



Plant Needs

Middle School Food and Agricultural Literacy Curriculum

Precepts

- B. Relationships
- B2. Interact and work with others

National Standards

- PS.01.03.01.a. Explain the basic process of photosynthesis and its importance to life on Earth.
- PS.02.01.01.a. Describe the qualities of light that affect plant growth.
- PS.02.01.02.a Describe the effects air, temperature, and water have on plant metabolism and growth.
- PS.02.02.01.a. Identify the major components of growing media and describe how growing media support plant growth.
- CS.01.02.02.b. Utilize communication skills to collaborate in a group setting.
- NL-ENG.K-12.4 – Communication Skills
- NL-ENG.K-12.12 – Applying Language Skills
- NS.5-8.3 – Life Science

Student Learning Objectives

- As a result of this **unit** the students will...
- Utilize plant science concepts in the agriculture industry.
- As a result of this **lesson** the students will ...
- Identify four basic plant requirements.

Content Outline

Objective 1. Identify four basic plant requirements

I. Basic Plant Requirements

- A. Photosynthesis
 - 1. The process by which plants make their energy (food)
 - 2. Most photosynthesis occurs in the leaves of the plant because they have the greatest surface area to collect the most light.
 - 3. Photosynthesis occurs when light, carbon dioxide, and water are converted into energy for the plant.

Time

Instruction time for this lesson: 45 minutes.

Resources

National FFA Organization. (2009). LifeKnowledge Online. Retrieved July 9, 2009, from <http://agedlearning.org> — National FFA Organization. (2003). LifeKnowledge Precepts and Signs of Success.

Tools, Equipment, and Supplies

- Overhead projector/transparencies
- Writing utensils
- MS.PS.1.2.TM.A – one per teacher
- MS.PS.1.2.TM.B – one per teacher
- MS.PS.1.2.TM.C – one per teacher
- MS.PS.1.2.AS.A – one per student
- MS.PS.1.2.ASSESS.A – one per student

Key Terms

The following terms are presented in this lesson and appear in **bold italics**:

Photosynthesis

Media

Natural Light

Artificial Light

- B. Light
 - 1. Light is required for photosynthesis
 - 2. Light is the energy that powers the photosynthetic process
 - 3. Light can be either natural or artificial
 - a. Natural Light: light from the sun. The sun is the most important energy source in the world as all of our food products (even meat and eggs) ultimately rely on the sun's energy. Ex: Steaks come from cows, who eat plant matter, which was grown using the sun's energy.
 - b. Artificial Light: Plants can also use artificial light for the process of photosynthesis. Artificial light is light from bulbs and other man-made sources. Artificial light can be used to manipulate plants to flower, fruit, or germinate at specific times.
- C. Air
 - 1. Plants must have plenty of air to perform photosynthesis and to live.



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2. During photosynthesis, plants absorb carbon dioxide and release oxygen
3. Plants are necessary to our survival and the health of the earth because they convert harmful carbon dioxide into the oxygen we breathe.

D. Water

1. All living organisms, including plants, require water to live.
2. Water is essential for the process of photosynthesis.
3. Also, plants use water to transport minerals and nutrients from the roots to the rest of the plants and the energy created by photosynthesis from the leaves back down to the roots.

E. Growing Media.

1. Plants require a medium to anchor the plant and provide minerals.
2. Soil:
 - a. Plants are most commonly grown in soil.
 - b. Plants anchor themselves in the soil using their roots.
 - c. Soil provides water and nutrients for the plants.
3. Soilless Media:
 - a. In greenhouses, plants are commonly grown in soilless medium.
 - b. Soilless medium may contain moss, perlite, vermiculite, sand, and bark.
 - c. Soilless media is effective because it is sterile.
4. Hydroponics:
 - a. Hydroponics is the practice of growing plants in the absence of soil, using just water.
 - b. In large greenhouse operations, hydroponics reduce the amount of water needed and wasted by ensuring that all of the water reaches the roots.

Interest Approach

Utilize the Me-You-Us e-Moment®. Students will complete a Venn diagram (refer to **MS.PS.1.2.TM.A**) which will eventually compare and contrast the students' needs to the needs of plants.

First, have students write down all of the things they need to survive in the first circle that is labeled MY NEEDS. Then, have the students share their response with their neighbors. Next, the groups will share their responses with the class as you record their answers on the transparency or on a replicated Venn diagram drawn on a whiteboard or chalkboard.

Welcome class! I am very happy to see everyone in their seats and eager to begin class. Let's jump right into today's discussion on what plants need to grow. Take an activity sheet and label it with your name and date. On the top of the sheet you will see a Venn diagram. Venn diagrams are used to compare and contrast two different ideas. On this diagram, we will compare and contrast our needs with plant needs.

Display **MS.PS.1.1.TM.A**.

When I say GO, in the first circle list all of your needs. Remember, needs are those things that are necessary for your survival. You will have two minutes to list of all your needs. What questions are there?

Allow 10-15 seconds for student questions. GO.

Monitor the class during this activity to ensure students are on task and understand the activity. Allow two minutes for this activity. Provide a warning announcement when thirty seconds remain. Next, the students will complete the "You" part of the Me-You-Us Moment by sharing their thoughts with their partner or the person sitting nearest them.

Thank you for working so diligently. Please focus your attention back to the front of the room. Now that you have listed all of the things you can think of that you need for survival, when I say SHARE, you will share your responses with your neighbor. As you share your responses, remember that when working with a partner or in a group, it is important that you listen to other people's opinions respectfully, present your thoughts clearly, and work through differences to reach a consensus. You will have two minutes to share with your partner. Let's review.

How long will you have to share with your partner?

Two Minutes

What are a few things to remember when working with your partner?

Listen, communicate clearly, and reach a consensus.



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When will you begin?

When you say SHARE.

Very good listening skills class! Ready? SHARE.

Monitor the class during this activity to ensure students are on task and understand the activity and that their conversations are on task. Allow two minutes for this activity. Provide a warning announcement when 30 seconds remain. Next, the students will complete the "Us" part of the Me-You-Us Moment by sharing their thoughts with the whole class as you record these answers on the transparency or a replica drawn on the board.

Time is up. Please find a stopping point for your conversation and refocus your attention up front. Now we are going to share our thoughts as a class. Who will share their thoughts first?

Go around the class calling on students to share one need at a time. As the class discusses their responses, record these on the transparency or a replica drawn on the board.

Great! We have determined what we need to grow. Now that we have discussed our needs, let's begin to discuss what plants need to live, grow, and reproduce. How similar do you think plant needs are to our needs?

Allow 10-15 seconds for student responses. Students should connect that just like humans, plants need nutrition and water to survive and that unlike humans, plants require carbon dioxide to produce energy and can collect energy from the sun.

Summary of Content and Teaching Strategies

Objective 1. Identify four basic plant requirements.

Now you will move into discussing what plants need to grow. For this part of the lesson, students will need a copy of **MS.PS.1.2.AS.A** and a pencil. Use **MS.PS.1.2.TM.B** to help guide the lesson and provide a visual reference as students take notes. Also, ensure that you have **MS.PS.1.2.TM.C** (photosynthesis) available. First, students must understand the process of photosynthesis and how this process dictates what plants need to grow.

Take 20 seconds to get out a sheet of paper and writing utensil and be ready to capture some thoughts.

Let's continue discussing plant needs as we capture some key points in our notes. You will need this information for an activity at the end of the class.

Quietly think about how you would answer these questions.... We discussed that one of the things we all need as humans is food. Think to yourself for just a few seconds: When we are hungry what do we have to do to get full? Where do we get our food and energy from?

Allow about 20 seconds for the students to contemplate the question.

Think about this as well: If you did not have stores, food in your cabinet, or any way of getting food, what would happen?

Allow about 30 seconds for the students to contemplate the question.

What do you think?

Discuss how humans are reliant on outside sources of energy and would die without it.

While we rely on food sources such as fruits, vegetables, and meats to provide energy, plants are able to produce their own "food" through a process called **photosynthesis**. Take a look at this diagram on the projector.

Show the class **MS.PS.1.2.TM.C**.

This diagram illustrates the process of **photosynthesis**. When I say GO, you will have two minutes to sketch this process on your activity sheet under the label that reads "The Process of **Photosynthesis**." When you are finished, we will discuss it in more detail. GO.

Allow two minutes for students to sketch the diagram on their student activity sheet, **MS.PS.1.2.AS.A**.

Now that everyone has their sketch drawn, let's continue. As you see, **photosynthesis** is the process by which plants use carbon dioxide from the air, water from the soil, and light to create energy that plants need to live, grow, and reproduce.



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Let's take a closer look at the four major plant requirements. As we go over each of these needs, place them on the Venn diagram in the circle labeled "Plant Needs."

As you discuss the basic plant requirements, display **MS.PS.1.2.TM.B** (content outline) and **MS.PS.1.2.TM.C** (photosynthesis diagram) using the overhead projector.

The most important plant requirement is light. Light is the energy that powers the photosynthetic process. Where do plants get their light?

Student responses will probably be that plants get their light from the sun.

That is correct! Most commonly, plants get the light they need from the sun. Light from the sun is called **natural light**. In fact, the sun is the most important source of energy for all forms of life on earth. Even the steaks we eat can trace their energy back to the sun because steaks come from cattle, which eat plants, which get their energy from the sun. However, plants can also use light from other sources. For example, horticulturalists growing plants in greenhouses often use special bulbs to trick the plants into fruiting, flowering, and growing at different times. Light from means other than the sun is called **artificial light**. Now, take a minute to add light to the Venn diagram and any additional facts you have learned so far.

Allow one to two minutes for students to add notes to the student activity sheet, **MS.PS.1.2.AS.A**.

Great! Everyone focus your attention back to the front and we will discuss more plant needs. Look again at the diagram of **photosynthesis**.

Display **MS.PS.1.2.TM.C** on the overhead projector.

Notice that plants need air to live and grow. Do we also need air?

Yes

What do we need from the air we breathe?

Oxygen

According to the diagram, what do plants use from the air?

Carbon Dioxide

Isn't it amazing that plants absorb carbon dioxide from the air and release oxygen which we need to survive? In fact, if you were to design an airtight dome and place in it several plants and a small mammal such as a rat, theoretically, the oxygen created from the plants would keep the animal alive. Take a second to think about this question and be ready to share with the class when I call on you: What would happen if all of the plants on earth died?

Quietly observe the students for about a minute as they ponder the questions. Then allow four or five students to share their thoughts.

All right, raise your hand if you have an idea. Remember, we are talking about what you think would happen if all the plants on earth died. Who will share their thoughts?

Hopefully students will agree that if all of the plants on earth were to die, so would every other living thing.

That's right! Good thinking! Without plants we would not have oxygen to breathe or food to eat. Now, make sure you add oxygen to your Venn diagram.

Allow time for students to add carbon dioxide to **MS.PS.1.2.AS.A**.

Now let's discuss the third basic requirements plants need to survive. Close your eyes and think about this scenario: "You walk into your house and notice something different. The beautiful green plant your mom has always been so proud of is not looking quite like its self. Its perky green leaves are now drooping and looking a little sad. You notice that there is plenty of light shining on the plant and the house is obviously full of fresh air. You wonder what could be wrong." What is most likely the problem? Think about this for about 30 seconds to yourself.

Observe students as they think about the scenario. Allow about 30 seconds for their silent thoughts.

Great! Now that everyone thinks they know what the problem is with your mom's favorite plant, when I clap my hands, share your thoughts with your neighbors. Clap!



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Allow the students about 30 seconds to discuss their thoughts with their neighbor. Then redirect their attention back to the front of the room.

Thank you for working so well together. Now we will go around the room and share our thoughts.

Allow students to share their thoughts. While responses may vary, hopefully students will suggest that the plant needs water.

Those were really great ideas, class. Most likely the problem is that the plant is in need of water. Plants need water to for **photosynthesis**. Also, plants use water to help transport minerals and nutrients collected by the roots to the rest of the plant and to transport energy created in the leaves to the rest of the plant. Are there any questions?

Allow 10-15 seconds for questions before continuing.

Now we will discuss the last of the major plant requirements. But first, let me ask you a question: Do plants need soil to survive? I will let you think about it for a minute and then when I say GO, stand up if you think the answer is yes.

Allow students about a minute to ponder the question.

GO.

Observe the number of students who stand up.

All right, everyone please be seated. Thank you for your enthusiasm! The correct answer is that plants do not necessarily need soil to survive. However, you are also right that plants require some form of growing **media** to help protect their roots, preserve water, and anchor the plant. So both answers were correct.

Growing **media** is the substance that anchors the plant and provides moisture, vitamins, and nutrients. Growing **media** can be soil, which is the natural material on the surface of the earth created as rocks, leaves, and other organisms decompose. Growing **media** could also be soilless.

Soilless **media** is commonly used in greenhouse operations because it is sterile and free of harmful pests. Soilless medium is usually made of material such as peat moss, bark, and sand.

Now remember that plants need water to survive. But, do you think plants can live if their roots are placed directly in water without soil or any other **media**?

Allow students a few seconds to think about the question.

The answer is yes, plants can survive when planted directly in water. Growing plants in the absence of soil with only water is called hydroponics. Hydroponics is a growing practice in the horticulture industry because when you place the plants directly in the water, you reduce the amount of water wasted because all of the water reaches the roots. Now, be sure to add growing **media** to your Venn diagram. By this time, your Venn diagram should be completed and you have a complete idea of what plants need to grow. Also, you should have a list of what humans need to grow and live.

Allow about one minute for students to complete their notes before beginning to review.

Review/Summary

All right class, by this point you should have the four basic plant needs listed in the right hand circle of the Venn diagram on your student activity sheet. Let's review these four. Raise your hand if you would like to share one of the four basic plant needs.

Call on four students to share the four basic needs (water, air, light, and growing media.)

Great! Thank you for your thoughts. Now, when I say THINK, I want everyone to quietly review both sides of your Venn diagram. First review your basic needs. Then, review the four basic plant needs. Finally, in the center of the diagram, where the two circles overlap, place the needs you and plants have in common. You will have one minute. What can I clarify? THINK!

Allow the students one or two minutes to think about the question and fill in the common needs they share with plants. They should decide that both plants and humans need air and water.

OK class, please refocus your attention back to the front of the room. I hope everyone decided that both plants and humans need air and water to survive. Also, always remember that without plants, we would not have air or food.



Application

Extended classroom activity:

To further the students' understanding of the need for three of the basic plant requirements, water, air, and light, conduct a mini-experiment with the class. This experiment will take about two weeks to show clear results. For this, you will need four identical plants, a clear nonporous bag, and a very dark closet or room. On day one, show the class the four identical plants. Then place one plant in the nonporous bag and label it AIR. Place another plant in a very dark room or closet and label it LIGHT. The third plant should be labeled WATER; do not water this plant for the entire length of the experiment. The fourth plant should be in an area with plenty of light and air and should be labeled CONTROL.

Let the class observe the plants about every two days and document changes in the different plants. By the end of two weeks, the three plants which were restricted from light, water, and air will be dead or close to dead. Discuss these results with the class.

FFA activity:

Students who enjoy this lesson may be interested in the floriculture FFA CDE which requires students to have extensive knowledge of plant parts, functions, needs, and uses as well as to be able to identify common floriculture plants. For more information visit: ffa.org.

SAE activity:

This lesson can be used to introduce the many opportunities students have to pursue a Supervised Agricultural Experience Program in plant science. Students may wish to conduct an experimental SAE to explore how manipulating one or more of the basic plant requirements can affect growth, appearance, and reproductive ability. Students may wish to conduct experiments such as the one described in the classroom extension section or may conduct a project with the intent of manipulating one or more of the basic plant requirements to produce a greater yield or quality in plants. Also, students who find this lesson interesting may wish to pursue an SAEP in plant production or greenhouse management.

Evaluation

MS.PS.1.2.ASSESS.A

Answers to Evaluation

1. Leaves
2. Hydroponics
3. Carbon Dioxide, Oxygen
4. Artificial
5. Photosynthesis

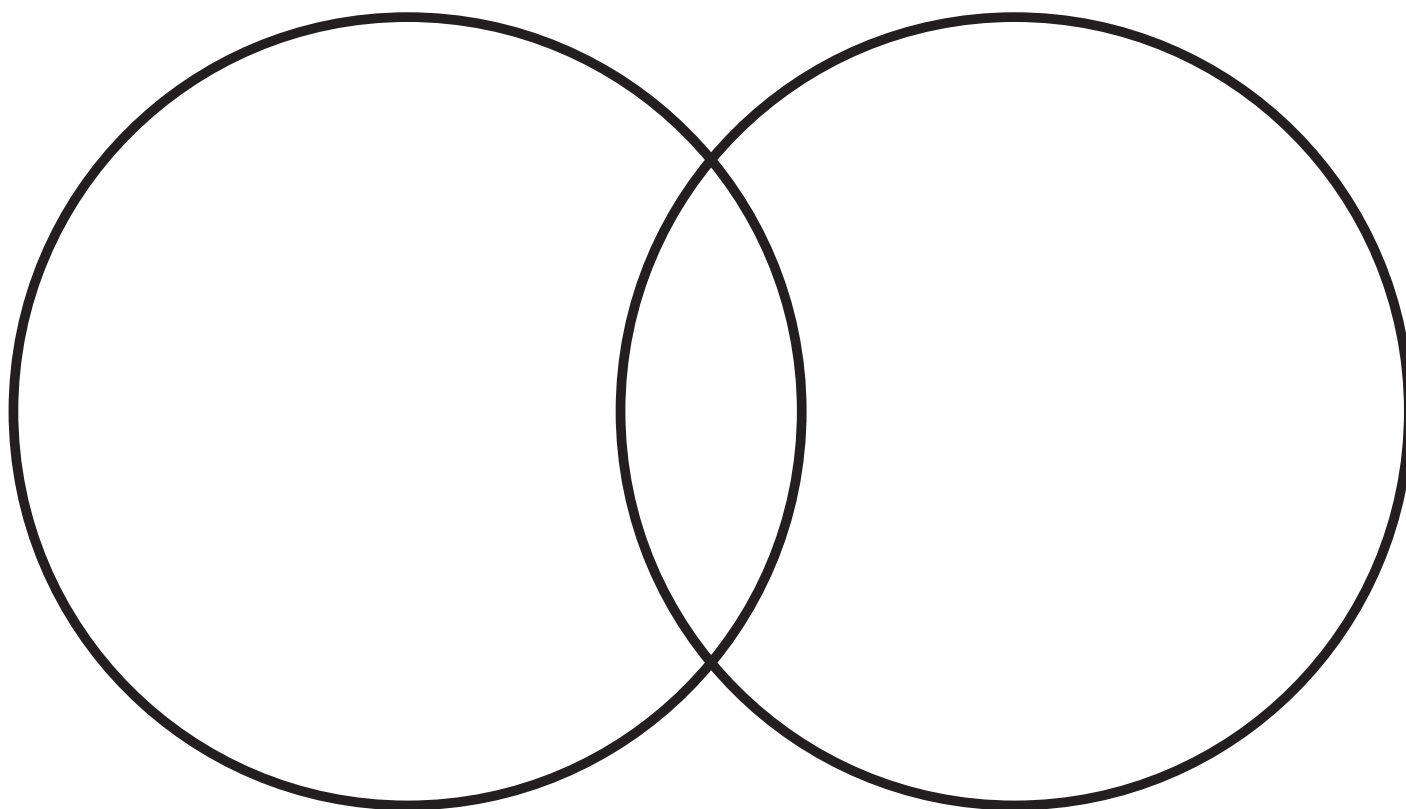


Basic Plant Requirements

A Venn diagram comparing MY NEEDS with PLANT NEEDS.

MY NEEDS

PLANT NEEDS





Basic Plant Requirements

A. Photosynthesis:

1. The process by which plants make their energy (food)
2. Most photosynthesis occurs in the leaves of the plant because they have the greatest surface area to collect the most light.
3. Photosynthesis occurs when light, carbon dioxide, and water are converted into energy for the plant.

B. Light:

1. Light is required for photosynthesis
2. Light is the energy that powers the photosynthetic process
3. Light can either be natural or artificial
 - a. Natural Light – light from the sun.
The sun is the most important energy source in the world as all of our food products (even meat and eggs) ultimately rely on the sun's energy.
Ex: Steaks come from cows that eat plant matter, which was grown using the sun's energy.
 - b. Artificial Light – Plants can also use artificial light for the process of photosynthesis. Artificial light is light from bulbs and other man-made sources. Artificial light can be used to manipulate plants to flower, fruit, or germinate at specific times.

C. Air:

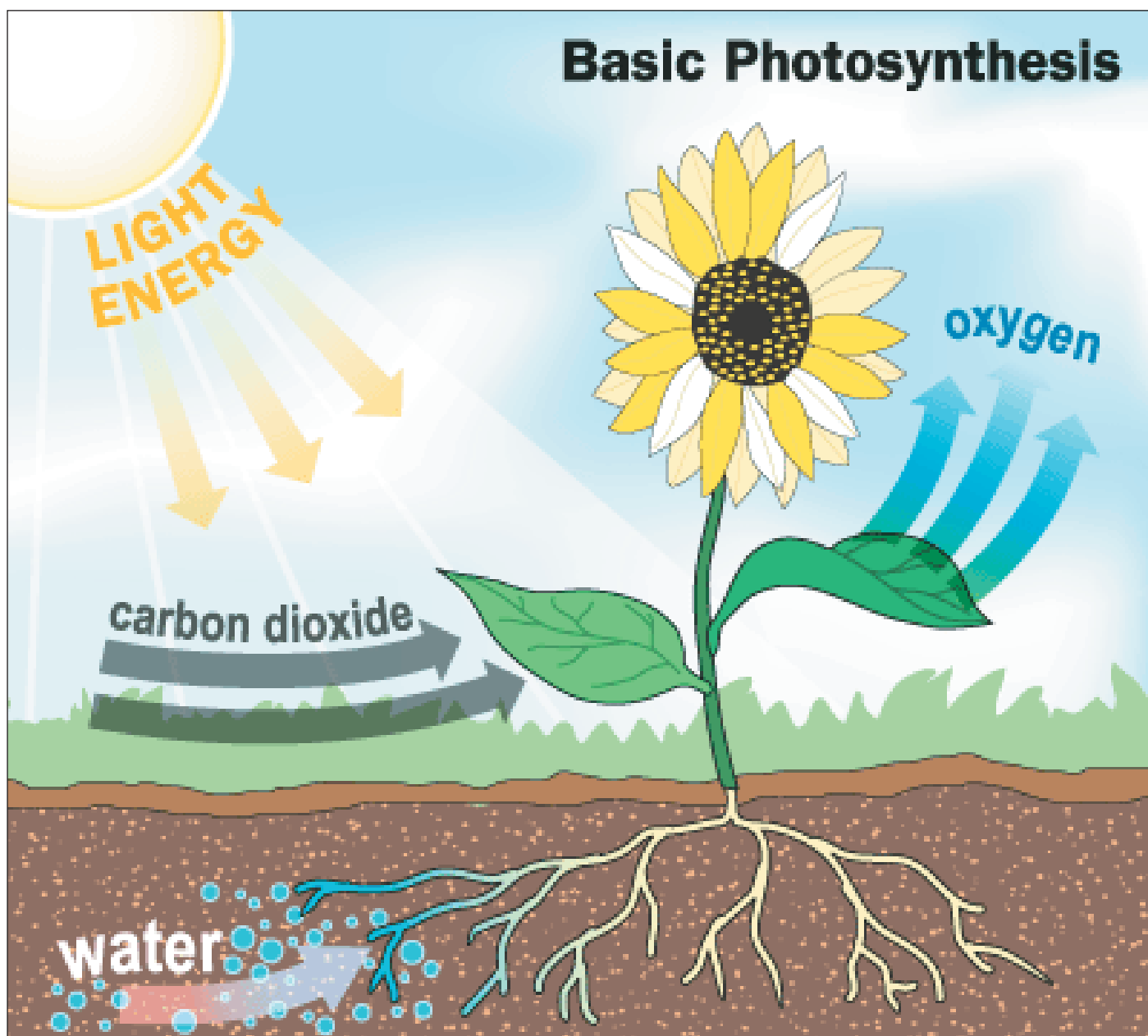
1. Plants must have plenty of air to perform photosynthesis and to live.
2. During photosynthesis, plants absorb carbon dioxide and release oxygen
3. Plants are important to our survival and the health of the earth because they convert harmful carbon dioxide into the oxygen we breathe.

D. Water:

1. All living organisms, including plants, require water to live.
2. Water is essential for the process of photosynthesis.
3. Also, plants use water to transport minerals and nutrients from the roots to the rest of the plants and the energy created by photosynthesis from the leaves back down to the roots.

E. Growing Media:

1. Plants require a medium to anchor the plant and provide minerals.
2. Soil –
 - a. Plants are most commonly grown in soil.
 - b. Plants anchor themselves in the soil using their roots.
 - c. Soil provides water and nutrients for the plants.
3. Soilless Media –
 - a. In greenhouses, plants are commonly grown in soilless medium.
 - b. Soilless medium may contain moss, perlite, vermiculite, sand, and bark.
 - c. Soilless media is effective because it is sterile.
4. Hydroponics –
 - a. Hydroponics is the practice of growing plants in the absence of soil, using just water.
 - b. In large greenhouse operations, hydroponics reduce the amount of water needed and wasted by ensuring that all of the water reaches the roots.



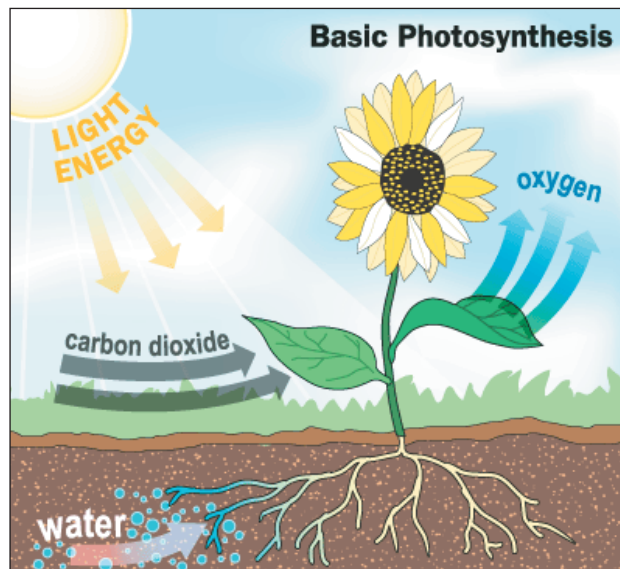
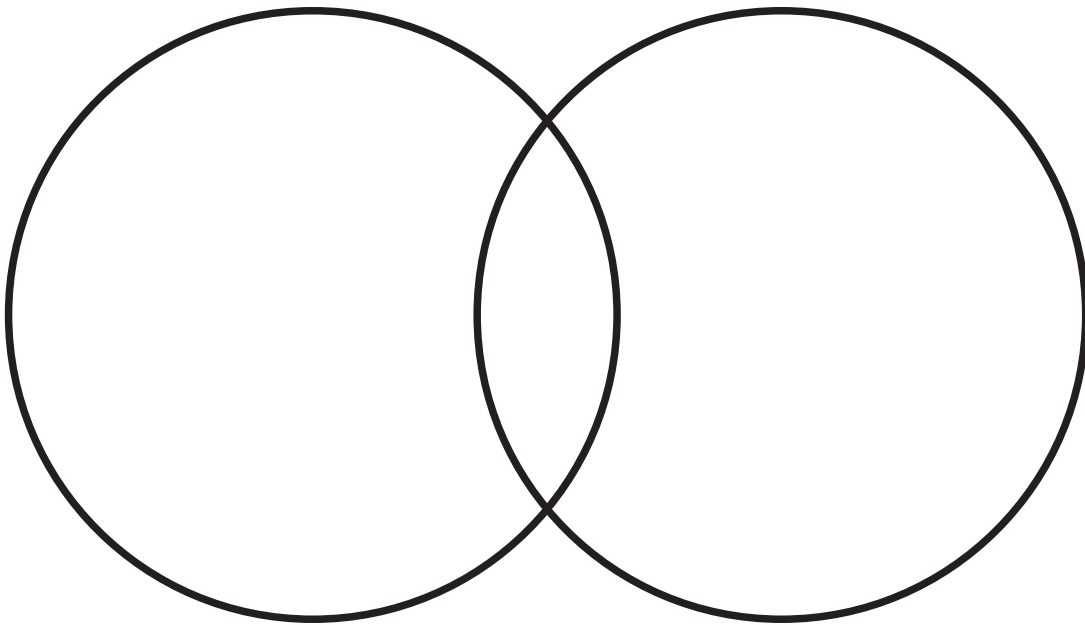


Basic Plant Requirements

Name _____

MY NEEDS

PLANT NEEDS



The Process of Photosynthesis



Name _____

Directions: Using the word bank provided below, answer the questions below by filling in the blanks. Each word will only be used once.

Word Bank:					
Photosynthesis	Carbon Dioxide	Oxygen	Hydroponics	Artificial	Leaves

- _____ are the primary site of photosynthesis in plants. This is where plants gather the most sunlight to be converted to energy.
- _____ is the practice of growing plants in water with the absence of soil or any other growing media.
- During photosynthesis, plants take in _____ from the air and release _____ which humans breathe.
- While most plants and crops grow using the sun's light, _____ light, such as light bulbs, is often used in greenhouse operations.
- Plants convert carbon dioxide, water, and energy from the sun to produce all of the energy they need to grow and reproduce through a process called _____.