# Student Energy Journal

Created Fall 2007

SUGGESTED ANSWERS KEY (pages selected from the Student Journal)

Revised July 2004

NAME: **Suggested Answers Key** DATE: ____________

**NOTES:**

**What is energy?**

(This can be done using words, drawings or both.)

*Notes information will vary according to*

*teacher introduction/pre-assessment activity.*

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**Renewable – Nonrenewable Venn Diagram:** Compare the properties and the sources of renewable and non-renewable energy.

**Renewable Energy**

*Resource is used over and over*

*Solar*
*Wind*
*Hydropower (Water)*
*Geothermal*
*Chemical (Biomass)*

*Energy is stored in resources.*

*Stored energy is potential energy.*

*When energy is put to work it is used to make electricity*

**Nonrenewable Energy**

*Resource is used or consumed*

*Oil*
*Natural gas*
*Coal*
*Nuclear energy*

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Take a note or two.

Fill in this outline using the Energy Student Journal pages about Solar Energy

# I. Solar Energy

a. What is it?

i. __*radiant energy*______________________

ii. __*energy from the Sun*__________________

iii. __*electromagnetic radiation*______________

b. Electromagnetic Radiation

i. What is it?

1. ___*radiant energy*________________________

2. ____*energy in waves*______________________

3. ____*given off by the Sun*______________

ii. What types are there?

1. ____*tall or short waves*_______________________

2. _____*far or close together waves*_____________

a. Visible light

i. ___*comes from Sun*______________________

ii. ____*colors of the rainbow*_______________

b. Infrared radiation

i. __*heat*__________ iii. __*invisible*_____

ii. *Produced by movement of atoms* iv. *lower energy than light*

c. Ultraviolet radiation

i. _*higher energy than light*_ iii. *causes sunburns*

ii. *three types, A,B,C*________ iv. __*invisible*___

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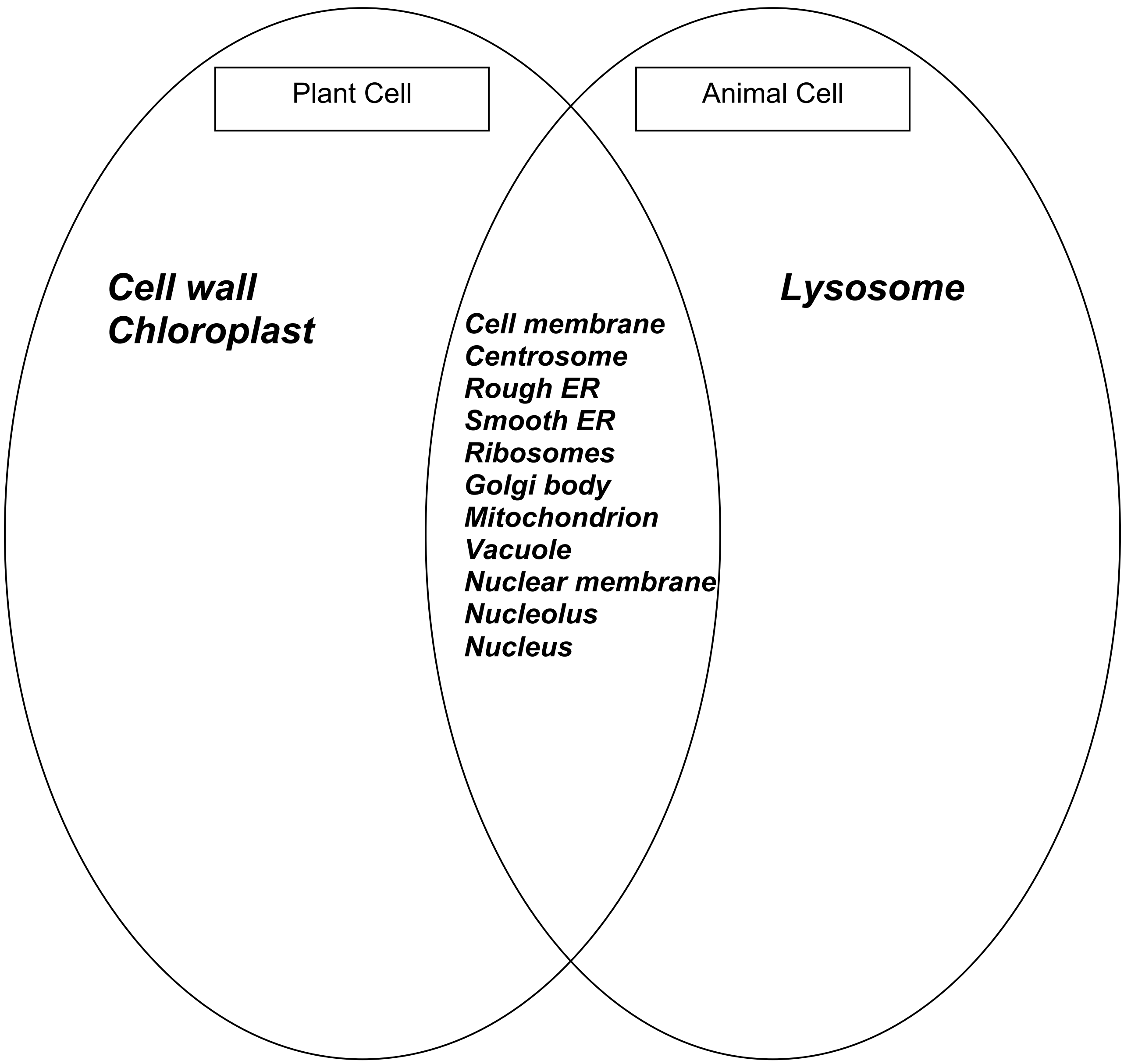
## Plant and Animal Cell Comparison:

**Materials:** plant cell picture, animal cell picture, Venn diagram

**Directions:**

Look at each of the pictures. Using the Venn diagram compare and contrast the parts of the plant and animal cells. When you are finished, find information about any parts that are only found in plant cells.



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**Activity 5A:**

# Powerful Plant Cells

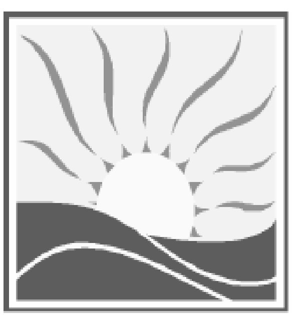
**Question:** What are the parts and functions of a plant cell?
Helpful hints: www.eurekascience.com/Icandothat

**Materials:**

Paper soufflé cups
*Jello/knox mix
*Packageof "Runts" (or other kind of candy with different shapes)
Plastic spoon
*Paper towels

* Teacher Provided

| Name of Plant Cell Part | Function of Cell Part |
|---|---|
| Cell Wall | ***Adds support to the cell and the plant. Acts as a gate to allow certain matter in and keep out other material.*** |
| Chloroplasts | ***Place in the cell where photosynthesis takes place*** |
| Cytoplasm | ***Fluid that fills the cell*** |
| Endoplasmic Reticulum | ***A system of tubes in the cell that stores and packages materials. Proteins are made here.*** |
| Nucleus | ***The brain of the cell (processing center).*** |
| Vacuole | ***Storage area of the cell.*** |
| Mitochondria | ***It is here that food energy is put into a form that the cell can use.*** |
| Plasma Membrane | ***Cell membrane – keeps the the cell's parts together.*** |
| Golgi body | ***Packages small molecules into larger ones that are needed by the body.*** |



Question: How is sunshine turned into sugar? Describe the process or write the formula down to answer this question.

***It is through chemical reactions that carbon dioxide and water are joined to form simple sugars. Light energy from the Sun is used to bond the elements together.***

***( Carbon dioxide + Water + Energy → Sugar and oxygen )***

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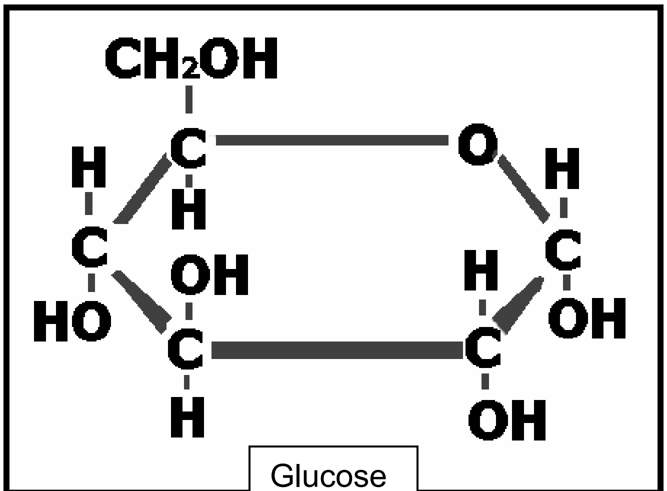
**What is the chemical compound that plants make to store energy?**

Plants store energy in compounds called **sugars**. Sugars provide the energy resource for cells. The simplest form of sugar is **glucose**. Glucose is made up of the chemical elements of carbon, oxygen, and hydrogen. You can write the chemical formula for the glucose molecule. Do this by counting the number of carbon (C), hydrogen (H), and oxygen (O) atoms. Write the number next to the letter in the formula written below. (Write the number smaller than the letter.)




Glucose

$C_6 H_{12} O_6$

**Simple sugars** are put together to form **complex sugars**. Complex sugars are called **polysaccharides** (poly=many saccaride= sugar). The complex sugars that plants make are called **starches**.

This storage of chemical energy as sugar is done in the cells of the plant's leaves. It happens in the parts of the cells called **chloroplasts**. If a plant or tree has its leaves eaten by an insect, it loses its ability to store energy. The plant uses the energy from the Sun to tie or bond together chemical elements into sugars. It gets the elements from water and carbon dioxide.

**Chemical Reaction of Photosynthesis**

$6\ H_2O + 6\ CO_2 + \text{energy} \rightarrow C_6H_{12}O_6 + 6\ O_2$

water + carbon dioxide + energy → glucose + oxygen

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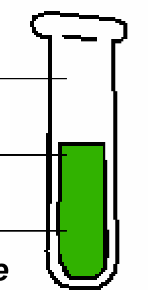
Questions: **Calories in a Peanut**

1) What were some of the things you observed during the time the peanut was burning?



***The peanut started to ooze a liquid substance. The peanut was burning. There was a flame. The flame started low and then grew larger. The flame became smaller and then disappeared. The water started to bubble and then boil. The bottom of the test tube became black.***

2) List the different forms of energy in this activity.

***light***

***heat***

***motion***

***sound (boiling sounds)***

> Heat value: amount of energy released from burning a substance.

3) Starting with the peanut, give the <u>forms</u> of energy changes that you observed. (What form of energy is stored in the peanut?)

***chemical*** → ***light*** → ***heat*** → ***motion***

Where did the peanut get its stored energy?
***The peanut plant got it from the Sun (light).***

7) What would be your answer to the activity question? (see title of activity) Write a sentence to support your answer.

***Yes, there is energy stored in the peanut. Once enough energy was input to get the reaction started the peanut continued to burn giving off light and heat energy.***

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## Activity 6b: How much energy is stored in food?

*To start you need to do some research to find out the following information.*

How would you find out how much energy is stored in a slice of bread?
***I would look at the bag that the bread came in to see look up the amount of calories.***

What unit is used to measure the energy stored in food? ***Calorie***

*Look at a lunch menu for a day.* **(Depends on food items selected.)**

1) Which food item do you expect to have the most stored energy?

________________________________________

2) Which food item do you expect to contain the least amount of stored energy?

________________________________________

Think of a way of finding out the amount of energy there is in a serving of each menu item.

Fill in the chart with the name of the menu item and the energy per serving.

| Name of the food | Energy per Serving |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |

**Total Amount of energy** ________________

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## Thinking about the activity:

A. Write a short paragraph comparing how you felt to the number of calories used for each action.

***(Students should relate the higher calorie activities to feeling "out of breath" and "warm". The greater the activity level the more "uncomfortable" we feel.)***

B. Energy in and energy out. Fill in the diagram with the forms of energy that were transferred in to do the action and taken out by the action.

Energy in: ***FOOD*** → Sitting / Walking / Jumping → Energy out: ***MOTION*** ***HEAT***

C. How many minutes would you need to jump rope to "burn off" lunch? ***(varies)***

D. Write a conclusion about the relationship between the energy stored in food and the energy that we need for our daily activities.

***( Students should relate that the energy stored in food is the energy that we need for our daily activities. The greater our activity level the greater our energy needs and therefore, our food needs. )***

E. Write a sentence telling how biomass becomes an energy source for animals.

***Biomass is (organic) matter that is combined or built up by using the Sun's energy. Animals can use that stored energy directly or indirectly. Directly by consuming the Biomass and indirectly by consuming another animal that has consumed the biomass.***

**Challenge question!** What do you think happens to the Calories of food energy that you may consume but your body doesn't use? ***It is stored for later use in body tissues (as "fats".)***

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## <u>Can Chemical Reactions Release Energy?</u>

Biomass As An Energy Source

We have found that stored energy can be released. Our bodies release the energy stored in food so we can change it to other forms of energy. We need to reverse the energy storage formula. It needs to be a reaction that gives off energy.

Find the energy storage chemical reaction in your journal. Use it to fill in the blanks to reverse the chemical reaction so energy is released.

$$C_6H_{12}O_6 + 6\ O_2 \rightarrow CO_2 + H_2O + \textit{energy}$$

*glucose + oxygen → carbon dioxide + water + energy*

Our bodies breathe in oxygen. We consume food. Using oxygen our bodies are able to break apart sugar (glucose) found in the food we eat. When our bodies do this energy is released. We also release heat, carbon dioxide and water. Our bodies can use the energy and water. The carbon dioxide is given off to the air. (We breathe it out.)

The same thing happens when biomass is burned. Oxygen is needed to release the energy. Carbon dioxide is given off to the air. It is the energy that we want, but we also get $CO_2$ gas. (Burning fossil fuels also gives off energy and carbon dioxide.)

As the biomass material is burned, the chemical energy is released. If you have a fireplace, the wood you burn in it is a biomass fuel. What we now call biomass was the chief source of heating homes and other buildings for thousands of years. In fact, biomass is still a major source of energy in much of the developing world.

Biomass is special in that it is renewable. You can grow more plants. Also, plants have a part in the $CO_2$ cycle. Plants are able to take carbon dioxide out of the air. You will see how this is important later on. Right now we will look at a <u>special project</u>. This project involves using <u>renewable</u> <u>biomass</u> as an energy source. This could be an energy source for power plants to make electricity.

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**How can we use density of wood to help us estimate the wood's heat value?**

**Investigation 1:**

Below is a chart that shows data for heat value and density for different tree species.

1) Most of the trees on the data table are called hardwoods. What is the definition of a hardwood? What is softwood?

***A hardwood is a tree that has very hard interior material.***

***A softwood is a tree that has less hard interior material. ( Today, hardwoods are defined as deciduous trees and softwood are defined as evergreens.)***

2) Look at the density of the only softwood on the data table. Think about what density means. How do you think the terms softwoods and hardwoods first came about?

***People found that some trees were very hard to cut into lumber so they called them hardwood. They were hard because there was a lot of matter packed into them. The trees that had softer lumber were called softwood.***

3) Look at the data table. What happens to the heat value as density increases?

***The heat value increases as the density increases.***

| **Heat Values and Densities of Some Species of Trees/Shrubs** | | |
|---|---|---|
| **Tree/Shrub** | **Heat Value (MMBtu/cord[1])** | **Density of Dry Wood g/cm³** |
| Hickory | 27.5 | .74 |
| Sugar Maple | 25.5 | .69 |
| Red Oak | 24.6 | .66 |
| White Ash | 24.5 | .65 |
| Black Cherry | 20.4 | .55 |
| Willow | 17.6 | .48 |
| Cottonwood | 15.8 | .43 |
| White Pine | 14.3 | .42 |

[1] Note: A cord of stacked wood is 4 ft high, 4 ft wide and 8 ft. long (128 cubic feet). A MMBtu is a million Btus. A Btu is a "British thermal unit." One Btu = 1055 joules of energy. One Calorie = 4.18 joules.

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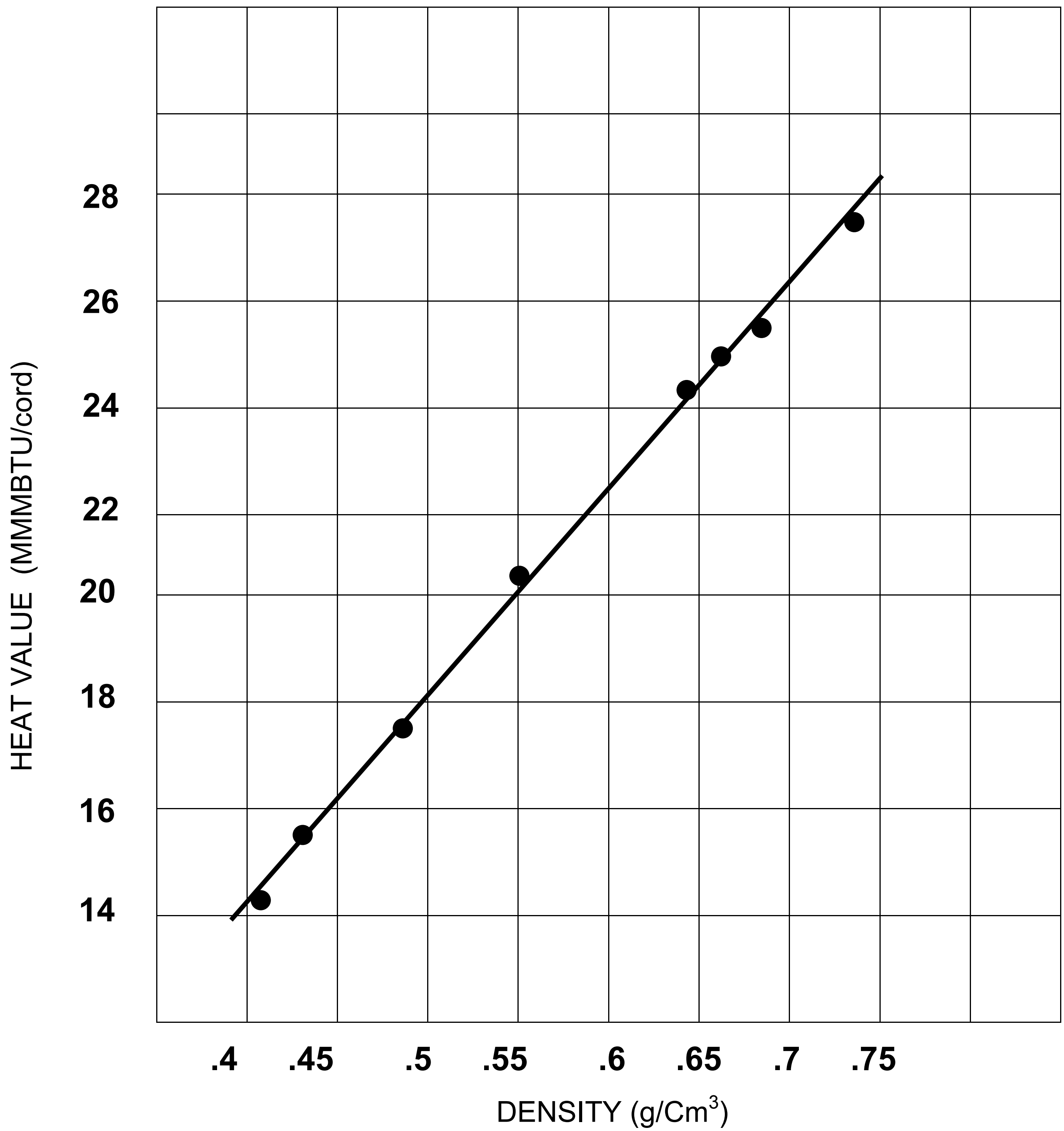
**Investigation 2:**

1) Your challenge is to graph the data from the data table. You should place **MMBTU/cord** on the vertical axis (Heat Value). Next, place **g/cm$^3$** on the horizontal axis (Density).



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2) Look back at the density value that you calculated for your willow sample. Plot your density for willow on your graph.
Is it equal to the listed density value for willow?____________
Here is some more information about your willow stem.

## Willow is Willow is Willow or is it?

Your willow stems are from special willow. Scientists at the SUNY College of Environmental Science and Forestry (SUNY-ESF) have selected this willow from hundreds of others that have been collected from the wild. The willow twigs in your kit are from a species of willow called *Salix Dasyclados*. (Its nickname is SV1.) SV1 was collected along a stream bank in southern Ontario. It has all the basic characteristics of a willow shrub, but it has wood density that is greater than the hundreds of other willow clones in SUNY-ESF's collection.

By a **clone** we mean that the plant has been grown from a piece of a plant, not from seeds. By planting an 8 – 10 inch long piece of one-year old stem a new willow plant can be grown. It is planted so only a half-inch sticks up above the ground. Roots and stems develop from this piece of willow stem. The new plant that grows will be identical to and have the same characteristics as the plant it was cut from. This is why it is called a clone. Your density result should be slightly higher than the .48 in the data table. This is due to the fact that the SV1 clones have been selected for higher density from hundreds of willows.

3) Think about willow as an energy source. What advantage is there in selecting willows that have a higher density? (Why should the SUNY ESF researchers go through the trouble of looking at hundreds of willow plants?)

***You want to grow willow that will capture the most energy from the Sun. A willow with a higher density will have stored more energy as matter and have a greater heat value.***

4) How does the density of SV1 willow compare to the other woods in the data table?
***It has a lower heat value than 5 woods and a higher one than 2 woods.***

5) Does willow like SV1 have the highest heat value of all the woods? ***NO***

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Hmmm, let's gather more information to help us understand why SUNY ESF researchers are working with willow as an energy source.

**Let's look at growth rates of different species.** The term **yield** is used as a measure of how much wood that can be harvested from a hectare each year. A hectare is about 2.5 acres in size.

| Growth Yields of Some Species of Trees/Shrubs | | |
|---|---|---|
| **Tree/Shrub** | **Yield Tons/ha/yr** | **Density of dry wood $g/cm^3$** |
| Sugar Maple | 1.1 – 2.3 | .69 |
| Red Oak | 1.1 – 2.3 | .66 |
| Beech | 1.1 – 2.3 | .62 |
| Willow | 11.3-16.8 | .48 |

6) How does the amount of willow that can be harvested compare to the other woods?

***You can harvest 10 to 15 times more willow than the other woods.***

7) Do you think willow grows faster or slower than the trees in the data table? ***FASTER***

For Your Information:

Willow has an interesting growing pattern. It can be planted using four to eight inch cuttings from a young tree. This small cutting is placed into the ground about ¼ of its length. It will begin to root and grow a new tree. It also **coppices**. Coppicing relates to how you can start a new tree growing. Once the willow tree is more than several years old, it can be cut down to the ground and will start new sprouts again the next year.

You can research how to identify willow shrubs and try to find them close to your school. In the spring, go to these shrubs and cut eight-inch stems from the willow. Try planting these and watch them grow.

8) Putting it together: In a paragraph tell why you think SUNY ESF researchers are working with willow as a renewable energy source. (For 1st prize, give three reasons!) ***(grows quickly, coppices and has a good heat value)***

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## How do we use these Joules or BTUs of heat energy?

Heat can be absorbed, transferred, and radiated (given off). We use heat to make electricity.

<u>Heat and energy transfer to make electricity</u>

In a power plant electricity is made by converting energy of motion into electrical energy. Power plants have huge generators. Inside the generators are magnets that must be turned to create an energy flow in wires. To turn the magnets you need energy of motion. Many power plants burn fuel to transfer heat energy to energy of motion. They boil water to make steam. The steam has a lot of energy of motion. The force of the steam is used to turn the generator. Think about the steam that comes out of a teakettle. It has a lot of force. It can make the kettle whistle. Other power plants use different heat sources to boil the water, such as solar energy, nuclear energy, or geothermal energy.

Can we capture energy of motion without burning a fuel? We could do this by using a source that has its own motion. This is how we make electricity from the wind or from water. The wind and moving water have energy of motion. That energy is used to turn parts of the generator. Where does the wind get its energy? How about water?

The Sun has a part in causing air to move. It does this by heating the Earth. The heated Earth warms the air and the energized warmed air moves.

The Sun also has a part in the water cycle. Through evaporation water is moved to higher places. The water then comes out of the air as precipitation. This water is pulled downhill by gravity. The stored energy becomes energy of motion. Hydroelectric power plants use moving water to turn the generators.

**Below are listed several energy sources.**

Heat energy plays a role in our use of each of these sources. In some of these heat is given off by the source. In others heat is used to store energy in the energy source. Tell how heat is a factor in each of the energy sources listed below. Think about whether heat is given off from the source or if heat is used to store energy in the energy source.

| Energy Source | Is heat given off or used to store energy? |
|---|---|
| Hydropower | ***Store Energy (heat evaporates the water in the water cycle)*** |
| Solar power | ***Given Off ( solar panel heats up)*** |
| Wind power | ***Store Energy (uneven heating of earth's surface causes wind)*** |
| Geothermal | ***Given Off ( earth's interior gives off heat)*** |
| Bioenergy | ***Given Off ( burning biomass gives off heat)*** |
| Nuclear energy | ***Given Off ( nuclear reaction gives off heat)*** |
| Fossil fuels | ***Given Off ( burning fuel gives off heat)*** |

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## Heat energy in our lives.

You can see that heat is very important in the production of electrical energy. Heat energy is a part of our lives every day. Think about different ways that we use heat energy. Think about the things that we use that give off heat energy.

Make a list of **ten** common ways that we use heat energy or use something that gives off heat energy.

For example: We use heat energy to make hot water. We use a lawn mower to mow a lawn but it gives off heat energy.

***Some Possible answers:***

***Use heat energy to cook.***

***Use heat energy to keep warm.***

***Use heat energy to dry clothes, dry hair.***

***Heat energy is given off when I watch TV, run a fan, play a radio …***

***Heat energy is given off when I ride in a car, ATV, boat, train, airplane…***

There is a lot of heat energy radiated in our environment. The next activity looks at variables that affect heating. This will be measured by a temperature change.

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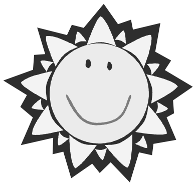
## Can We Use Our Container Models to Study the Earth?

**Radiate**: This means to send out rays. This is how waves of energy travel. They are radiated.



**Conduction**: This is how heat energy moves through a solid. Some solids are better conductors of heat than others.

Scientific work is like building a home. A solid foundation is first formed. Next, one brick is placed on another until the building is constructed. We build upon the work and discoveries of past scientists. Over time a larger and larger information base is created. Sort of like a large group of people added pages to an encyclopedia. As we add information to our knowledge of science, we also create new questions.

The activities your class just completed were about energy. Let's build an information base by filling in the "bricks" found below.

In the experiments energy was radiated, absorbed, and re-radiated.

The source of the radiated energy was the ***light***

The ***plastic*** container allowed the light to pass in freely. One difference (variable) that seemed to affect how the containers heated was

***lid on / off, water/no water, soil/ no soil, clear/opague***

We used a ***thermometer*** to measure this difference.

If the container had soil in it, the soil ***absorbed*** the energy. The soil is a solid and can radiate the ***energy*** back to the air. This would cause the air temperature to increase.

Let's say you have two containers and a light source. In one container the air was allowed to leave and in the other it was trapped. The air temperature of the trapped air should ***rise.*** .

If you add ***water vapor*** to the air in the closed container, the air temperature will increase.

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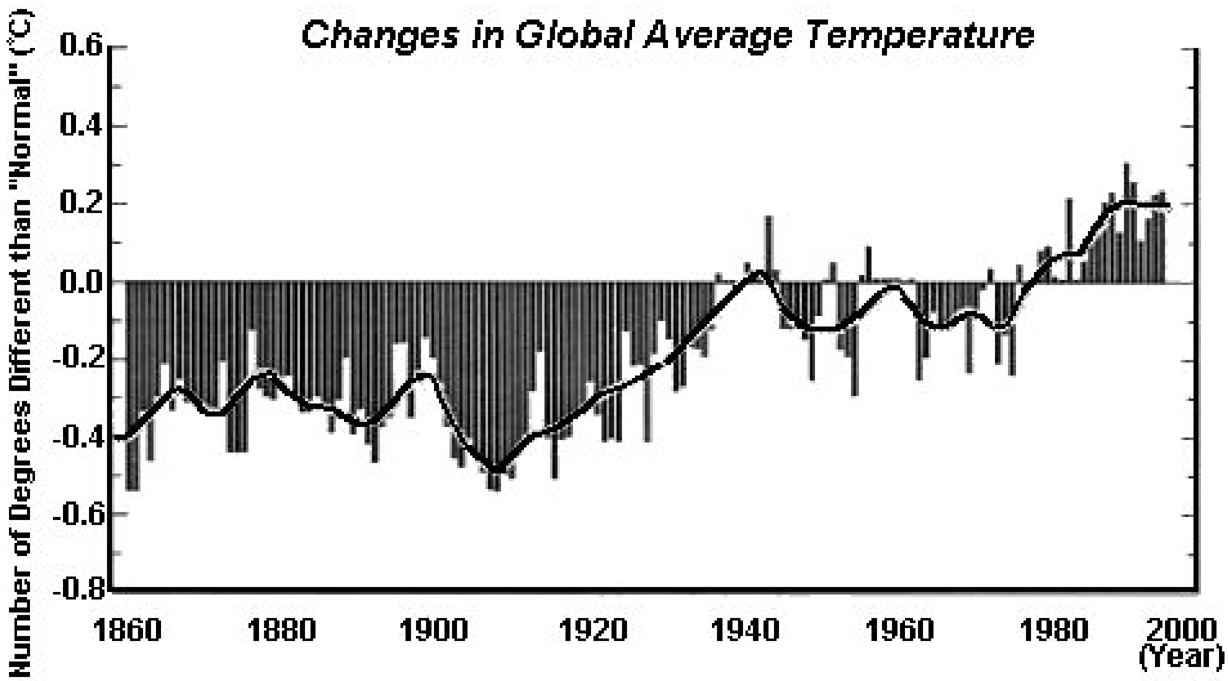
# Changes in Global Average Temperatures

## What do you think Global Average Temperature means?

***( The average of the temperature taken from places all over the globe during a certain time period.)***




1. Make an observation about the line from 1860 to 2000.

***The line goes up and down between some years but generally it goes upward.***

2. Make an observation about the Average Temperature from 1860–2000.

***The Average Temperature is below normal from 1860 – 1980. / The temperature is generally increasing over the years. / It starts to go above normal in 1980 and continues upward to 2000.***

3. The graph represents 140 years (1860 – 2000). Do you think this graph shows a long-term change in Global Average Temperatures?

***It depends on what you call "long term". Over the history of the Earth, 140 years is not considered a very long time.***

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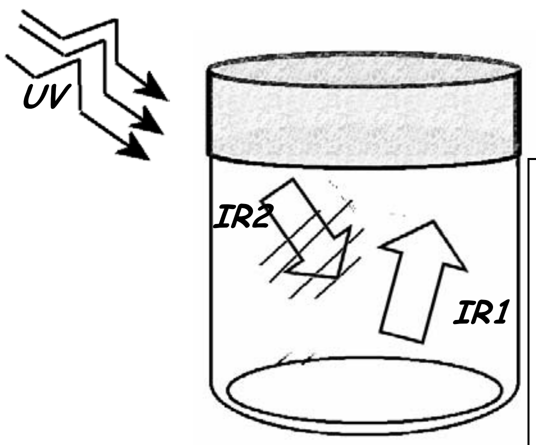
## What Affects Our Atmospheric Temperatures?

A model for a green house:

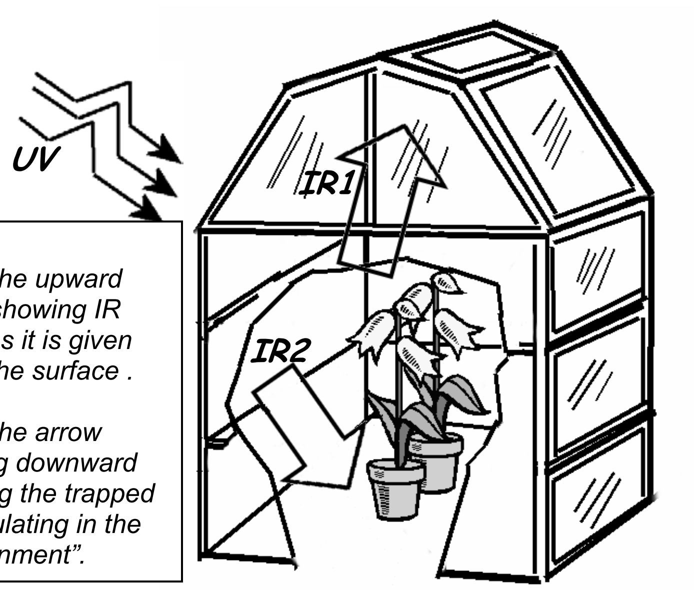
Compare the covered container (from the activity) to a greenhouse.

Create a Venn diagram to compare/contrast the container and the greenhouse.




***NOTE:***
*IR1 is the upward arrow showing IR rising as it is given off by the surface .*

*IR2 is the arrow pointing downward showing the trapped IR circulating in the "environment".*




Label the UV rays from the Sun. - **UV**

Label the Infrared rays given off from the heated surfaces inside. - **IR1**

Label the Infrared rays trapped inside. - **IR2**

How is the greenhouse like the Earth? (Think about the picture)

Reading about the "greenhouse effect" may help you do this. (See the next page)

***The Earth's surface is heated by the Sun's UV radiation. The Sun's UV radiation can pass through the atmosphere and the clouds (Although a great deal of it is blocked). The heated surface gives off Infrared radiation to warm the Earth's atmosphere. This IR can not readily pass through the clouds and into space, so it stays in the atmosphere.***

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Take a note or two.

Fill in this outline using the Energy Student Journal pages titled, "What is the Greenhouse Effect?"

# The Greenhouse Effect

c. About the greenhouse effect

   i. _***keeps the Earth warm***_______________

   ii. _***occurs naturally***____________________

   iii. _***happening for billions of years***_

   iv. _***keeps our average temperature near 59°F***__

d. Greenhouse effect and the Earth

   i. ***short wave energy from the Sun hits the Earth's atmosphere***

   ii. ***most of the energy reaches and warms the Earth's surface***

   iii. ***the surface radiates heat (long wave) energy to the environment.***

   iv. ***some gases in the atmosphere block the heat from leaving***

e. Why is the greenhouse effect important?

   i. ***It keeps the Earth warm enough for living things to live.***

f. Greenhouse gases (Why are they important? What are they?)

   i. ***greenhouse gases absorb IR trapping heat in the atmosphere***

   ii. ***30 gases including CO2, water vapor, methane and ozone.***

g. Global Warming

   i. ***The Earth is being warmed greater than what is normal.***

   ii. ***Evidence of global warming: ice sheets melting, weather patterns changing***

   iii. ***Need solutions that reduce greenhouse gases.***

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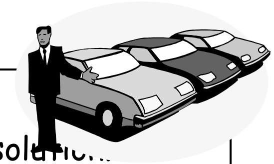

**A Solution to Global Warming?**

Scientists who are concerned about Global Warming have a solu… Their solution is for people to put less greenhouse gases into the air. We have to decrease the output of some of these gases.

Some of these chemicals compounds are used by industry. They are put into the air as they are used. The government has limited companies from using some of these chemicals. An example of this is a compound that was once used in aerosol spray cans, refrigerators, and air conditioners called chlorofluorocarbons (cfc).

Some of these chemicals are given off by chemical reactions. Remember the chemical reaction for releasing energy?

$$C_6H_{12}O_6 + 6\,O_2 \rightarrow 6\,H_2O + 6\,CO_2 + \text{energy}$$

glucose + oxygen → water + carbon dioxide + energy

You can see that water and carbon dioxide are given off. Water and carbon dioxide are on the list of greenhouse gases.

<u>One solution</u> for decreasing these gases in the air is to <u>burn less fuel</u> so that there is less carbon dioxide given off. Energy conservation is a way of burning less fuel.

<u>Another solution</u> is to use sources of energy that <u>do not use burning</u> to release energy. Can you think of any of these energy sources? (There are four, write them here.)

***Energy sources: Wind Power, Solar Power, Hydropower, Geothermal***

<u>A third possibility</u> is the <u>use of biomass</u> as an energy source. How would this help? Let's look at carbon dioxide in our environment for the answer.

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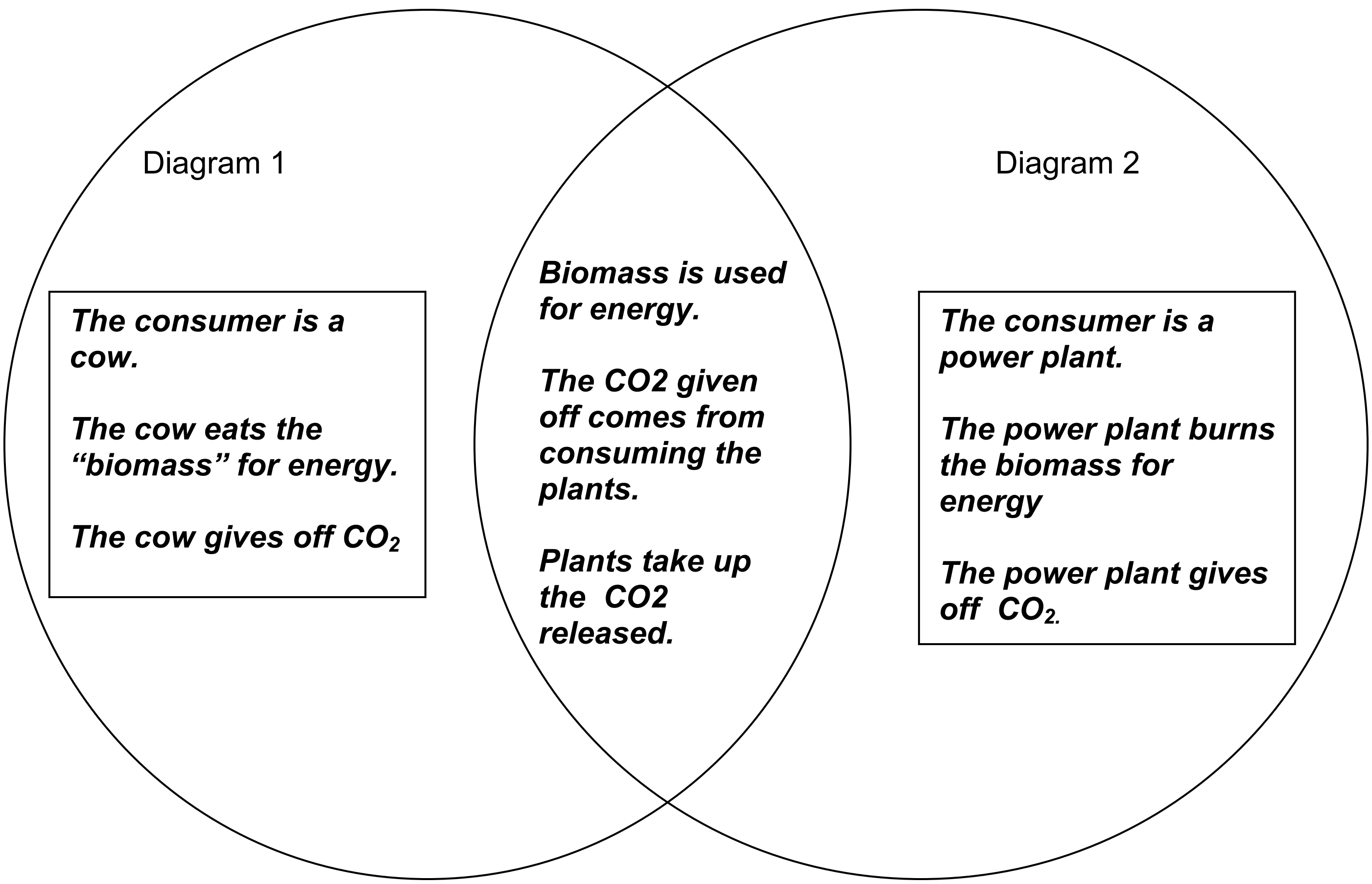
## Does Carbon Dioxide Cycle in Our Environment?

You've heard of the water cycle. There is also a carbon dioxide cycle. The carbon dioxide cycle shows where carbon dioxide is absorbed and released in our environment. Sometimes it is part of our atmosphere as a gas. At other times it is tied up in chemical compounds, like sugars. Carbon dioxide returns to the atmosphere when it is given off from a chemical reaction. Carbon dioxide is thought to be the main greenhouse gas.

On the next page there are two forms of the carbon dioxide cycle. Look at each diagram. How are they the same? How are they different? Fill in the Venn diagrams below by comparing and contrasting the two diagrams.



NAME: **Suggested Answers Key** DATE:

A cycle is a series of events that repeat. Does carbon dioxide cycle in our environment?

***Carbon dioxide does cycle in our environment. Sometimes it is in the atmosphere as a gas. When plants take it in they use the carbon and oxygen from the carbon dioxide to build simple sugars (store energy). When the living thing uses the sugars or is burned in a power plant (or fireplace) carbon dioxide is released into the atmosphere. It can be used by plants.***

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**More on carbon dioxide cycles-**

On the next page there are two more diagrams of the carbon dioxide cycle. Look at each diagram. How are they the same? How are they different? Fill in the table below by comparing and contrasting the two diagrams ($CO_2$ cycle with Biomass and $CO_2$ cycle with Fossil Fuels).

| Things that are the same | Things that are different |
|---|---|
| ***$CO_2$ in air*** | ***With biomass the same $CO_2$ is*** |
| ***$CO_2$ in plants as sugars*** | ***recycled.*** |
| ***$CO_2$ released by burning*** | ***With fossil fuels $CO_2$ is given off*** |
| | ***by burning the fuel AND some is released*** |
| | ***when the plant is consumed.*** |

Fill in the blanks: (use your diagrams)

**Carbon Dioxide Cycle with Biomass**

Output $CO_2$ from burning biomass becomes input for _***atmosphere***____.
Output $CO_2$ from the atmosphere becomes input for _***plants***_________.
$CO_2$ output as stored energy in trees becomes input for _***power plant***_.

**Carbon Dioxide Cycle with Fossil Fuels**

Output $CO_2$ from burning fossil fuels becomes input for _***atmosphere***__.
Output $CO_2$ from the atmosphere becomes input for _***plants***_______.
$CO_2$ output as stored energy in trees becomes input for _***consumers***___.

In the **"Carbon Dioxide Cycle with Biomass"** $CO_2$ is output by which parts? ***It is output by the power plant.***

In the "**Carbon Dioxide Cycle with Fossil Fuels"** $CO_2$ is output by which parts? ***It is output by the power plant and by the plants.***

**Which of the diagrams show carbon dioxide kept in the cycle?**
***Carbon Dioxide Cycle with Biomass***

**Which of the diagrams show a cycle with carbon dioxide leaving?**
***Carbon Dioxide Cycle with Fossil Fuels***