below:

Add oxygen to 20mL of BTB solution. Record observations below:

Questions:

1. BTB is an indicator of:
2. When BTB solution is blue:
3. When BTB solution is yellow:
4. What other source of the substance can we use to confirm these results?

Notes: Cellular Respiration

LG #2 – I can identify the cell part in which photosynthesis & cellular respiration take place inside the cell.
LG #5 – I can list the types of cells that would carry out photosynthesis & cellular respiration.
LG #6 – I can write the balanced chemical equations for photosynthesis & cellular respiration, identify the reactants and products of the reactions, and describe the reactions in words.
LG #7 – I can describe the change in energy forms from the beginning of photosynthesis to the end of cellular respiration.
LG #14 – I can identify the molecules of ATP and ADP.
LG #15 – I can describe how energy is released from ATP and what the energy is used for.

Introduction

Respiration is not equal to Cellular Respiration, but there is a connection. Cellular respiration is the process that we use to release energy from Sugar. This process requires Oxygen, which is why we need to breath!

A Calorie is a unit of energy used in science. We also see that unit on food packages, but one calorie on a nutrition label is actually equal to 1000 calories or 1 Kilocalorie in science terms. One gram of sugar releases 3811 calories, which would be 4 calories on a food label.

The Transformation

- Law of Conservation of Energy states that energy is neither created or destroyed, it is simply transformed.
- Energy is transformed from chemical energy in the form of glucose to chemical energy in the form of ATP.
- Where is chemical energy found?

  In the bonds of molecules, like glucose.

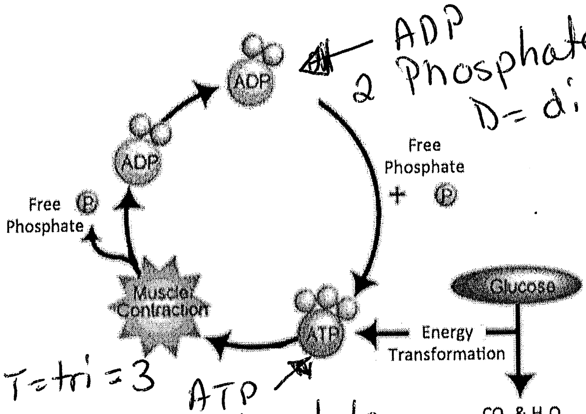
The Materials

- Reactants: Glucose - $C_6H_{12}O_6$
  Oxygen - O_2
- Products: Water - H_2O
  Carbon Dioxide - CO_2
  Energy - ATP

The Reaction

In Words: Glucose + oxygen react to form carbon dioxide and water which releases energy in the form of ATP.

Equation: $6O_2 + C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O + ATP$



ADP 2 Phosphates D = di = 2

T = tri = 3

ATP 3 phosphates

To release energy from ATP...

Break off the 3rd Phosphate

Additional Requirements:

- Cell Part: Mitochondrion
- Substances:
  ADP

Mitochondria Structural Features

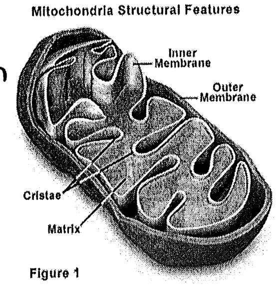


Figure 1

Additional Outcomes:

- Substance:
  ATP

To add energy to ADP...

Add on a 3rd phosphate → ATP

Demo: Exercise & Cellular Respiration

LG: #6 – I can write the balanced chemical equations for photosynthesis and cellular respiration, identify the reactants and products of the reactions, and describe the reactions in words.

Purpose: Determine how exercise affects the rate of cellular respiration.

Introduction: Cellular respiration is the process that releases energy by breaking down food molecules in the presence of oxygen. The following chemical equation summarizes cellular respiration:

In order to test for the presence of carbon dioxide we will, again, use an indicator called bromothymol blue. Bromothymol blue will change from blue to green to yellow in the presence of CO_2.

Materials:
- 2 small Erlenmeyer flasks
- Graduated cylinder
- Bromothymol blue solution
- Straws
- Stop watch

Hypothesis:

Procedure:
1. Record your hypothesis of how exercise will affect the time for the bromothymol blue solution to change color.
2. Put on your safety goggles.
3. Put 20 mL of bromothymol blue solution in each of 2 Erlenmeyer flasks.
4. When the timer says "go," slowly and gently blow air through a straw into the bottom of the flask. **CAUTION:** *Do not inhale through the straw.*
5. When the solution changes color the timer will say "stop." Record how long the color change took.
6. Jog in the hall for at least 2 minutes.
7. Repeat steps 4 and 5 using the other flask.

Data:

	Time for BTB solution to change color (seconds)	
	Before Exercise	**After Exercise**
1.		
2.		
3.		
4.		
5.		

Analyze and Conclude:
1. How did exercise affect the time for the solution to change color?
2. What process in your body produces carbon dioxide?
3. How does exercise affect the rate of this process?
4. Why does exercise affect the above process in this way?

Demo: Seed Germination

LG: #5 - I can list the types of cells that would carry out photosynthesis & cellular respiration.

Background

In this investigation we will have two jars present. Both will contain a small beaker of bromothymol blue solution. One of the jars will contain some germinating seeds. Germinating seeds are seeds that are just starting to sprout. Before a plant sprouts green leaves can it do photosynthesis? __No__! What process will the seeds be doing in order to release energy to grow? __Cellular Respiration__.

Hypothesis – create a hypothesis about what will happen to the color of the bromothymol blue solution in each of the jars. Refer back to our previous experiments with bromothymol blue to help you create your hypothesis.

- Jar with seeds:

- Jar without seeds:

Identify the following parts of the experiment:

Independent variable:

Dependent variable:

Control:

Constants:

Conclusion (Restate hypothesis, state if hypothesis is correct or incorrect, support with data):

- Jar with seeds:

- Jar without seeds:

Notes: Fermentation

LG #12 – I can explain when and why a cell would perform fermentation instead of cellular respiration.
LG #13 – I can name the two types of fermentation as well as the reactants, products and cell types of each.

Fermentation

- When there is no oxygen present cellular respiration cannot occur. Some cells can do other energy-releasing processes called fermentation
- Since fermentation does not require oxygen it is considered anaerobic. Cellular respiration requires energy so it is an aerobic process. (because it does require oxygen)
- Cell Part: Mitochondrion

There are two types of fermentation:

1. Alcoholic Fermentation

- Chemical equation:

Glucose → Yeast + Carbon dioxide + ATP

- Occurs in Yeast. When the yeast in dough runs out of oxygen it begins to ferment. This causes the dough to rise due to the bubbles of carbon dioxide that are given off. Alcoholic fermentation produces 2 ATP. ← way less then cellular respiration!

2. Lactic Acid Fermentation

- Chemical equation:

Glucose → Lactic Acid + Carbon Dioxide + ATP

- This type of fermentation occurs in human muscle cells during strenuous exercise when breathing cannot supply the cells with enough oxygen.

QUICK ENERGY

Muscles store a little bit of ATP, but only enough for a few minutes of intense activity. If you sprint for more than a few seconds then lactic acid fermentation will kick in. Lactic acid fermentation will give a 90 second supply of energy. Since fermentation does not use oxygen your build up an oxygen debt that you have to repay by breathing heavily after an intense activity.

LONG-TERM ENERGY

If you want to exercise longer than 90 seconds you have to do cellular respiration. Your body stores energy in muscles and other tissues in the form of the polysaccharide glycogen. These energy stores only last about 20 minutes. Then your body will begin to use other energy stores, such as fat. That is why some aerobic videos will tell you that after 20 minutes you're in the fat burning zone.

Notes: Photosynthesis

LG #1 – I can describe where a plant gets the materials it needs to grow.
LG #2 – I can identify the cell part in which photosynthesis & cellular respiration take place inside the cell.
LG #3 – I can name the pigment necessary for photosynthesis.
LG #5 – I can list the types of cells that would carry out photosynthesis & cellular respiration.
LG #6 – I can write the balanced chemical equations for photosynthesis & cellular respiration, identify the reactants and products of the reactions, and describe the reactions in words.
LG #7 – I can describe the change in energy forms from the beginning of photosynthesis to the end of cellular respiration.

The Basics

- Photo = Light   Synthesis = Put Together
- What is being put together? food in the form of sugar (glucose)
- Why do we need food? Energy

The Transformation

- Law of Conservation of Energy states that energy is neither created or destroyed, it is simply transformed.
- Energy is transformed from light energy (sun) to chemical energy in the form of glucose.
- What is the ultimate source of light energy? Sunlight!
- Where is chemical energy found? In the bonds of molecules like glucose

The Materials

- Reactants: Carbon Dioxide – CO_2, Water – H_2O
- Products: Oxygen – O_2, Glucose – $C_6H_{12}O_6$

The Reaction

In Words: Light energy converts carbon dioxide and water into chemical energy (glucose) and oxygen.

Equation:

$$6CO_2 + 6H_2O \xrightarrow{\text{Sunlight}} C_6H_{12}O_6 + 6O_2$$

Additional Requirements:

- Energy Source: Light Energy (Sun)
- Cell Part: Chloroplast (plant cells only)
  - Green Pigment (that makes the energy transformation): Chlorophyll
  - Why do we see the color green when light reflects off this pigment? Chlorophyll reflects green light only.
- ✱ Note: Soil is NOT required for photosynthesis.

Plant Cell Chloroplast Structure

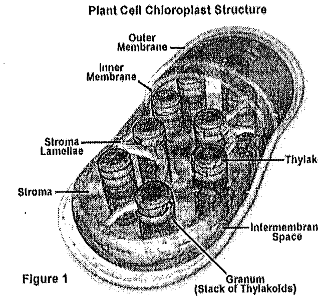


Figure 1

Demo: Elodea in Bromothymol Blue

LG: #6 – I can write the balanced chemical equations for photosynthesis and cellular respiration, identify the reactants and products of the reactions, and describe the reactions in words.

Background Information

Bromothymol blue is an indicator that we will use to show how much CO_2 there is in a solution. Bromothymol blue will turn yellow in the presence of CO_2. Elodea is a water plant that we will place in the solution of water, bromothymol blue, and carbon dioxide.

Purpose

Determine whether elodea has an affect on the amount of CO_2 in a solution.

Equation

(Write out the equation for photosynthesis)

Procedure:

1. GENTLY exhale through a straw into the bromothymol blue solution until it turns yellow.
2. Label the test tubes 1-4.
3. Add 15 mL of the yellow solution to each of the four test tubes.
4. Add a small piece of Elodea to test tube "2".
5. Add a large piece of Elodea to test tube "3".
6. Add a large piece of Elodea to test tube "4" and cover it completely with foil.
7. Place all 4 test tubes in a test tube rack. Place the rack in front of a light source, such as an aluminum reflector lamp with a 60-100 watt bulb.
8. NOTE! If the test tube rack is placed too close to the lamp, the heat will have an affect on the experiment, adding a variable. To prevent this, place a large beaker of water in between the test tube rack and the lamp to absorb the heat (or act as a "heat sink").
9. View the colors of the test tubes after about an hour. Record.

Hypotheses

Create a hypothesis regarding what, if anything, will happen to the color of solution in each test tube. Hypotheses must be in complete sentences.

1. Solution only:

2. Solution containing a small piece of Elodea exposed to light:

3. Solution containing a large piece of Elodea exposed to light:

4. Solution containing a piece of Elodea kept in the dark:

Data

	"1" Solution only	"2" Small Elodea with light	"3" Large Elodea with light	"4" Large Elodea in the dark
Starting color of solution				
Color of solution after 1 hour				

Questions:

1. What is the name of the indicator that we used in today's investigation?
2. What was the indicator indicating?
3. Why did we initially blow into the solution, turning it yellow?
4. Did the plants alter the amount of CO_2 in the test tubes?
5. What was the relationship between the size of the plant and the amount of CO_2 in solution?
6. Which test tube was the control in this experiment? ______ Explain why.
7. Test tubes 3 and 4 both contained the same amount of Elodea. Why then, were the solutions different colors?
8. What was the purpose of the large beaker of water between the test tubes and the light source?

Article: Why Leaves Change Color

If you are lucky, you live in one of those parts of the world where Nature has one last fling before settling down into winter's sleep. In those lucky places, as days shorten and temperatures become crisp, the quiet green palette of summer foliage is transformed into the vivid autumn palette of reds, oranges, golds, and browns before the leaves fall off the trees. On special years, the colors are truly breathtaking.

How does autumn color happen?

For years, scientists have worked to understand the changes that happen to trees and shrubs in the autumn. Although we don't know all the details, we do know enough to explain the basics and help you to enjoy more fully Nature's multicolored autumn farewell. Three factors influence autumn leaf color-leaf pigments, length of night, and weather, but not quite in the way we think. The timing of color change and leaf fall are primarily regulated by the calendar, that is, the increasing length of night. None of the other environmental influences-temperature, rainfall, food supply, and so on-are as unvarying as the steadily increasing length of night during autumn. As days grow shorter, and nights grow longer and cooler, biochemical processes in the leaf begin to paint the landscape with Nature's autumn palette.

Where do autumn colors come from?

A color palette needs pigments, and there are three types that are involved in autumn color.

- Chlorophyll, which gives leaves their basic green color. It is necessary for photosynthesis, the chemical reaction that enables plants to use sunlight to manufacture sugars for their food. Trees in the temperate zones store these sugars for their winter dormant period.

- Carotenoids, which produce yellow, orange, and brown colors in such things as corn, carrots, and daffodils, as well as rutabagas, buttercups, and bananas.

- Anthocyanins, which give red, purple and blue colors to such familiar things as cranberries, red apples, concord grapes, blueberries, cherries, strawberries, and plums. They are water-soluble and appear in the watery liquid of leaf cells.

Both chlorophyll and carotenoids are present in the chloroplasts of leaf cells throughout the growing season. Most anthocyanins are produced in the autumn, in response to bright light and excess plant sugars within leaf cells.

During the growing season, chlorophyll is continually being produced and broken down and leaves appear green. As night length increases in the autumn, chlorophyll production slows down and then stops and eventually all the chlorophyll is destroyed. The carotenoids and anthocyanins that are present in the leaf are then visible.

Certain colors are characteristic of particular species. Oaks turn red, brown, or russet; hickories, golden bronze; aspen and yellow-poplar, golden yellow; dogwood, purplish red; beech, light tan; and sourwood and black tupelo, crimson. Maples differ species by species-red maple turns brilliant scarlet; sugar maple, orange-red; and black maple, glowing yellow. Striped maple becomes almost colorless. Leaves of some species such as the elms simply shrivel up and fall, exhibiting little color other than drab brown.

The timing of the color change also varies by species. Sourwood in southern forests can become vividly colorful in late summer while all other species are still vigorously green. Oaks put on their colors long after other species have already shed their leaves. These differences in timing among species seem to be genetically inherited, for a particular species at the same latitude will show the same coloration in the cool temperatures of high mountain elevations at about the same time as it does in warmer lowlands.

How does weather affect autumn color? The amount and brilliance of the colors that develop in any particular autumn season are related to weather conditions that occur before and during the time the chlorophyll in the leaves is dwindling. Temperature and moisture are the main influences.

A succession of warm, sunny days and cool, crisp but not freezing nights seems to bring about the most spectacular color displays. During these days, lots of sugars are produced in the leaf but the cool nights and the gradual closing of veins going into the leaf prevent these sugars from moving out. These conditions-lots of sugar and lots of light-spur production of the brilliant anthocyanin pigments, which tint reds, purples, and crimson. Because carotenoids are always present in leaves, the yellow and gold colors remain fairly constant from year to year.

The amount of moisture in the soil also affects autumn colors. Like the weather, soil moisture varies greatly from year to year. The countless combinations of these two highly variable factors assure that no two autumns can be exactly alike. A late spring, or a severe summer drought, can delay the onset of fall color by a few weeks. A warm wet spring, favorable summer weather, and warm sunny fall days with cool nights should produce the most brilliant autumn colors.

What triggers leaf fall?

In early autumn, in response to the shortening days and declining intensity of sunlight, leaves begin the processes leading up to their fall. The veins that carry fluids into and out of the leaf gradually close off as a layer of cells forms at the base of each leaf. These clogged veins trap sugars in the leaf and promote production of anthocyanins. Once this separation layer is complete and the connecting tissues are sealed off, the leaf is ready to fall.

What does all this do for the tree?

Winter is a certainty that all vegetation in the temperate zones must face each year. Perennial plants, including trees, must have some sort of protection to survive freezing temperatures and other harsh wintertime influences. Stems, twigs, and buds are equipped to survive extreme cold so that they can reawaken when spring heralds the start of another growing season. Tender leaf tissues, however, would freeze in winter, so plants must either toughen up and protect their leaves or dispose of them.

The evergreens-pines, spruces, cedars, firs, and so on-are able to survive winter because they have toughened up. Their needle-like or scale-like foliage is covered with a heavy wax coating and the fluid inside their cells contains substances that resist freezing. Thus the foliage of evergreens can safely withstand all but the severest winter conditions, such as those in the Arctic. Evergreen needles survive for some years but eventually fall because of old age.

The leaves of broadleaved plants, on the other hand, are tender and vulnerable to damage. These leaves are typically broad and thin and are not protected by any thick coverings. The fluid in cells of these leaves is usually a thin, watery sap that freezes readily. This means that the cells could not survive winter where temperatures fall below freezing. Tissues unable to overwinter must be sealed off and shed, otherwise the plant would be vulnerable to infection. Thus leaf fall precedes each winter in the temperate zones.

Compare & Contrast Table: Energy-Related Cellular Processes

LG #2 – I can identify the cell part in which photosynthesis and cellular respiration take place inside the cell.
LG #4 – I can list he types of cells that would carry out photosynthesis and cellular respiration.
LG #5 – I can write the balanced chemical equations for photosynthesis and cellular respiration, identify the reactants and products of the reactions, and describe the reactions in words.

	Cellular Respiration	Fermentation	Photosynthesis
Equation		Lactic Acid: Alcoholic:	
Reactants		Lactic Acid: Alcoholic:	
Products		Lactic Acid: Alcoholic:	
Type of cell(s) process occurs in		Lactic Acid: Alcoholic:	
Cell part process occurs in			
Function: Energy			

Graphic Organizer: Energy-Related Cellular Processes

Use the following word bank to fill in the graphic organizer below: (Words will only be used once)

- ATP
- Breaking off a phosphate group
- Carbohydrates
- Cellular Respiration
- Chemical
- Chloroplast
- Disaccharide
- Fructose
- Glucose
- Glycogen
- Lactose
- Light
- Mitochondria
- Monosaccharide
- Opposite
- Photosynthesis
- Polysaccharide
- Release energy
- Starch
- Store energy
- Sucrose
- Sugar & oxygen
- Water & carbon dioxide