



Forest Ecology Project

Buds, Leaves, and Global Warming

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Massachusetts State Frameworks

Biology Strand – Energy & Living Things

16. Recognize that producers (plants that contain chlorophyll) use the energy from sunlight to make sugars from carbon dioxide and water through a process called photosynthesis. This food can be used immediately, stored for later use, or used by other organisms.

Massachusetts State Frameworks

Physical Science Strand

Elements, Compounds, & Mixtures

5. Recognize that there are more than 100 elements that combine in a multitude of ways to produce compounds that make up all of the living and nonliving things that we encounter.
7. Give basic examples of elements and compounds.
8. Differentiate between compounds and mixtures.
10. Differentiate between physical changes and chemical changes.



Physical & Chemical Properties

Outline of Activities

- Physical Properties of Leaves Activity
- Lab on Leaf Chromatography
- ComicLife Cartoon on Photosynthesis and Respiration

Physical Properties of Leaves

Info Sheet - WHAT TREE IS THAT?

Information sheet to help identify tree



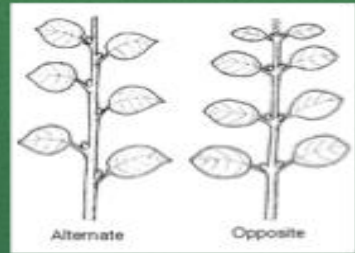
What tree is that?

Tree identification can be accomplished by looking at the shape and pattern of the leaves on the trees.



CLUE 1: TWIGS AND BUDS

Trees have either alternate or opposite buds.



Alternate buds: oaks, alder, birch, beech

Opposite: maple, ash, dogwood



CLUE 2: SIMPLE VERSUS COMPOUND LEAF



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Simple: the leaf blade is NOT divided into leaflets

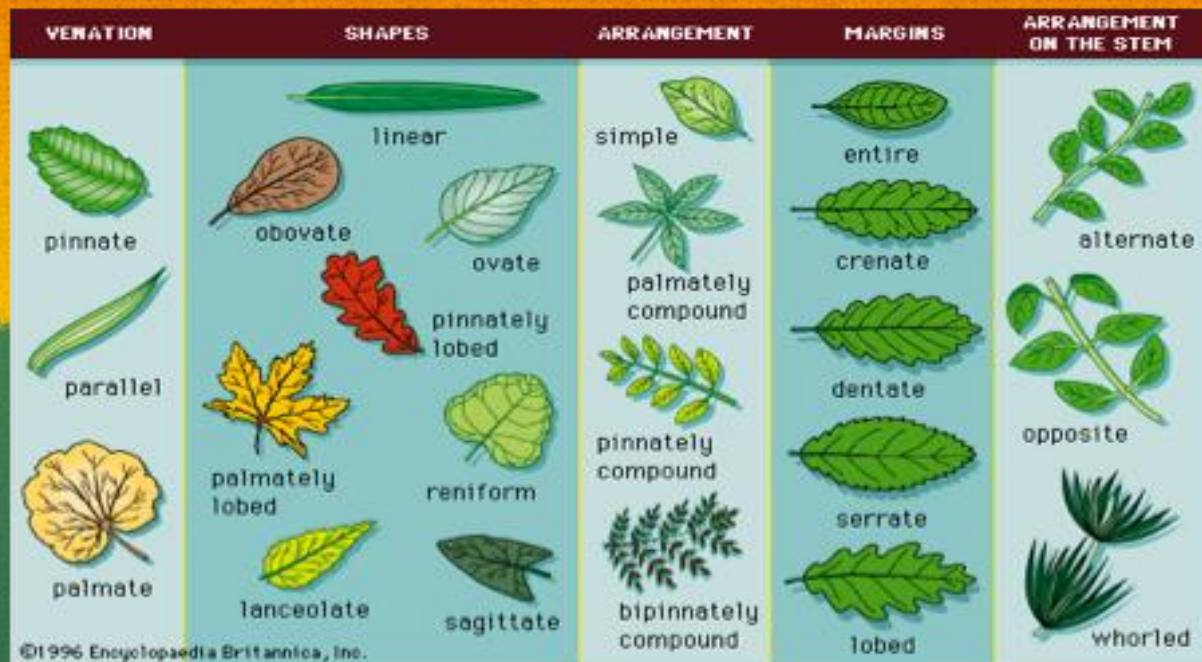
Compound: the leaf blade is divided into leaflets



CLUE 3: VEINS, SHAPES, AND MARGINS



©EnchantedLearning.com



Pinnate: Central mid vein with side veins arising from it

Palmate: Several main veins



CLUE 4: DICHOTOMOUS TREE KEY

Use the books in class or the following websites to identify your tree.

Arbor Day Foundation Animation on how to identify trees:

<http://www.arborday.org/trees/wti/>

Arbor Day Foundation Guide to identify your tree:

<http://www.arborday.org/trees/whatTree/WhatTree.cfm?ItemID=E6A>

Environmental Education for Kids – Tree Key:

<http://dnr.wi.gov/org/caer/ce/ee/veg/treekey/index.htm>

Physical Properties of Leaves

Activity - TREE ID



Leaf Observation Activity to identify physical properties of leaves

TREE ID

Draw the shape of the leaf and show its vein pattern in this box.

ALTERNATE or OPPOSITE

SIMPLE or COMPOUND

LENGTH OF LEAF: cm

WIDTH OF LEAF: cm

PHYSICAL PROPERTIES:

color, veins, shape, smell, etc

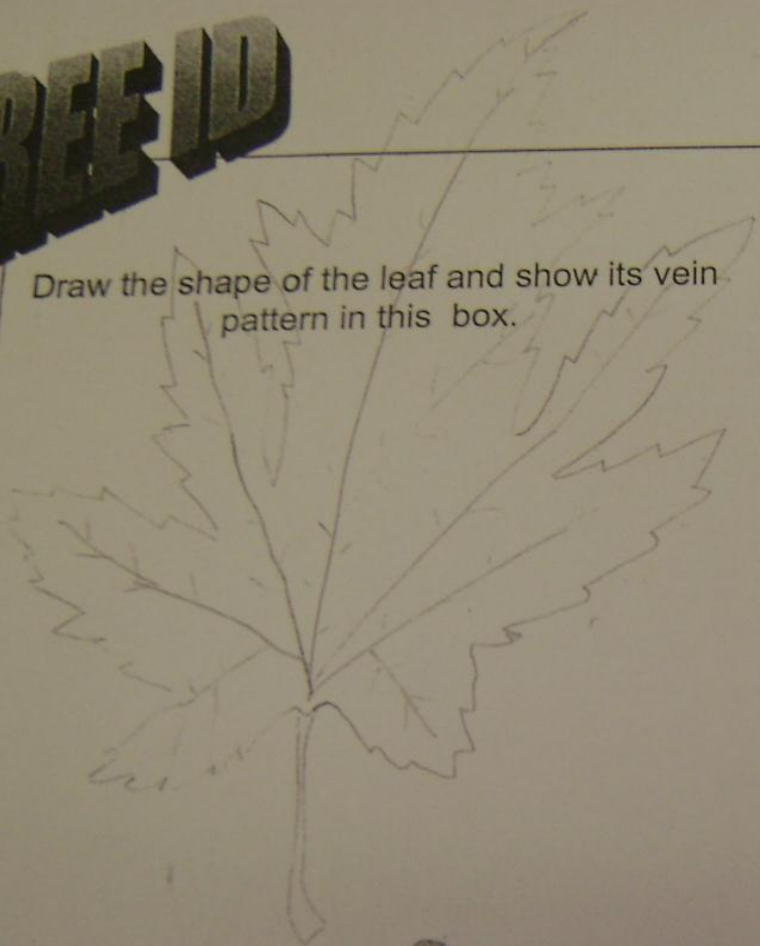



Type of tree:



TREE ID

Draw the shape of the leaf and show its vein pattern in this box.



 Type of tree:

Silver Maple

ALTERNATE or OPPOSITE

SIMPLE or COMPOUND

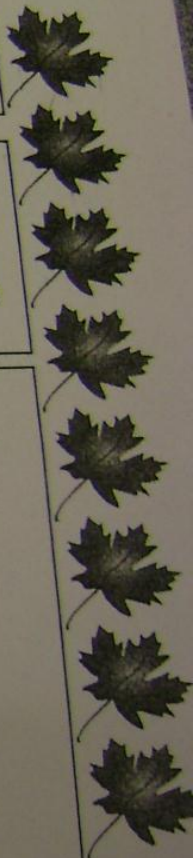
LENGTH OF LEAF: 20 cm

WIDTH OF LEAF: 12 cm

PHYSICAL PROPERTIES:

color, veins, shape, smell, etc

- red stem
- dark green leaf
- veins are light green
- brown stick
- pointy end
- smells like the woods and outdoor
- Paris are 4 angle
- smells fresh



TREE ID

Draw the shape of the leaf and show its vein pattern in this box.



Type of tree:

White Oak

ALTERNATE or OPPOSITE

SIMPLE or COMPOUND

LENGTH OF LEAF: 17.5 cm

WIDTH OF LEAF: 11.3 cm

PHYSICAL PROPERTIES:

color, veins, shape, smell, etc

Green with brown spots, light green veins, smells like woods, lobed margins, pinnately lobed, palmate veins



Physical Properties of Leaves



Worksheet BRANCH SCETCH

Worksheet for sketching
branch



Branch Sketch

Names:

Class:

Tree Number:

Branch Letter:

Tree Species:

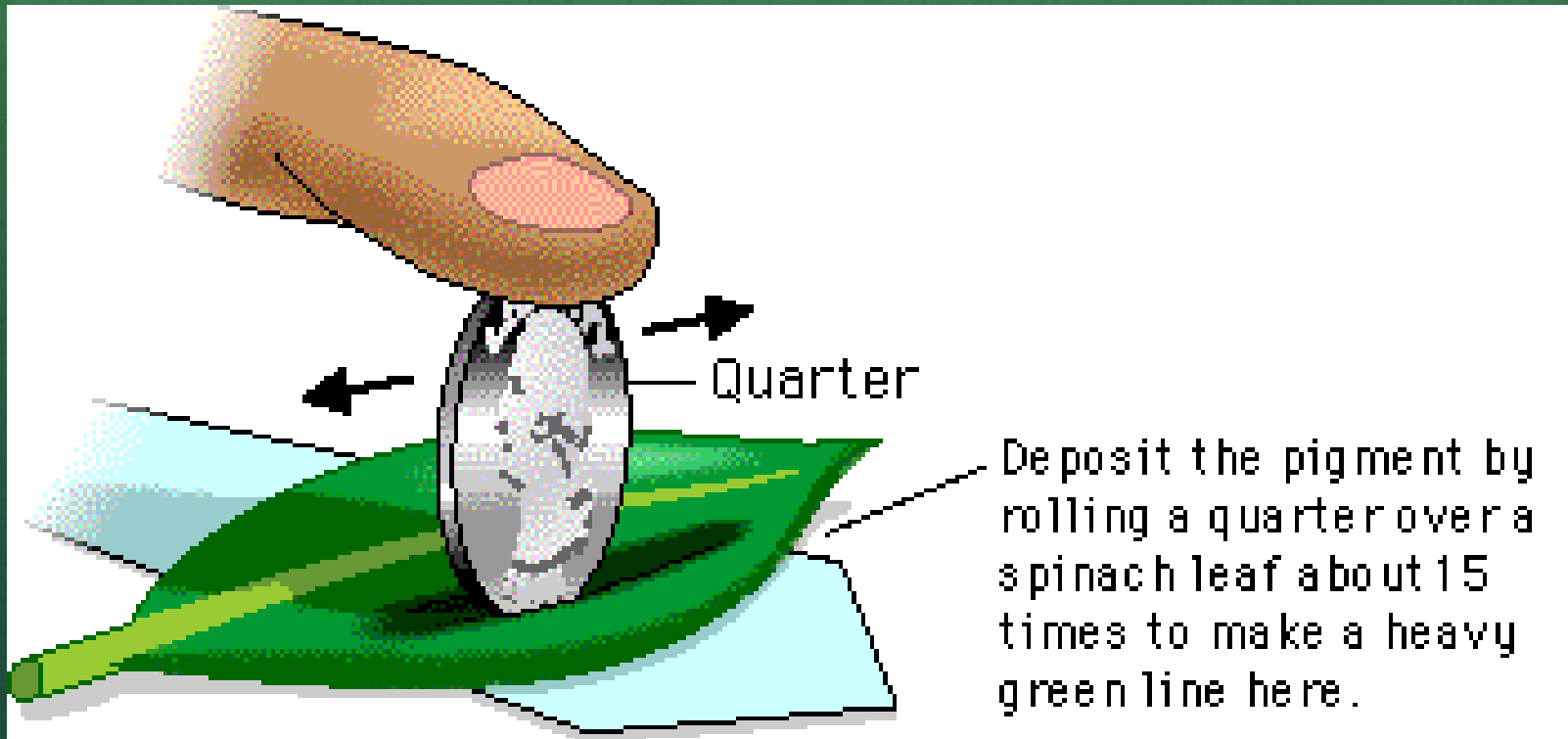
Draw your branch and label the six leaves you will be studying.

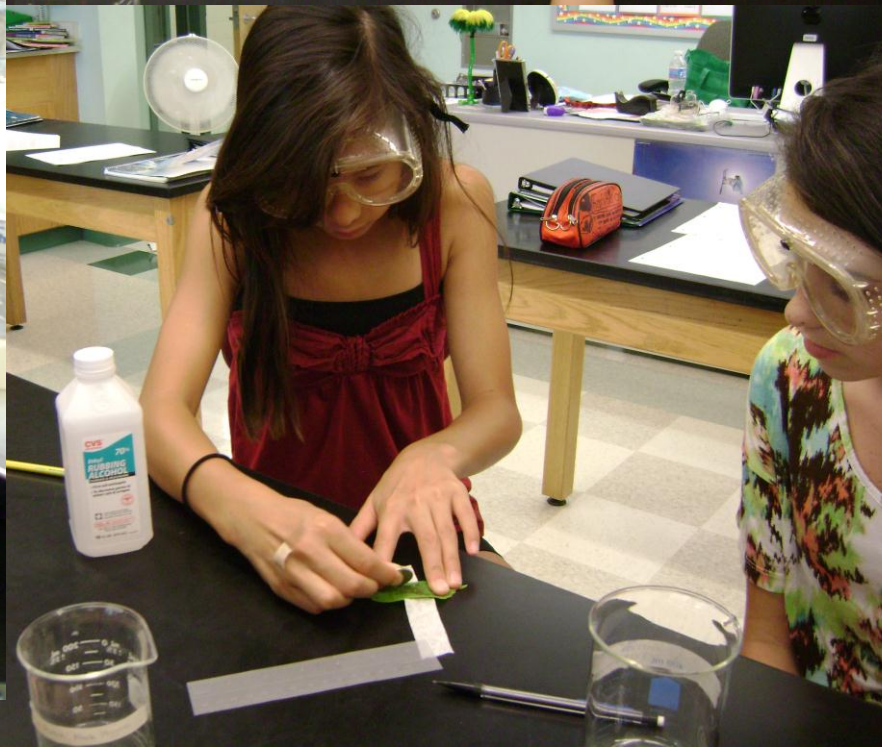
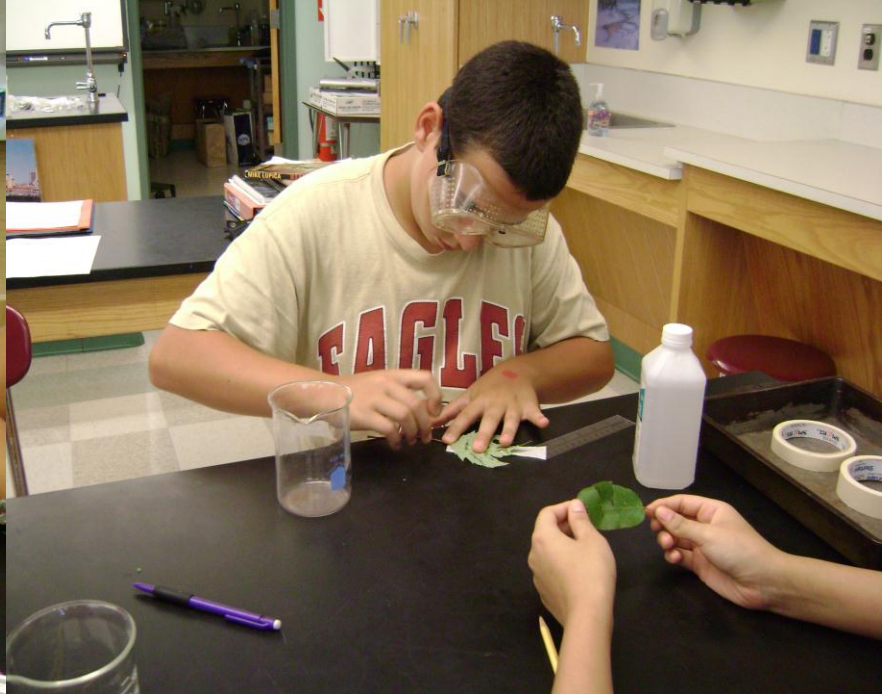
Leaf Chromatography

Step 1: Collect leaf from tree!



Step 2: Deposit pigment on filter paper!

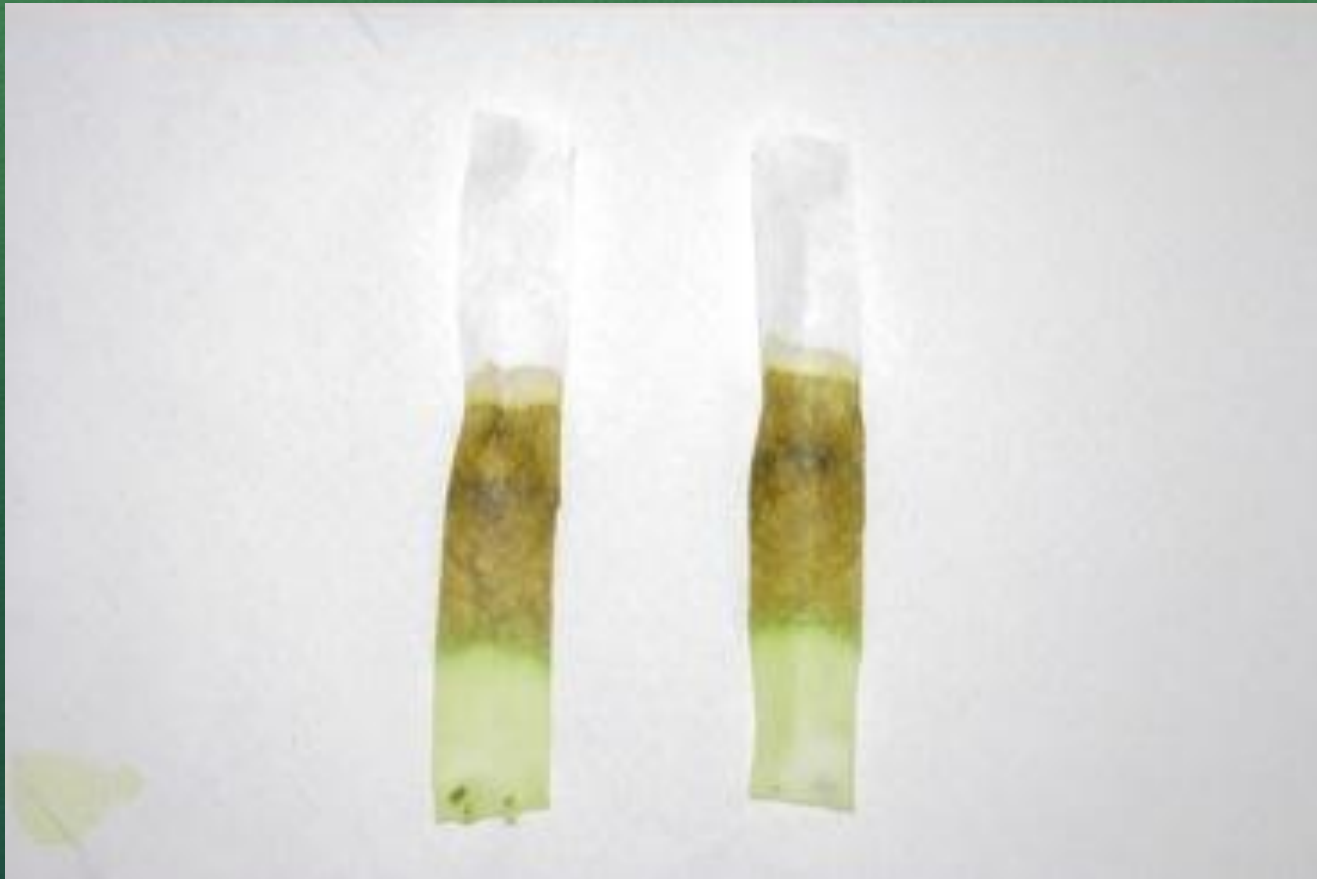




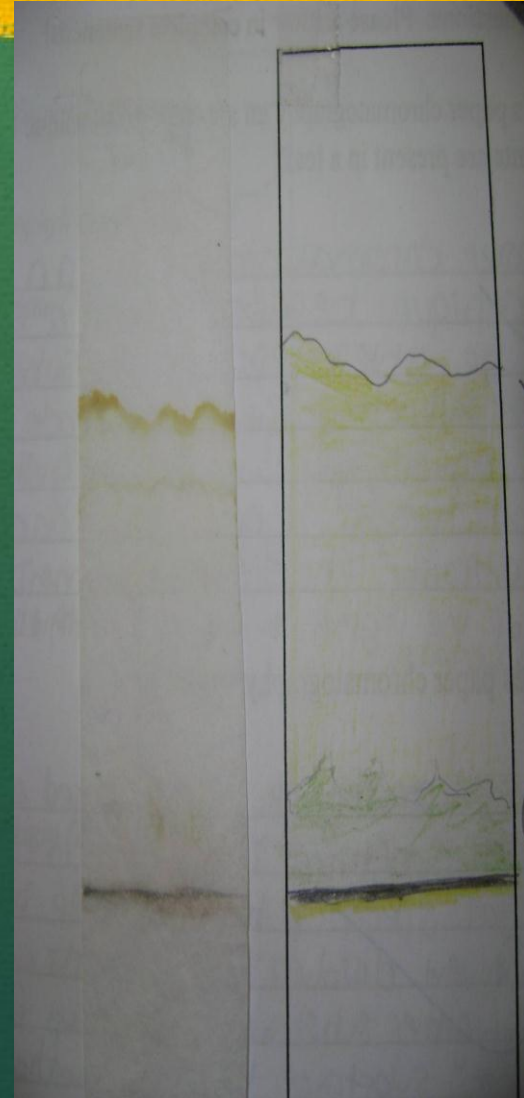
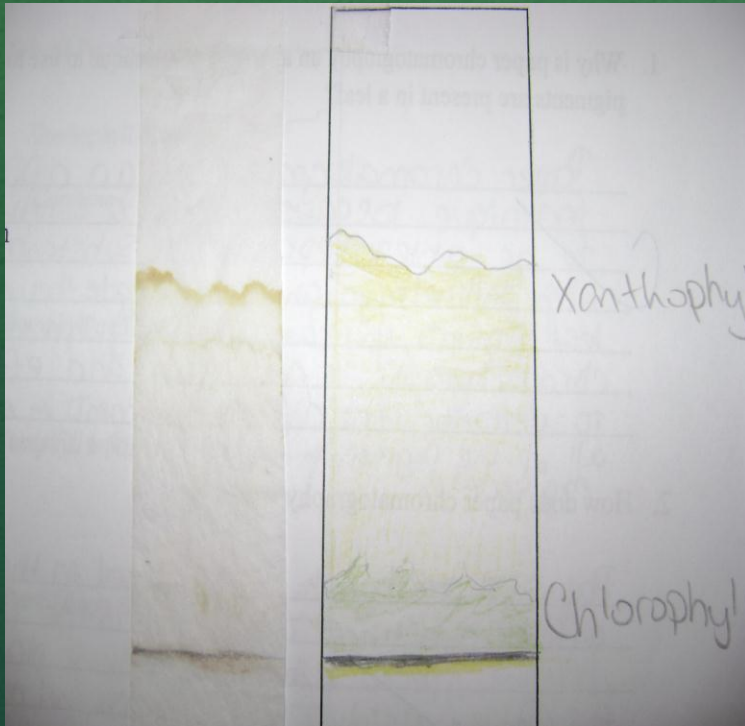
Step 3: Place filter paper in alcohol.



Step 4: Remove filter paper and let it dry.



Step 5: Label and measure each pigment!



Teacher Tips

- Must transfer LOTS of pigment to filter paper
- Alcohol level should not go above pigment line
- Chromatography can take 30-45 minutes
- Pigment front – measure distance pigment moved from starting line (NOT bottom of the filter paper)
- Filter paper or white construction paper works best

Alternative Method



zhishan90.blogspot.com



Leaf Chromatography Assessment

Draw and label pictures of their chromatography strip.

Measure the pigment fronts and calculated the Rf (retardation factor) value for each pigment.

Answer conclusion questions about the process of chromatography, the data collected in the lab, and supported/rejected their claim based on their evidence.

Measure and calculate the Rf value for a chromatography sample.

Name _____

Class _____



Leaf Chromatography Lab

Problem: Do green leaves contain other pigments?

Claim: _____

Background Information:

Several substances mixed together but not chemically combined is called a mixture. Mixtures can be separated by different physical techniques. For example, salad is mixture that can be separated by picked out the different pieces with your hands. Salt water is a mixture that can be separated by evaporating off the water and leaving the salt behind. Chromatography is another way to separate a mixture and one of the most useful techniques chemists have to analyze everything from biological materials to finding clues at a crime scene.

Paper chromatography is a technique that uses filter paper to separate and identify the different substances in a mixture. It works on the idea that different pigments will travel through a piece of filter paper at different speeds. A sample mixture is placed on the filter paper. The paper is then placed in a solvent, usually water or alcohol. We will use alcohol in our lab. The substances in the mixture dissolve in the alcohol and move up the paper. The heavier substances move up the paper more slowly. The lighter substances move up the paper more quickly.

Think of chromatography as a race and you'll find it's much simpler than it sounds. Waiting on the starting line, you've got a mixture of chemicals in some unidentified substance, just like a group of runners at the starting line. When a race starts, runners soon spread out because they have different abilities. In exactly the same way, substances in a mixture spread out over the filter paper because they travel at different speeds.

We will use paper chromatography to identify the pigments in a leaf. The key to identifying the different pigments in the leaf is measuring how far the pigment has traveled from its starting point. Be very precise in your measurements. You will calculate the R_f (retardation factor) value for each pigment. This factor is calculated by comparing the distance the alcohol has moved with the distance the pigment has moved.

Materials: Coffee filter, ruler, pencil, leaf, coin, isopropyl alcohol, beaker, tape, colored pencils

Safety First:

Do **NOT** touch, smell, or taste the alcohol.

Procedures:

1. Get a piece of coffee filter paper that is 3 cm wide.
2. Make a pencil mark (**do not use a pen!**) on the coffee filter 2cm from the bottom.
3. Using a coin, rub a leaf onto the line that you just drew at the bottom of the filter paper. Keep rubbing until a lot of pigment has been transferred.
4. Pour alcohol into the beaker until it is about 1 cm high.
5. Carefully place the bottom portion of the filter paper (closest to the line you drew) into the jar. The bottom of the paper should come into contact with the alcohol but the alcohol should not touch the pigment line.
6. Use a piece of tape to secure the filter paper to the rim of the jar.
7. **Wait 15 to 20 minutes for the chromatograms to develop.**
8. Remove your filter paper from the jar and place it onto the table.
9. Use a pencil (**do NOT use a pen!**) to mark where the alcohol stopped as it moved up the filter paper. It should still be wet! This is called the alcohol or solvent front.
10. Let the filter paper dry for about a minute.
11. Use a pencil to mark the highest point of each pigment (color).
12. Draw your results below using colored pencils and label the pigments.
13. Using a ruler, measure the distance (in cm) between the pigment origin (the line you drew on the bottom of the filter paper) and the highest point of each pigment. Record your data in the chart provided. *Note: depending on the type of leaf that you use, you may not see all of the pigments listed on the data table.*
14. Measure the distance between the pigment origin and the solvent front (the highest point the alcohol traveled). This number should be the same for each pigment. Record data in the chart
15. Using the formula provided, calculate the R_f value for each pigment and record on the data chart.



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Observations & Data:

Pigment Identification:

Chlorophyll a – blue/green
Chlorophyll b - yellow green
Xanthophyll - yellow
Carotene – orange
Anthocyanin - red



Data Table 1: Pigments in Leaf

	Chlorophyll a	Chlorophyll b	Xanthophyll	Carotene	Anthocyanin
Pigment Origin	2 cm	2 cm	2 cm	2 cm	2 cm
Pigment Front					
Alcohol Front					
R _f Value					

Pigment Front: distance moved by pigment from original spot

Alcohol Front: distance moved by alcohol from original spot

$$R_f \text{ Value} = \frac{\text{Pigment Front}}{\text{Alcohol Front}}$$

Conclusion Questions: Please answer in complete sentences!

1. Why is paper chromatography an appropriate technique to use to determine if different pigments are present in a leaf?

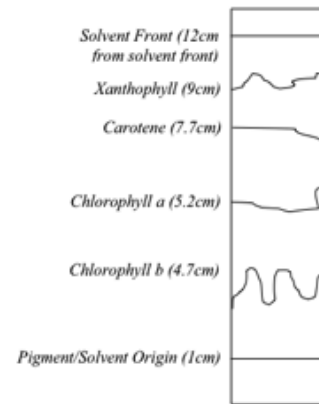
2. How does paper chromatography work?

3. Was your 'claim' correct? Use your results to support your answer.

4. Based on what you have learned, explain why leaves tend to change color in the fall.

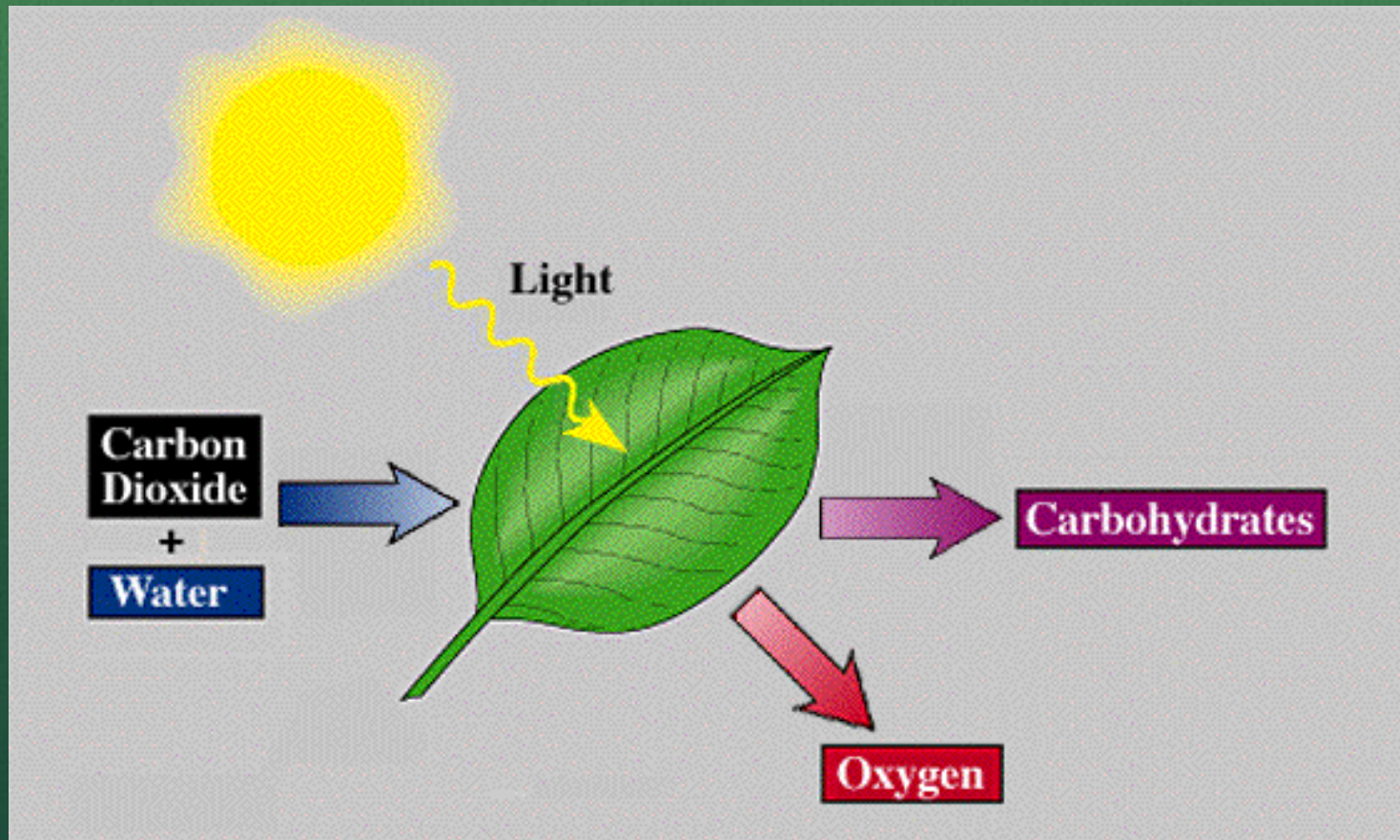
OVER

5. Use the chromatography below to complete the data chart.



	Chlorophyll a	Chlorophyll b	Xanthophyll	Carotene
Pigment Origin				
Pigment Front				
Solvent Front				
Rf Value				

Chemical Reactions in Leaves



Photosynthesis & Respiration

- Poem, video, and Brainpop clip introducing Photosynthesis and Respiration
- PowerPoint and background readings on the topic
- Kinesthetic activity modeling the compounds
- Chart on similarities and differences between the two processes
- Differentiated fact sheet showing chemical equation, reactants, products, and location of each process

Name: _____ Date: _____ Class: _____

Cell Processes Fact Sheet

Directions: Fill in the information needed to complete this fact sheet on photosynthesis and respiration, and fermentation.

<i>Process</i>	<i>Goal</i>	<i>Chemical Equation</i>	<i>Reactants - Substances Needed (including quantity)</i>	<i>Products - Substances Produced (including quantity)</i>	<i>Location</i>
<i>Photosynthesis</i> Only occurs in:					
<i>Respiration</i> Occurs in:					

Cell Processes Fact Sheet

Directions: Fill in the information needed to complete this fact sheet on photosynthesis and respiration.

<i>Process</i>	<i>Purpose</i>	<i>Chemical Equation</i>	<i>Reactants: Substances Needed (including quantity)</i>	<i>Products: Substances Produced (including quantity)</i>	<i>Location</i>
<p><i>Photosynthesis</i></p> <p>Only occurs in _____</p>	<p>Produce _____</p>	<p>$6\text{ CO}_2 + 6\text{ H}_2\text{O}$</p> <p style="text-align: center;">→</p> <p>$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{ O}_2$</p>	<p>Sunlight, 6 molecules of _____ and 6 molecules of _____</p>	<p>1 molecule of _____ (or _____) and 6 molecules of _____</p>	<p>_____</p>
<p><i>Respiration</i></p> <p>Occurs in _____ things</p>	<p>Produce _____ using _____</p>	<p>$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{ O}_2$</p> <p style="text-align: center;">→</p> <p>$6\text{ CO}_2 + 6\text{ H}_2\text{O} +$ energy</p>	<p>1 molecule of _____ (or _____) and 6 molecules of _____</p>	<p>6 molecules of _____, 6 molecules of _____ and a large amount of _____</p>	<p>First stage- _____</p> <p>Second Stage- _____</p>

Cell Processes Fact Sheet

<i>Process</i>	<i>Purpose</i>	<i>Chemical Equation</i>	<i>Reactants (including quantity)</i>	<i>Products (including quantity)</i>	<i>Location</i>
<p><i>Photosynthesis</i></p> <p>Only occurs in <u>plants</u> (<u>autotrophs</u>)</p>	Produce <u>food</u>	$6 \text{ CO}_2 + 6 \text{ H}_2\text{O} \longrightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{ O}_2$	Sunlight, 6 molecules of <u>water</u> and 6 molecules of <u>carbon dioxide</u>	1 molecule of <u>sugar</u> (or <u>glucose</u>) and 6 molecules of <u>oxygen</u>	<u>Chloroplasts</u>
<p><i>Cellular Respiration</i></p> <p>Occurs in <u>living things</u></p>	Produce <u>energy</u> using <u>oxygen</u>	$\text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{ O}_2 \longrightarrow 6 \text{ CO}_2 + 6 \text{ H}_2\text{O} + \text{energy}$	1 molecule of <u>sugar</u> (or <u>glucose</u>) and 6 molecules of <u>oxygen</u>	6 molecules of <u>water</u> , 6 molecules of <u>carbon dioxide</u> and a large amount of <u>energy</u>	First Stage- <u>Cytoplasm</u> Second Stage- <u>Mitochondria</u>

Photosynthesis & Respiration Cartoon

I am in desperate need of energy! Money is tight, so I am only looking to purchase one glucose molecule. Using the software ComicLife, your task is to make a cartoon explaining how organisms obtain energy. Be as creative as you want!

Photosynthesis & Respiration Cartoon

Task:



I am in desperate need of energy! Money is tight, so I am only looking to purchase one glucose molecule. Using the software Comic Life, your task is to make a cartoon explaining how organisms obtain energy. Be as creative as you want!



Requirements:

- 1) Photosynthesis AND respiration are explained in detail
- 2) Names, chemical formulas, and quantities of the substances involved in each reaction are included
- 3) Shows how the molecules combine for EACH reaction
- 4) Any environmental factors needed for the reaction to happen are stated and depicted with a picture/graphic
- 5) Pictures/graphics are included for EACH substance and for EACH process
- 6) Correct spelling/grammar
- 7) Use vocabulary from class – photosynthesis, respiration, molecule, reactants, products, chloroplasts, chlorophyll, mitochondria, stomata, phloem, xylem
- 8) BE CREATIVE!!!!

Grading: See rubric

Timeline: 3 days in the computer room

Alternative Assignment: Please see me for approval if you want to work on a different project that demonstrates your understanding of photosynthesis and respiration.

Template to Make Cartoon

LIST THE PROCESS TAKING PLACE, INCLUDE WHICH ORGANISMS USE THIS PROCESS AND A PICTURE OF THE ORGANISM

LIST THE NAME OF THE COMPOUND, THE MOLECULAR FORMULA, THE CORRECT NUMBER OF MOLECULES, WHERE THE COMPOUND COMES FROM OR IS GOING TO AND A PICTURE THAT REPRESENTS THE MOLECULE

DESCRIBE ANY SPECIFIC ENVIRONMENT NEEDED FOR PROCESS TO OCCUR AND INCLUDE A PICTURE.

LIST THE NAME OF THE COMPOUND, THE MOLECULAR FORMULA, THE CORRECT NUMBER OF MOLECULES, WHERE THE COMPOUND COMES FROM OR IS GOING TO AND A PICTURE THAT REPRESENTS THE MOLECULE

HOW ORGANISMS OBTAIN ENERGY

LIST THE NAME OF THE COMPOUND, THE MOLECULAR FORMULA, THE CORRECT NUMBER OF MOLECULES, WHERE THE COMPOUND COMES FROM OR IS GOING TO AND A PICTURE THAT REPRESENTS THE MOLECULE

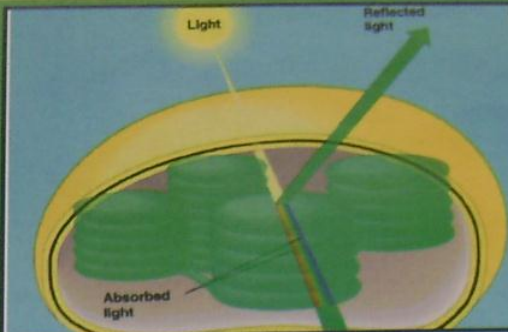
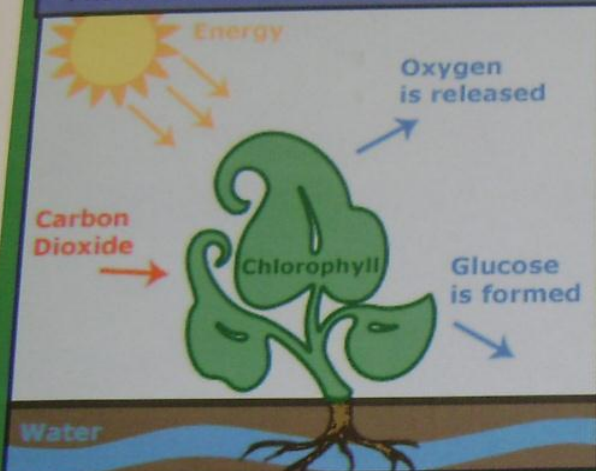
DESCRIBE ANY SPECIFIC ENVIRONMENT NEEDED FOR PROCESS TO OCCUR AND INCLUDE A PICTURE.

LIST THE NAME OF THE COMPOUND, THE MOLECULAR FORMULA, THE CORRECT NUMBER OF MOLECULES, WHERE THE COMPOUND COMES FROM OR IS GOING TO AND A PICTURE THAT REPRESENTS THE MOLECULE

LIST THE PROCESS TAKING PLACE, INCLUDE WHICH ORGANISMS USE THIS PROCESS AND A PICTURE OF THE ORGANISM

Cartoon Requirements	4	3	2	1
Processes	Covers processes in depth with details and examples. Subject knowledge is excellent.	Explains the processes. Subject knowledge is good.	Includes essential information about the processes but there are one or two factual errors.	Both processes lack detail. Content knowledge is questionable. More than two factual errors.
Substances	All of the substances are correctly spelled and identified.	One of the substances is not identified or spelled correctly.	Two of the substances are not identified or spelled correctly.	Three or more of the substances are not identified or spelled correctly.
Chemical Formulas	All four chemical formulas are written correctly.	Only three of the chemical formulas are written correctly.	Only two of the chemical formulas are written correctly.	Only one of the chemical formulas is written correctly.
Proportions	All four of the molecular formulas are in the correct proportion.	Only three of the molecular formulas are in the correct proportion.	Only two of the molecular formulas are in the correct proportion.	Only one of the formulas is in the correct proportion.
Environmental Conditions	Appropriate environmental conditions are clearly stated and represented with an image.	Missing image(s) for environmental factors.	Missing the environmental condition(s).	Missing both the environmental condition and the image.
Organization	The order in which the molecules combine is correct and easily followed. Content is well organized and follows a logical order.	One of the molecules is not represented and/or the order is unclear. Content is logically organized.	Two or more of the molecules are not represented and/or the order is unclear.	Three or more of the molecules are not represented and/or the order is unclear. Content shows little organization.
Picture Choice and Graphics	The pictures are attractive (size and color) and clearly and cleverly support the content.	The pictures clearly support the content.	All graphics are attractive but a few do not support the content.	Several pictures do not represent the content with which they are associated.
Formatting	Can move text/objects to create an attractive, complex document. Choice of fonts and formats enhances readability and content.	Is able to perform most functions independently. Choice of fonts and formats enhances readability.	Requires assistance to complete more basic skills. Choice of fonts and formats complement the content but may be too hard to read.	Has little concept of editing or laying out the comic. Font and formatting makes it difficult to read the material.
Creativity	Exceptional degree of student creativity in their creation.	Comic reflects creativity in its creation.	Comic design elements are based on template given in class.	Comic design used the template given in class.
Grammar and Spelling	No grammar or spelling mistakes.	One grammar or spelling mistake.	Two grammar or spelling mistakes.	More than two grammar or spelling mistakes.

PHOTOSYNTHESIS IS THE PROCESS IN WHICH GREEN PLANTS (AUTOTROPHS) CAPTURES ENERGY FROM THE SUNLIGHT AND USES IT TO MAKE FOOD.
 -ENERGY FROM SUNLIGHT-USED TO MAKE CARBON DIOXIDE AND WATER INTO OXYGEN AND SUGAR.
 -PHOTOSYNTHESIS-TWO STAGES.



THE FIRST STAGE CAPTURES ENERGY FROM THE SUNLIGHT.
 -CHLOROPLASTS IN THE PLANT CELLS ARE THE ENERGY IS BEING CAPTURED.
 -IN THE CHLOROPLASTS, THERE IS CHLOROPHYLL.
 -CHLOROPHYLL DIVIDES WATER INTO HYDROGEN AND OXYGEN.
 -WATER COMES THROUGH ROOTS AND GOES THROUGH THE XYLEM.
 -OXYGEN RELEASED IN THE AIR THROUGH THE STOMATA.
 -ENERGY-IS MADE TO CONTINUE THE NEXT STAGE OF PHOTOSYNTHESIS.

6 MOLECULES OF CARBON DIOXIDE GAS, 6 MOLECULES OF LIQUID WATER, AND SUNLIGHT ARE REACTANTS. 1 MOLECULE OF SOLID SUGAR AND 6 MOLECULES OF OXYGEN GAS ARE PRODUCED. THE MOLECULAR FORMULA:
 $6 CO_2 + 6 H_2O \rightarrow C_6H_{12}O_6 + 6 O_2$

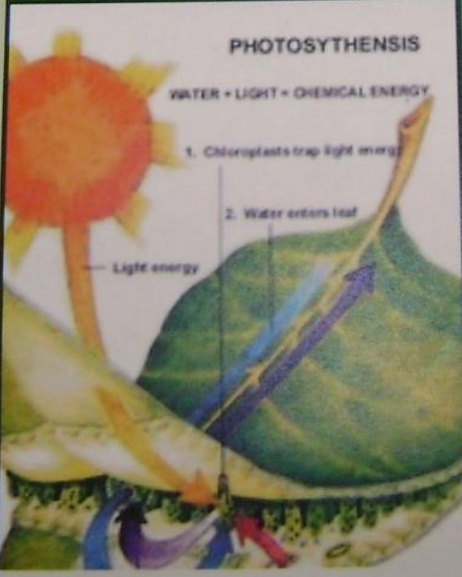
ENVIRONMENT FOR PHOTOSYNTHESIS: LOTS OF SUNLIGHT, WATER, AND OXYGEN.

Photosynthesis



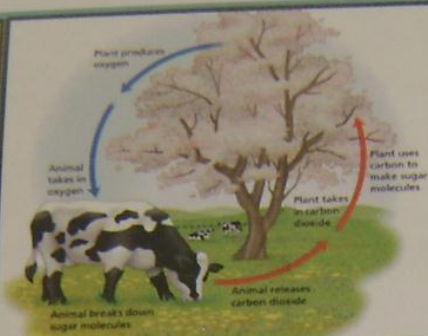
JULIA TSENG CLASS 3

IN THE SECOND STAGE OF PHOTOSYNTHESIS, THE PLANT USES THE STORED ENERGY TO MAKE FOOD.
 -TWO REACTANTS NEEDED FOR THIS STAGE: CARBON DIOXIDE AND WATER.
 -CARBON DIOXIDE-THROUGH THE STOMATA UNDER THE LEAF AND WATER MOVES THROUGH THE XYLEM.
 -CHLOROPLASTS, WATER AND CARBON DIOXIDE GO THROUGH CHEMICAL REACTIONS POWERED BY THE ENERGY FROM THE FIRST STAGE.
 -SUGAR AND OXYGEN- PRODUCTS OF THE CHEMICAL REACTIONS.
 -FOOD- GOES THROUGH THE PHLOEM.

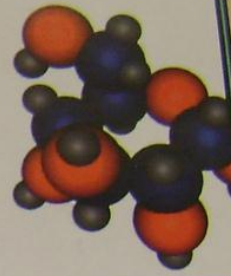
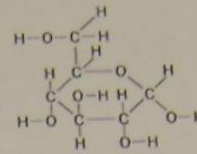


THE LEFT SIDE OF THE EQUATION REPRESENTS THE REACTANTS FOR PHOTOSYNTHESIS. THE RIGHT SIDE OF THE EQUATION THE PRODUCTS OF PHOTOSYNTHESIS. OXYGEN GAS IS RELEASED INTO THE AIR. MOST OF THE OXYGEN FROM THE AIR IS IN THE ATMOSPHERE. THE SUGAR MOLECULES ARE USED FOR FOOD, MADE INTO DIFFERENT MATERIALS SUCH AS GLUCOSE. THEY ARE STORED FOR LATER USE.

CELLULAR RESPIRATION IS THE PROCESS WHEN CELLS OBTAIN ENERGY FROM GLUCOSE.
 -CELLS BREAK DOWN FOOD MOLECULES AND RELEASE THE ENERGY
 -LIVING THINGS, ALL OF THEM, GO THROUGH RESPIRATION
 -TWO STAGES OF RESPIRATION



Molecular Construction of Glucose



● Hydrogen
 ● Carbon
 ● Oxygen

-FIRST STAGE OF CELLULAR RESPIRATION-IN THE CYTOPLASM
 -GLUCOSE BROKEN DOWN INTO SMALLER MOLECULES, RELEASE A SMALL AMOUNT OF ENERGY

1 MOLECULE OF SOLID SUGAR, 6 MOLECULES OF OXYGEN GAS ARE REACTANTS. ENERGY, 6 MOLECULES OF CARBON DIOXIDE GAS, AND 6 MOLECULES OF LIQUID WATER ARE SUBSTANCES.
 THE MOLECULAR FORMULA:
 $\text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2 \rightarrow 6 \text{CO}_2 + 6 \text{H}_2\text{O} + \text{ENERGY}$

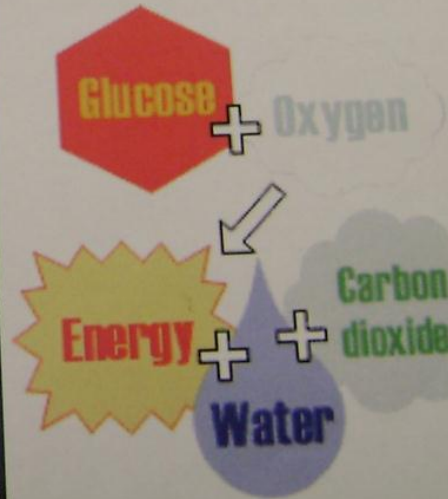
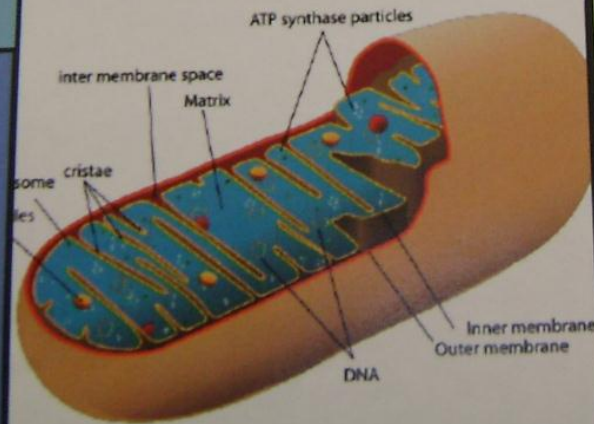


Cellular Respiration

ENVIRONMENT FOR CELLULAR RESPIRATION: ENERGY, OXYGEN, AND PLANTS

JULIA TSENG CLASS 3

-THE SECOND STAGE OF CELLULAR RESPIRATION-IN THE MITOCHONDRIA
 -MOLECULES FROM THE FIRST STAGE ARE BROKEN DOWN INTO SMALLER MOLECULES
 -RELEASE A LOT OF ENERGY
 -REQUIRES OXYGEN
 -CARBON DIOXIDE AND WATER ARE PRODUCED



PHOTOSYNTHESIS AND RESPIRATION ARE OPPOSITE PROCESSES.
 -WHAT IS USED DURING PHOTOSYNTHESIS IS CREATED DURING RESPIRATION
 -WHAT IS CREATED DURING PHOTOSYNTHESIS IS USED DURING RESPIRATION

HOW DO ORGANISMS MAKE ENERGY?

BY THOMAS SHERRIFF
CLASSES

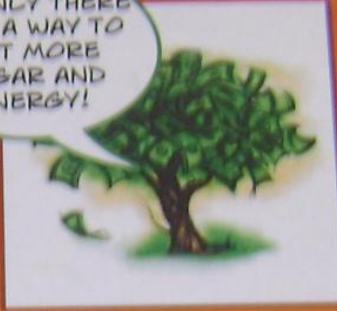
I ALWAYS FEEL LIKE I NEED MORE ENERGY!



I ALWAYS HAVE THAT THREE O'CLOCK FEELING...ZZZZZ



IF ONLY THERE WAS A WAY TO GET MORE SUGAR AND ENERGY!



HEY! LOOK AT THESE COMMERCIALS!



I NEVER KNEW THAT WHEN I ATE FOOD, I WOULD BE GAINING ENERGY!

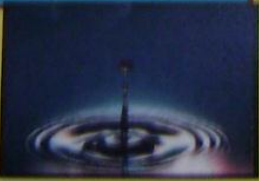


WOW, I SHOULD TRADE THIS MONEY IN FOR LEAVES!



PHOTOSYNTHESIS
DO YOU LOVE GLUCOSE? DO YOU FEEL YOU NEED MORE, BUT DON'T KNOW HOW TO GET IT AND/OR STORE IT? WELL, PHOTOSYNTHESIS CAN HELP YOU! THIS BREAKTHROUGH FORMULA PROVIDES A SAFE AND EASY WAY TO OBTAIN AND STORE YOUR NEEDED GLUCOSE! ALL YOU NEED IS SUNLIGHT, WATER, AND CARBON DIOXIDE. FIRST, ABSORB SUNLIGHT WITH CHLOROPLASTS, A GREEN ORGANELLE THAT CONTAINS A SUBSTANCE CALLED CHLOROPHYLL, WHICH CAPTURES SUNLIGHT. THEN, ROOTS ABSORB WATER AND MINERALS AS THE STOMATA IN THE LEAVES TAKES IN CARBON DIOXIDE. INSIDE THE CHLOROPLASTS, THESE COMPOUNDS ARE CONVERTED USING A SIMPLE EQUATION. $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$. THE PRODUCTS OF THIS REACTION IS OXYGEN AND GLUCOSE. FINALLY, THE EXTRA GLUCOSE IS STORED INSIDE THE VEINS. WARNING! DO NOT USE THIS FORMULA IF YOU ARE A HETEROTROPH. ONLY USE IF YOU ARE AN AUTOTROPH. ALSO, THIS FORMULA ONLY WORKS WHEN IT IS DAYTIME! SIDE EFFECTS ARE LARGE AMOUNTS OF GLUCOSE, LOTS OF ENERGY, AND OBESITY. CONSULT YOUR DOCTOR BEFORE USE.

RESPIRATION
DO YOU ALWAYS HAVE THAT THREE O'CLOCK FEELING? DO YOU FIND IT HARD TO STAY ACTIVE THROUGH-OUT THE DAY? WELL, RESPIRATION CAN HELP! RESPIRATION IS THE TRANSPORTATION OF SUGAR MOLECULES INTO ENERGY. WITH THE GLUCOSE MOLECULES AND OXYGEN MOLECULES, WE CAN CONVERT THAT INTO A HIGH SUPPLY OF ENERGY! IN THE CYTOPLASM, THESE MOLECULES ARE BROKEN DOWN INTO SMALLER PARTS. THEN, IN THE MITOCHONDRIA, THOSE MOLECULES ARE BROKEN DOWN EVEN MORE! THE FORMULA IS VERY SIMILAR TO PHOTOSYNTHESIS. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ENERGY$. THE REACTANTS FOR THIS FORMULA ARE GLUCOSE AND OXYGEN, WHICH IS THEN FORMED INTO CARBON DIOXIDE, WATER, AND ENERGY. THE ENERGY IS THEN USED IN THE BODY AS FUEL. WARNING! DO NOT USE THIS FORMULA IF YOU HAVE AN EXCESS AMOUNT OF ENERGY. THIS COULD CAUSE HYPERACTIVITY IN SOME PATIENTS. THIS IS MEANT FOR HETEROTROPHS AS WELL AS AUTOTROPHS. CONSULT YOUR DOCTOR BEFORE USING.





FINALLY! PHOTOSYNTHESIS IS A WAY FOR ME TO USE CARBON DIOXIDE, WATER, AND SUNLIGHT, TO PRODUCE GLUCOSE AND OXYGEN! MY LIFE IS COMPLETE.

LOOK! I HAVE LEAVES NOW! I CAN GET ALL THE GLUCOSE I WANT!



RESPIRATION HELPS ME STAY ACTIVE AND AWAKE. ALL I NEED TO DO IS USE OXYGEN AND GLUCOSE, TO MAKE CARBON DIOXIDE, WATER AND MOST IMPORTANTLY ...ENERGY!



I FEEL S
AWAKE NO



HOW ORGANISMS

OBTAIN ENERGY

COOKBOOK EDITION



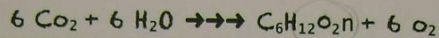
PHOTOSYNTHESIS IN PLANTS

Working with PHOTOSYNTHESIS for plants



Ingredients:

~6 molecules of liquid water,
~6 molecules of carbon dioxide,
~sunlight



Step 1: Mix the 6 molecules of water and 6 molecules of carbon dioxide together.



Step 2: Let blended ingredients sit in the sun. When it's ready you will have...



1 molecule of sugar and 6 molecules of oxygen gas. Congratulations, you have completed photosynthesis!

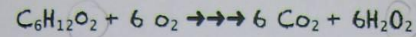


RESPIRATION IN ANIMALS AND PLANTS

Working with RESPIRATION for animals

Ingredients:

~1 molecule of sugar
~6 molecules of oxygen



Step 1: Blend the molecule of sugar and 6 molecules of oxygen together.



Step 2: Let mixture sit in the rain or shine and when it's done, you are left with...



6 molecules of carbon dioxide, 6 molecules of water and LOTS of energy. you have completed respiration! enjoy!



JOSHUA TROTT/
9/23/11 CLASS2

photosynthesis

= USE ENERGY FROM THE SUN TO MAKE FOOD, HAPPENS IN THE CHLOROPLASTS WHICH MAKE CHLOROPHYLL

REACTANTS

PRODUCTS



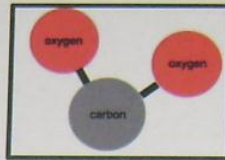
SUNLIGHT

+



6 WATER/
H₂O FROM
THE ROOTS
THROUGH
THE XYLEM

+



6 CARBON DIOXIDE/
CO₂ FROM THE
LEAVES THROUGH THE
STOMATA



SUGER/
GLUCOSE
FLOWS
THROUGH
THE
PHLOEM



6 OXYGEN
O₂ GETS
RELEASED
TO THE
AIR

respiration

= USE FOOD TO MAKE ENERGY, IT HAPPENS IN THE MITOCHONDRIA

REACTANTS

PRODUCTS



SUGER/
GLUCOSE IS
OBTAINED BY
EATING FOOD

+

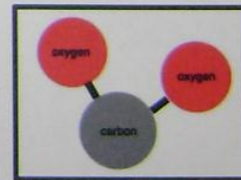


6 OXYGEN/O₂ IS
OBTAINED FROM OUR
LUNGS



6 WATER/H₂O WE
SWEAT WATER OUT OF
OUR BODY

+



6 CARBON DIOXIDE/
CO₂ WE BREATHE
OUT

+



ENERGY



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- Slide 5 – Fall color <http://brucefong.files.wordpress.com/2010/10/autumn-trees.jpg>
- Slide 6 - What Tree is That? <http://www.arborday.org/trees/graphics/wtit-logo.gif>
- Slide 6 – Alternative or Opposite Buds <http://www-saps.plantsci.cam.ac.uk/trees/images/altopp.gif>
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- Slide 8 – Leaf Changing Color <http://www.charliechestnut.org/Phase1/TACFgifs/LeafAnim.gif>

- Slide 9 – Autumn Leaf Border
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- Slide 14 – Colored Leaf Chromatography <http://www.mwt.net/~bionorse/Chromatography%201.gif>
- Slide 15 – Quarter over leaf
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