LESSON #4:

WHAT STRUCTURES DO WE NEED TO GROW AND SURVIVE?

SCIENCE

K- 5TH GRADE

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INTRODUCTION

The *Genomic Logic for Underlying Morphological Divergence (EPSCoR)* project aims to bring science-related learning experiences to schools. This lesson is the last of six, designed to facilitate learning the concepts of biodiversity (lesson 1), adaptation (lesson 2), evolution (lesson 3), plant and animal structures (lesson 4), heredity (lesson 5), and the care of butterflies (lesson 6). These lessons will serve as a tool for the trainer or professional in charge of teaching (teacher, professor, among others). For participants, they can be teachers (as part of their professional development) or students.[1]

In this fourth lesson, the instructors or teachers of the elementary level, and their students, will actively participate in some activities where they will understand the principles of the structure of plants and animals. The life cycles of the *Asclepias curassavica* plant will be discussed and in the case of an animal the monarch butterfly will be studied.

This lesson includes:

- ✓ Scientific background of the concepts
- ✓ Glossary
- ✓ Alignment of the content to the standards, expectations, and specificities of the Department of Education of Puerto Rico (DEPR)
- ✓ Educational Process
- ✓ Detailed activities to carry out in the classroom.

[1] Unless otherwise stated, the neutral term will be used with nouns such as teacher/s, participant/s, professor/s, instructor/s, and/or student/s.

TEACHER'S GUIDE

SUBJECT: Science **LEVEL:** Elementary (K-5)

CONCEPTS: plant and animal structures, life cycle, biodiversity, species, adaptation

PRIOR KNOWLEDGE: similarities and differences, characteristics of living beings

SPECIFIC LEARNING OBJECTIVES

Conceptual objectives:

- Identify similarities and differences between certain species.
- Interpret information related to the concepts of species and biodiversity.
- Recognize structural similarities and differences between plants and animals.
- Recognize particular characteristics that help a species survive in a given environment.
- Define adaptation.
- Define evolution.
- Mention mechanisms that help a species survive (e.g., camouflage).
- Describe the structures of plants (host plants) and animals (butterflies).
- Describe the stages of a plant's life cycle and the life cycle of a butterfly.
- Describe the morphology of butterfly wings.
- Distinguish which offspring (young) come from two given parents.
- Identify and mention the characteristics that are passed on and preserved from parents to offspring.
- Discuss and understand the order of events in the butterfly life cycle.
- Write, draw, and create a fold-out (or accordion-style book) to capture observations of the monarch butterfly.
- Mention how human intervention can contribute to or affect the availability of a species.

Procedural objectives:

- Observe and identify organisms that share similar and different characteristics and belong to the same species.
- Use drawings or diagrams to explain the structural similarities between species.
- Investigate how butterflies came into being (their evolutionary history).

Attitudinal objectives:

- Value and show appreciation for nature and the diversity of life.
- Recognize the importance of caring for biodiversity.
- Reflect on the fragility of a species in order to grow and how we can care for it.
- Accept, respect, and recognize the work and ideas of others.

STANDARDS, EXPECTATIONS, AND SPECIFICATIONS:

Grade: 1st-3rd (Indicators according to content standards)

Standard: Structure and Levels of Organization of Matter

- Recognize structural similarities and differences between humans, plants, and animals (you may use drawings, sculptures, or dramatic representations).
- Make observations with the purpose of describing the structures that plants and animals need to survive and grow.
- Develop logical arguments about the fact that plants and offspring closely resemble their parents, but are not exactly the same as them.

Standard: Conservation and Change

- Interpret information related to the concept of biodiversity, emphasizing appreciation for nature and the diversity of life.
- Recognize that matter (living and nonliving things) changes over time.
- Describe patterns of change in matter.
- Recognize that reproduction is a form of conservation of living things.
- Deduce that living things change over time.
- Identify characteristics that are passed on and conserved from generation to generation.

Standard: Interactions and Energy

- Build an argument based on evidence to explain that in a particular environment, some types of organisms survive better, others live with more difficulty, and others do not survive.
- Explain how variations in characteristics among individuals of the same species offer advantages for survival, finding a mate, and reproduction.
- Describe the life cycle of organisms (birth, growth, reproduction, and death).

- Analyze and interpret data to provide evidence that plants and animals have characteristics inherited from their parents, which vary within organisms belonging to the same group.
- Explain how variations in characteristics among individuals of the same species offer advantages for survival, finding a mate, and reproduction.
- Compare data from different areas and establish connections between biodiversity and environmental conditions.
- Observe plants and animals to compare the diversity of life in a variety of habitats.

Grade 4th and 5th (Indicators according to content standards)

Standard: Structure and levels of organization of matter

- Mention and discuss the functional advantages of structural adaptations in living beings.

Standard: Conservation and Change

- Define, identify, and use evidence to develop arguments about the adaptive mechanisms in plants and animals that allow them to survive and respond to changes in the environment.
- Identify ways to conserve the survival of organisms in their environment.
- Recognize that reproduction is necessary to perpetuate the species.
- Infer that reproduction allows some characteristics of species to be conserved or changed.
- Explain changes related to the form, structure, and vital functions of organisms.
- Recognize that organisms have life cycles and change over time.
- Recognize that the form, structure, and vital functions of organisms can change throughout their stages of development.

BACKGROUND

When we talk about **adaptation**, we refer to the characteristics that a species possesses that gives it the capability of survival in the environment it inhabits. A **species** is a group of organisms that share the same characteristics that can cross and produce a fertile descendance. However, individuals of one same species can show mild variations. These variations may be favorable or unfavorable. This lets the species survive in a particular environment. Depending on environmental factors, after many generations, a population can look very different. Adaptations can be **structural** or **physiological**. Butterflies are a particularly strong example of structural adaptations. These adaptations in butterflies include the way in

which they use **mimicry**, **camouflage**, and even their capability to fly. Some examples of adaptations that butterflies possess are:

Camouflage = The principal structural adaptation of butterflies is in their wings and how they use them to hide. The wings of many species have evolved to imitate its surroundings, with the common green as a particularly good example. These butterflies have wings that have a color and shape that match exactly to the leaves in which they are found, which makes it more difficult for predators to find them.

Disguise and subterfuge = Many butterflies have developed “eye spots” on their wings. When their wings are open, these spots give the butterfly the appearance of a much larger creature, terrifying possible predators. In that same way, viceroy butterflies deliberately imitate the appearance of a monarch butterfly, which has evolved to be toxic upon consumption. As a result, predators avoid hunting both species. Another example that we can mention are the colors of *Heliconius*, who have red because animals associate it with a bitter taste.

Delight = Butterflies are cold-blooded creatures, which means that they need to heat their wings before taking off. That is where they are more vulnerable to predators, but it is a vital part in the progress of the butterfly. Butterflies may simply fold their wings if they overheat.

Sensibility to light = Every fourth generation of monarch butterflies migrates 2,000 miles (3,220 kilometers), traveling from as North as Canada to places to hibernate in Mexico. Monarch butterflies use their antennae to detect the basic level of light around them. This lets them know the time of the day depending on the amount of light that they can see, which also lets them stay alert.

Examples of adaptation in living beings

Species	Adaptation	How can adaptation help it survive in the environment?
Crocodiles	Digestive apparatus	Adapted to ingest a large variety of preys
Fish	Travel	It is favored by the wavelike movements of its body
Horse	Growth in size	To face prairie predators
Wolves	Development of muscles for chewing	It makes it easier to chew their prey
Anteater	Tail	It works as a coat
Mollusks	Large muscular foot	It allows them to set themselves on the sand to travel
Primates	Fingers	To collect tree branches
Butterflies	Camouflage	It allows them to imitate its surroundings with makes it harder for predators to find them

GLOSSARY

1. **Similarity** – relation among people, animals or things that have common traits.
2. **Difference** – quality that lets something distinguish itself from another thing.
3. **Species** – a group of organisms that can interbreed to produce fertile descendants.
4. **Biodiversity** – variety of organisms in our Planet.
5. **Adaptation** – traits form an animal that helps it survive in a specific environment.
6. **Structural adaptations** – adaptations that include changes in structure of some parts of the species' body.
7. **Mimicry** – structural adaptation that provides protection to an individual, letting it copy the appearance of other species.
8. **Camouflage** – structural adaptation that lets the individual blend into its surroundings. It involves the individual's change in color.
9. **Physiological adaptations** – changes in metabolic processes of an organism.

Evolution – change in inheritable traits of a population through time.

EDUCATIONAL PROCESS

BEGINNING

This activity explores the knowledge that the participants have about what the structures of a plant and an animal are like (with an emphasis on the butterfly). The life cycles of the *Asclepias curassavica* plant and the monarch butterfly will be discussed.

1. Before beginning to discuss the structures that a plant and an animal (Monarch Butterfly) need to survive, the teacher will determine the student's knowledge of what a plant and the Monarch butterfly need to grow.
2. In the case of grades K-3 the teacher can ask the students what things a plant and an animal (Monarch butterfly) need to grow.
3. Once the students have mentioned it, the teacher proceeds to complete **Worksheet #1** with the students. See instructions in the worksheet.
4. For 4th to 5th grade students, the teacher asks students to cut out all the shapes that appear on **Worksheet #1.** The teacher tells the students that in the oval figures they will write the title "The plant needs…" and in the rest of the oval figures the things that a plant needs to grow. Students will form a flower (see key). Finally, the students' responses are discussed, and doubts are clarified.

5. Having discussed **Worksheet # 1** with students at both levels, the teacher you indicated “you already know the things that a plant and an animal like the butterfly need to grow, but what structures do plants and animals have that allow them to survive?” This question will start the development activity.

DEVELOPMENT

1. The teacher listens to the students' responses when mentioning the structures that plants and animals need to survive.
2. The teacher will use the PowerPoint presentation to elaborate on the answers given by the students and clarify doubts.
3. The teacher will talk about the main parts of a plant (flower, stem, leaves, roots, and the fruit) and the function that each one of them carry out for the maintenance and reproduction of the plant.
    a. We must remember that not all plants have fruits or flowers, or this same structure that has just been discussed.
4. The teacher will explain to students that some plants can reproduce by sexual or asexual reproduction. The teacher will utilize the life cycle of the *Asclepias curassavica* plant to explain this information.
5. The teacher uses the information in the PowerPoint to explain the importance of the flower in the sexual reproduction of the plant and how an *Asclepias curassavica* plant can reproduce asexually by cuttings.
6. To determine if K-3 students recognize the parts or structures that allow a plant to survive, **Worksheet # 2 The parts of a plant** will be completed. Students will cut out the pieces of a plant, color them, glue them correctly in the mold, and identify the different parts of the plant. The activity is discussed and the functions of the different parts of the plant are reviewed. The teacher will utilize the PowerPoint Presentation.
7. For 4^{th} and 5^{th} grade students, their corresponding **Worksheet #2** will be completed. Finally, the doubts are discussed and clarified.
8. To explain the structures that an animal like the butterfly needs to survive, 4^{th} and 5^{th} grade students will complete **Worksheet #3**.
    a. In the case of K-3 students, the teacher will show **Worksheet #3** and will ask the students for the name and role of each part or structure indicated (if the student cannot identify the name and the role of the structure, the teacher will indicate this through socialized discussion).
9. Then, K-3 students will complete **Worksheet #4a**. They will color and trim the sheets. They will glue the pictures in the corresponding number together with the word that represents each phase of the butterfly's life cycle.

10. In the case of 4th and 5th grade students, they will complete **Worksheet #4b**. Students will create the Butterfly Life Cycle fold (see instructions for creating the fold).

CLOSURE

1. In cooperative groups, prepare a skit to explain the phases in the life cycle of butterflies. Each student must act out a phase of the cycle (there may be a narrator).
2. Each group will present their skits to explain the life cycles of plants and animals.

Additional Worksheet :

- The teacher can also use sheets of the **Additional Worksheet. In the case of K-3,** the teacher can cut out the five pictures and hand them out to five students. If the students cannot read, the teacher could read the information so that they place the events of the life cycle of plants in the correct order in front of the group. For **4th and 5th grade students**, the teacher could form groups of 5 students. The teacher will hand out an envelope to each group with the five pictures for them to order the events correctly and explain the process amongst them. The teacher could work on the activity individually; that is, that each student could do the activity by themselves. See **Additional Worksheet.**

K-3

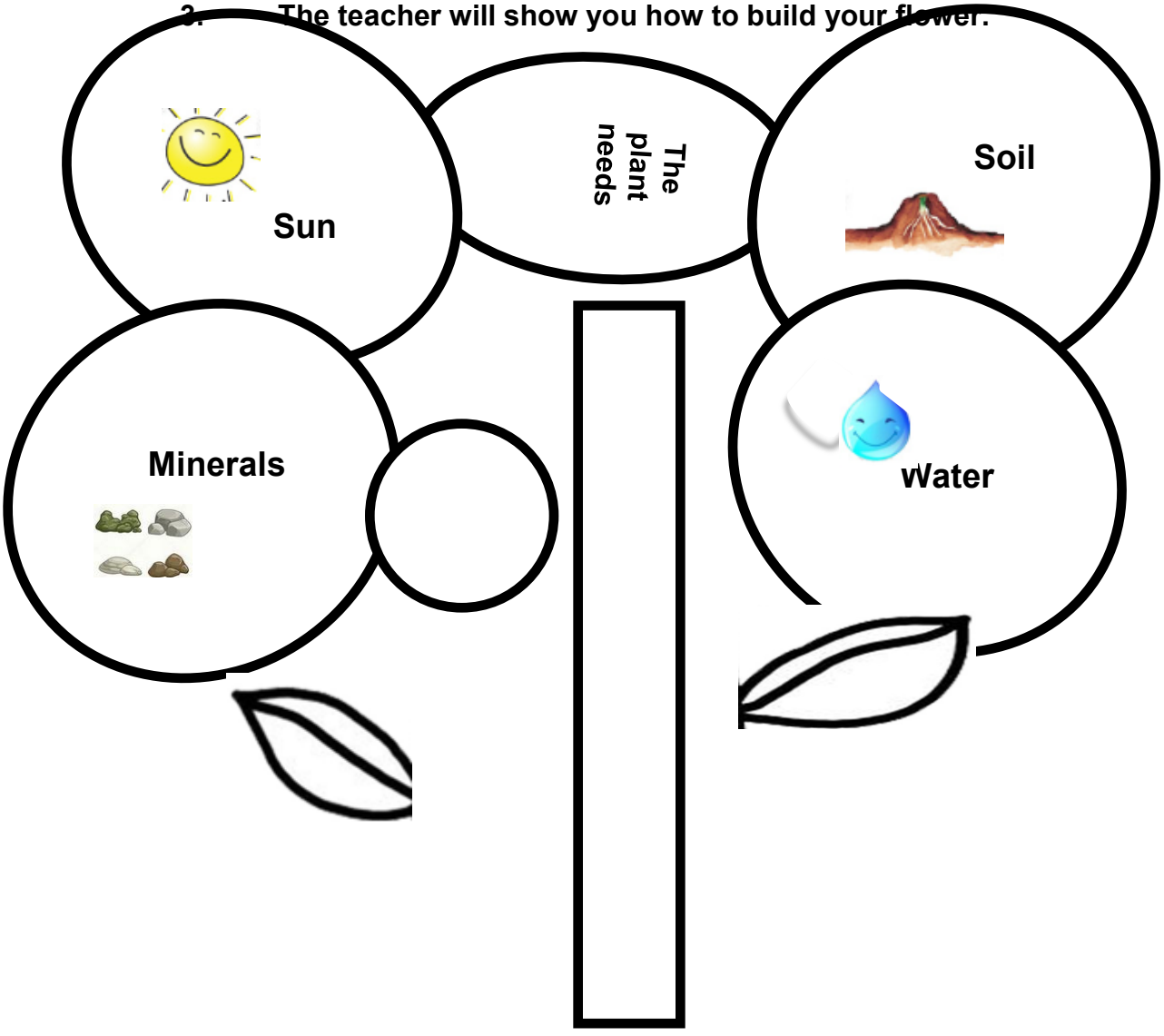
Worksheet # 1

Lesson #4: What structures do we need to grow and survive?

Materials:
Wooden palette (those used for ice cream popsicles)
Crayons
Scissors
Glue

Process:

1. **Use the materials and pictures to form a flower in which you will show the things that a plant needs to grow.**
2. **Use the scissors to cut out the different shapes. The teacher can cut out the figures beforehand.**
3. **The teacher will show you how to build your flower.**



4th-5th

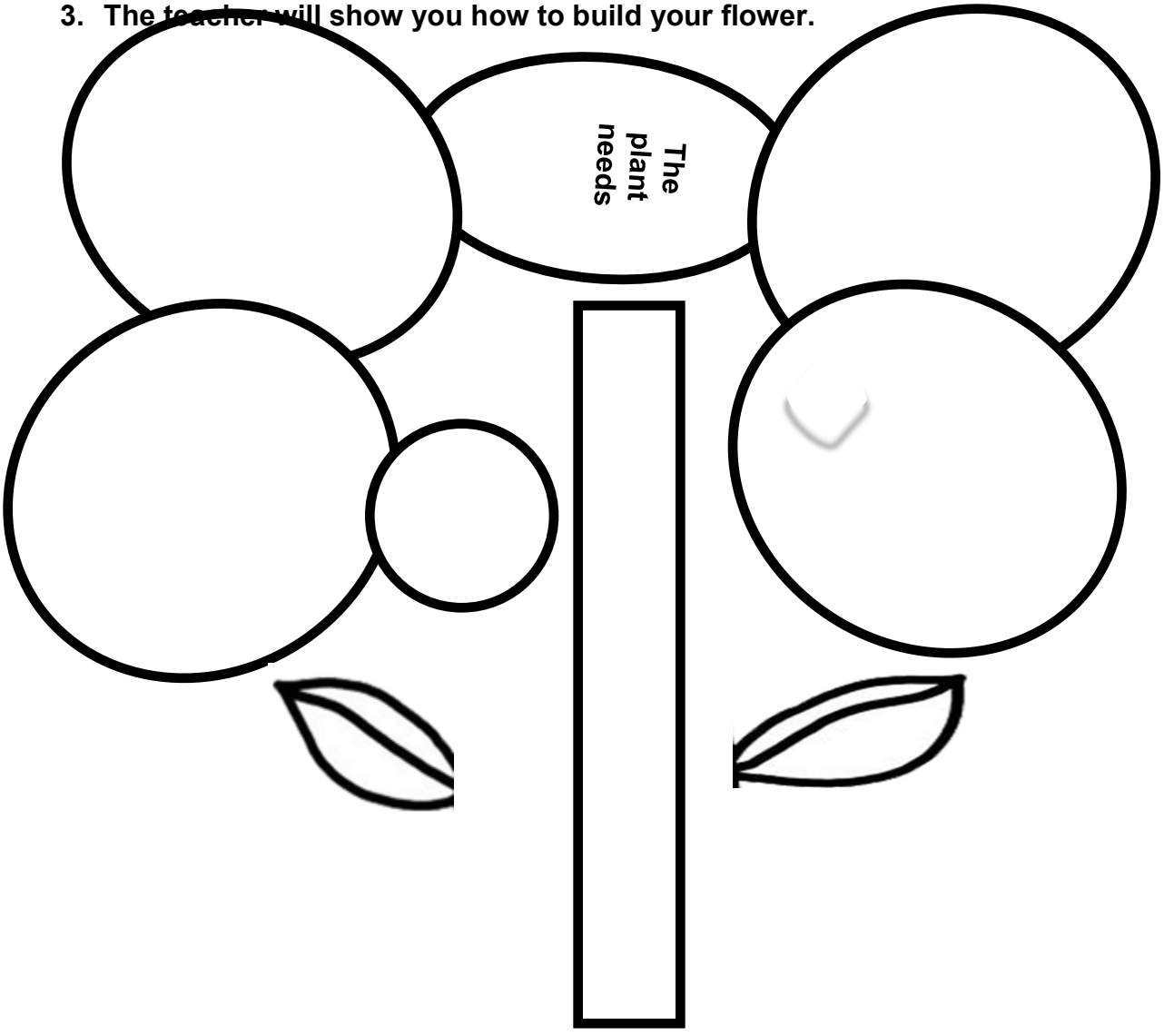
Worksheet #1

Lesson #4: What structures do we need to grow and survive?

Materials:
Wooden palette (those used for ice cream popsicles)
Crayons
Scissors
Glue

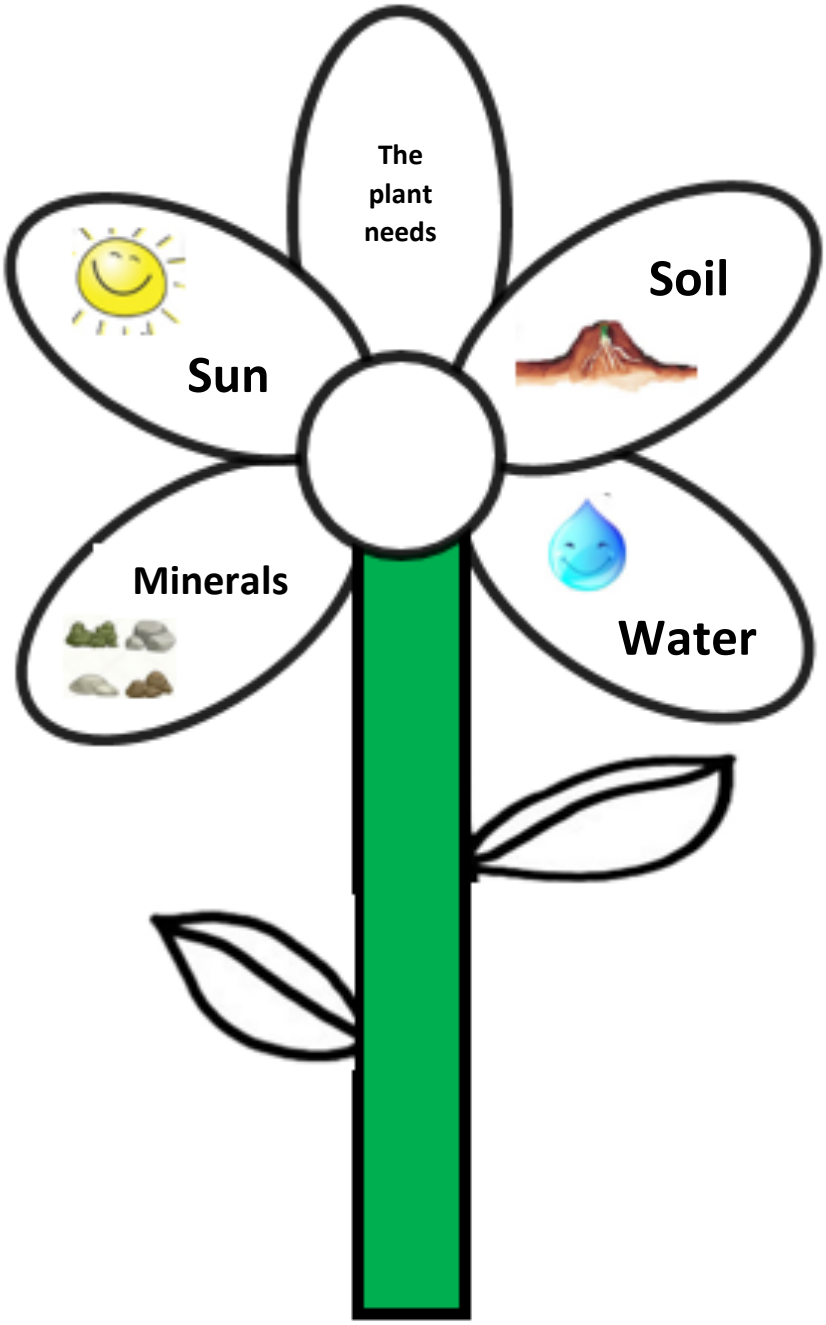
Process:

1. **Use the materials and pictures to form a flower in which you will show the things that a plant needs to grow.**
2. **Use the scissors to cut out the different shapes. The teacher can cut out the figures beforehand.**
3. **The teacher will show you how to build your flower.**



Worksheet # 1

Lesson #4: What structures do we need to grow and survive?



K-3

Worksheet #2

Lesson #4: What structures do we need to grow and survive?

Use the pieces to make a plant. Cut out, color, and paste in figure 1. Then identify the parts of the plant.

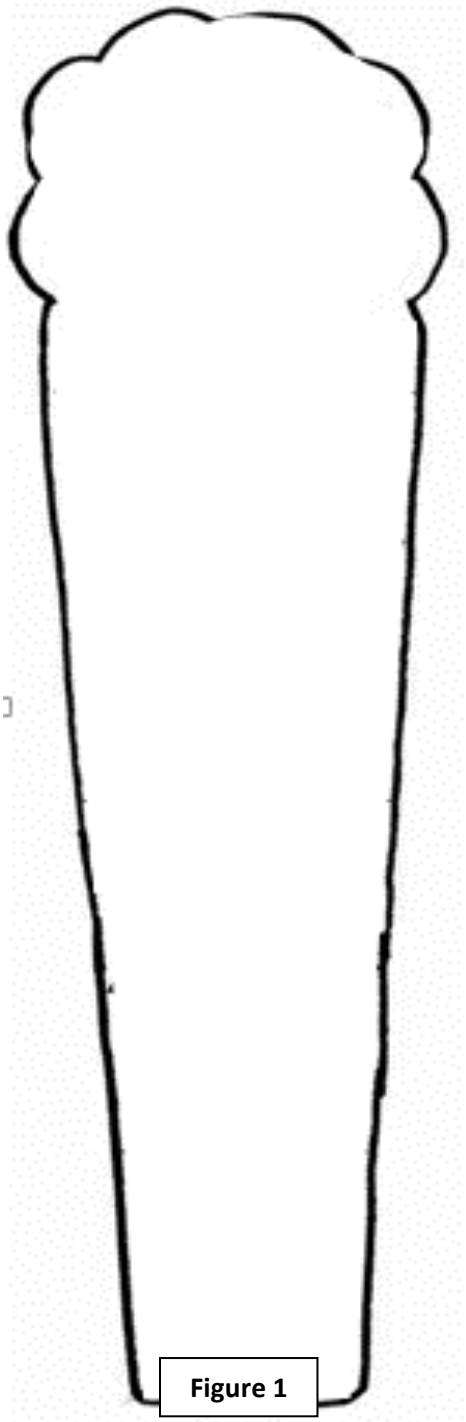
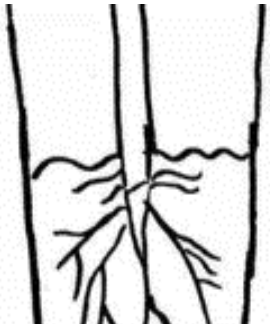
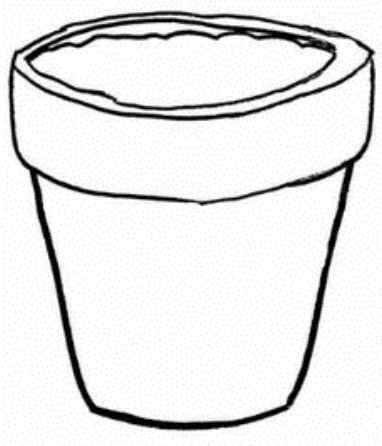


Figure 1





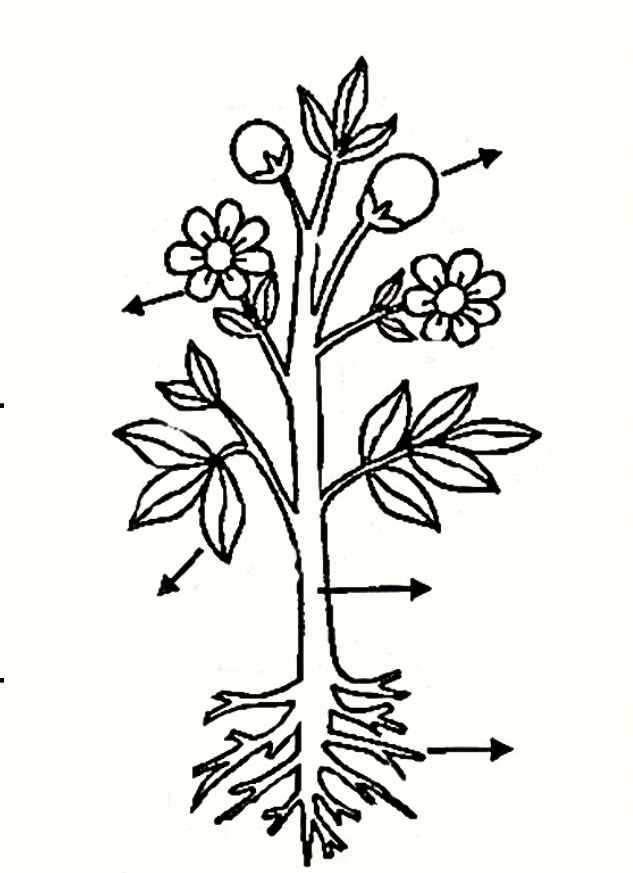
4th - 5th

Worksheet # 2

Lesson #4: What structures do we need to grow and survive?

Unscramble the words that appear in the box. Then label the parts of the plant.

evelas
efsorlw
sotro
tursif
emst



Match each part of the plant with its role. Write the number down in the corresponding space. You may repeat numbers in some cases.

1. Leaves
2. Roots
3. Stems
4. Fruits
5. Flowers

___ allow the plant to reproduce

___ elaborates the plant's food

___ include the seeds

___ fixates the plant to the soil

___ take water and nutrients from the soil

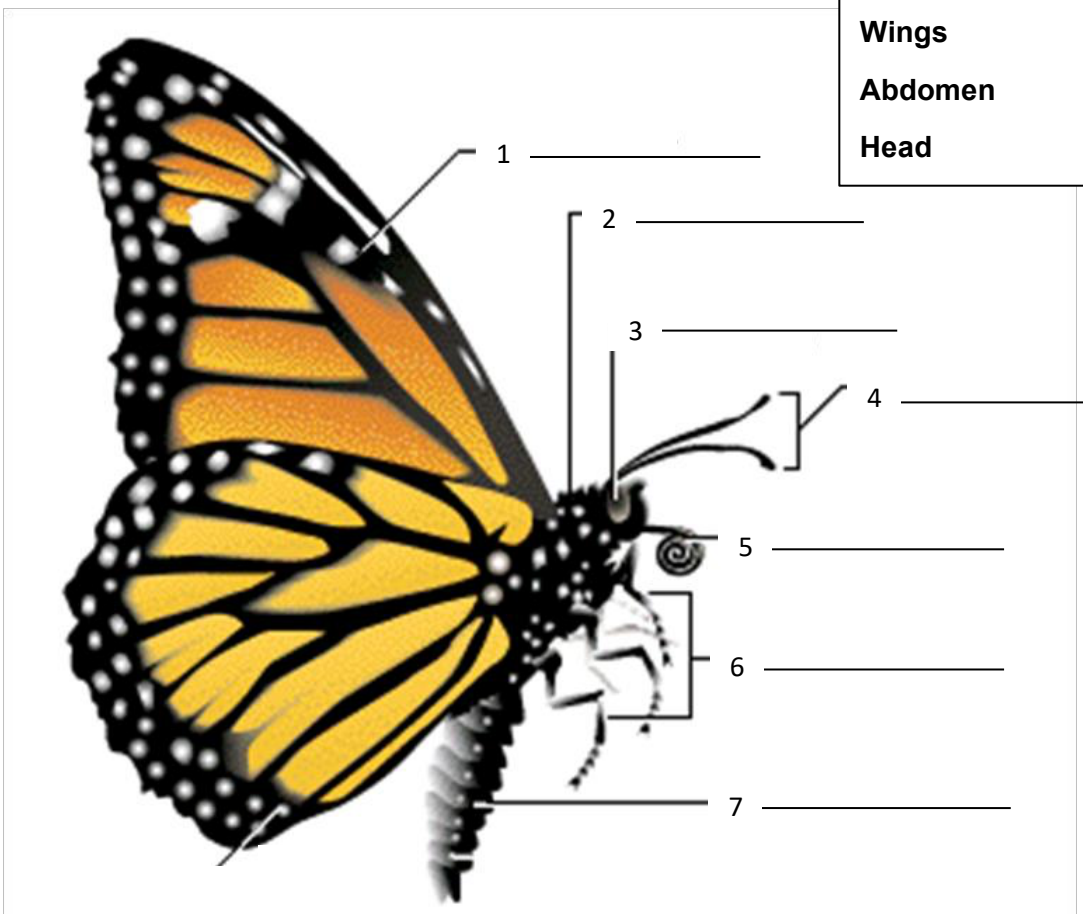
___ carries food to all parts of the plant

Worksheet #3

Lesson #4: What structures do we need to grow and survive?

Label the parts of the butterfly. Use the words that appear in the box.

Antennae	**Proboscis**
Wings	**Compound eye**
Abdomen	**Legs**
Head	



Match each part of the butterfly with its role. Write the number down in the corresponding space. You may repeat numbers in some cases.

1. Compound eye
2. antennae
3. wings
4. proboscis
5. abdomen

___ sucks nectar from flowers

___ its colors protect them from predators

___ allows the butterfly to feel slight movements.

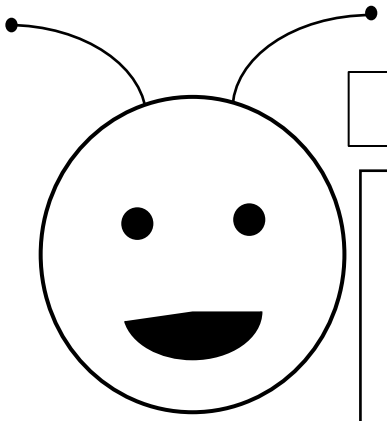
___ important for reproduction

___ responsible to allow flight

___ allows the butterfly to locate smell sources

Worksheet #4a

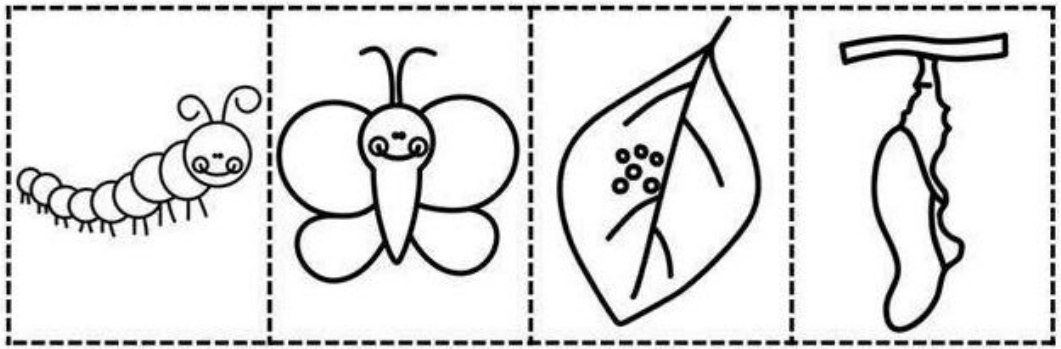
Lesson #4: What structures do we need to grow and survive?



The butterfly's life cycle

			
1	2	3	4

Color and cut out the pictures. Glue the pictures to the corresponding number along with the word that represents each phase of the butterfly's cycle.



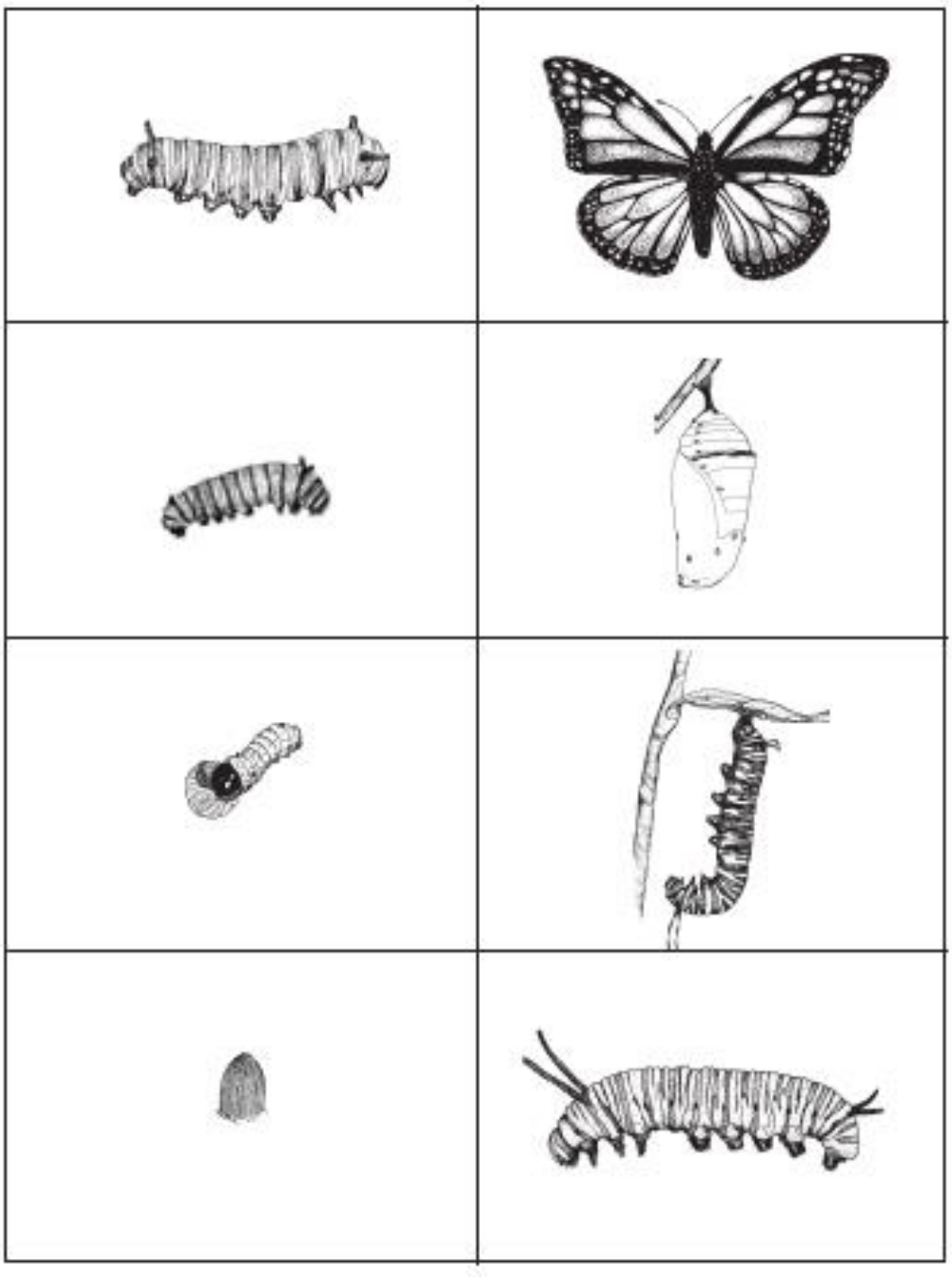
eggs	butterfly
caterpillar	chrysalis

4th - 5th

Worksheet # 4b

Lesson # 4: What structures do we need to grow and survive?

Cut out the illustrations and glue them to the manila envelope to create the fold. Follow your teacher's instructions.

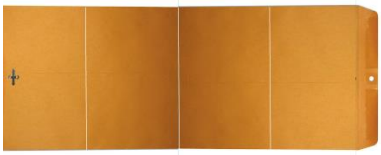


How to prepare the foldable to illustrate the life cycle of the monarch butterfly?

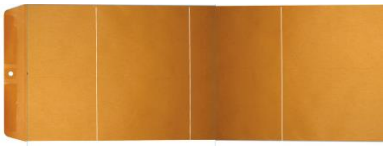
Illustrations

#1

#2



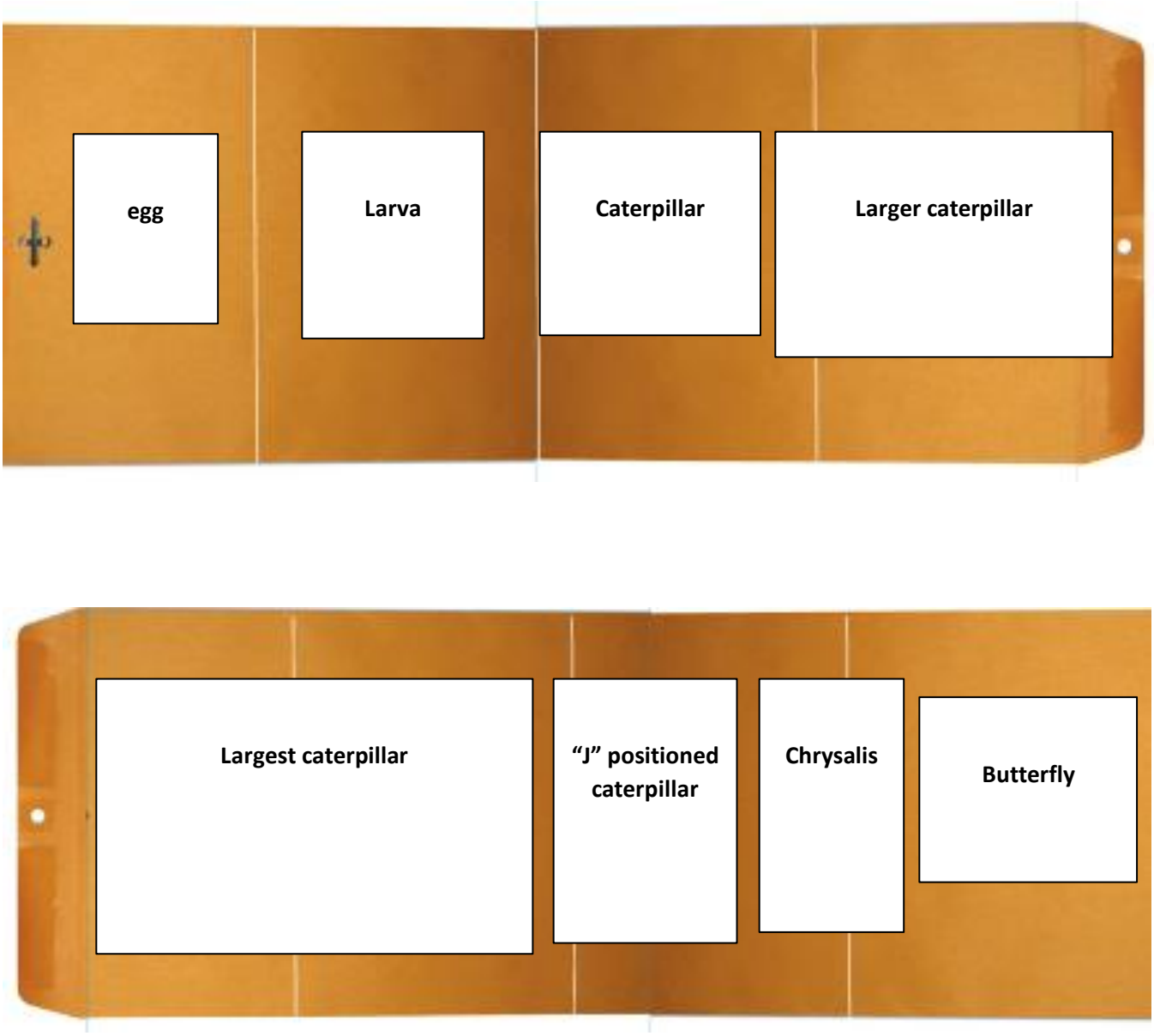
#3



#4

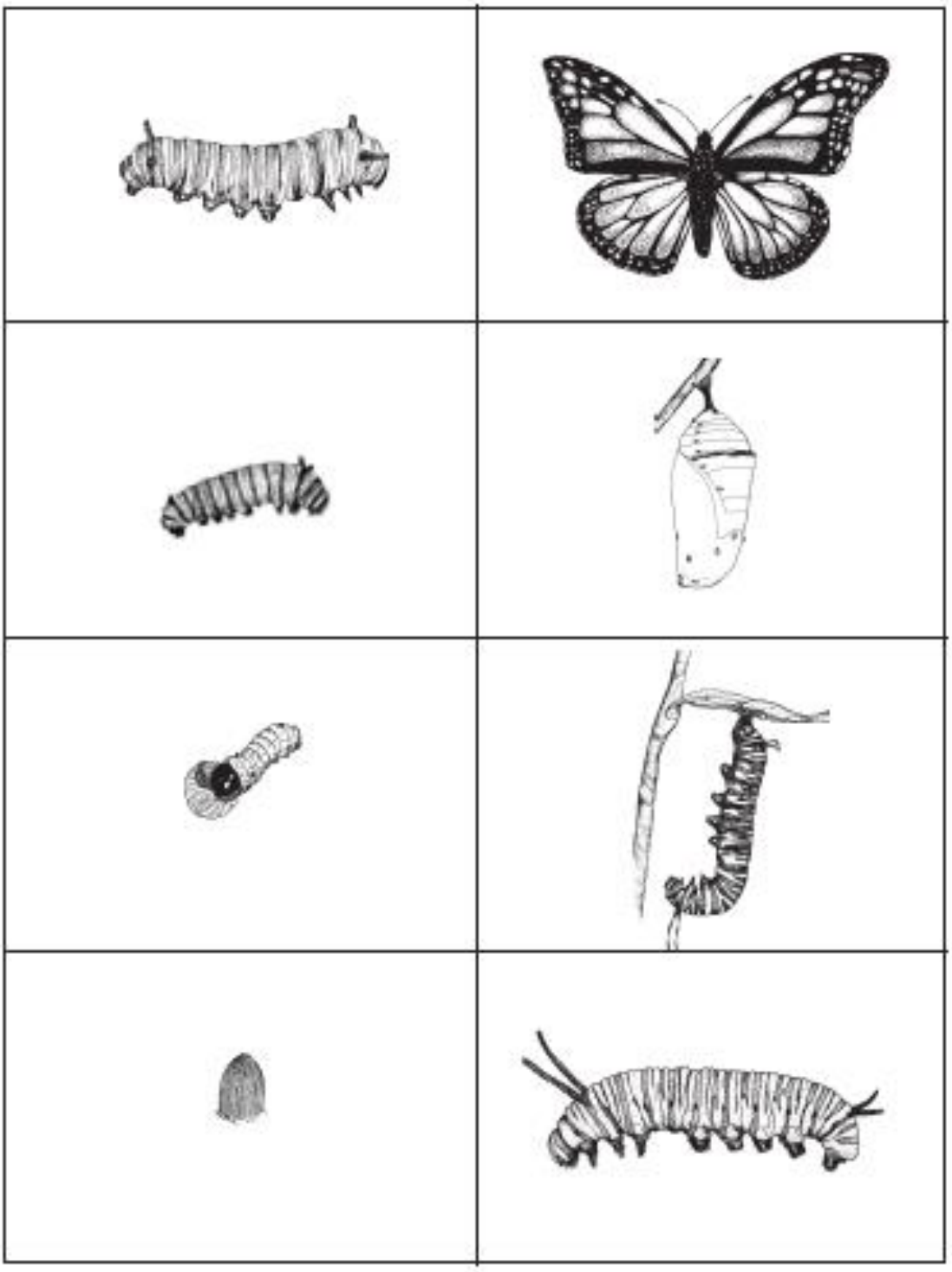
1. First, cut both ends of the envelope as shown in **Illustration # 1**.
2. Then fold the manila envelope in half.
3. Open the envelope so that a rectangular prism is formed, as shown in **Illustration #2**.
4. At the end, open the envelope. **Illustrations #3** and **#4** show the two sides of the envelope when it is open.
5. Once the foldable is formed, complete the parts according to the corresponding information or figures for each side (faces) of your rectangular prism (as explained in *Figure #1*).

Figure #1: Instructions to place the information on the foldable



✓ It is important that students can distinguish the size between caterpillars.

Figure #2: Illustrations for the foldable



Modified from: ***3-6 Life Cycle Curriculum Guide - MONARCHS IN THE CLASSROOM, p.33,*** **Curriculum Folder on the NSTA Thumb Drive (2015)**

Words to cut out and utilize on the foldable

(Students may write the words instead)

eggs

larvae

caterpillars

caterpillars

caterpillars

“J” positioned caterpillar

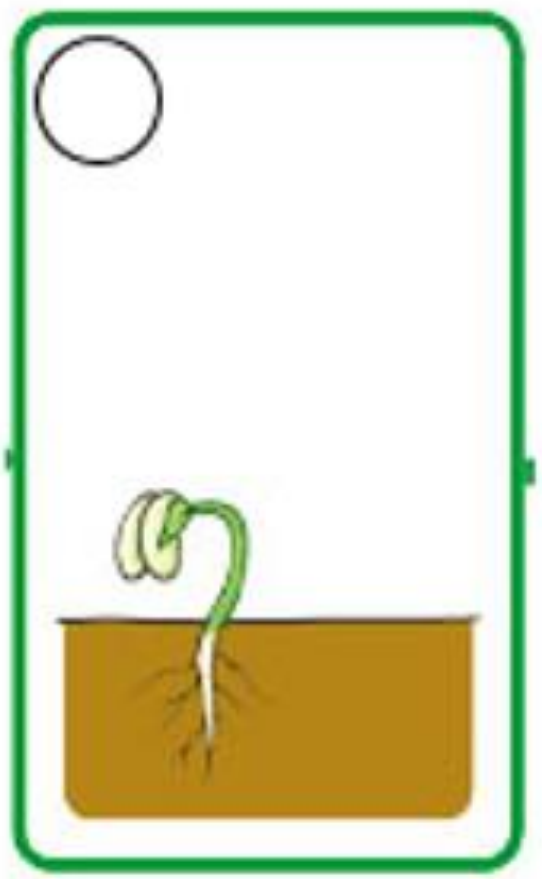
chrysalis

butterfly

✓ The size and the information may vary according to the observations or illustrations that the students have.

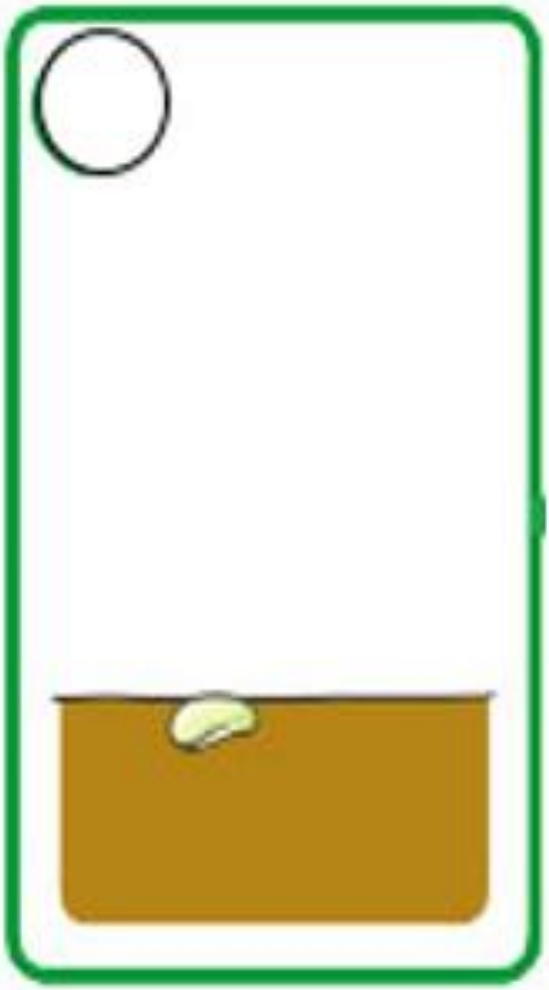
Additional Worksheet

Lesson # 4: What structures do we need to grow and survive?

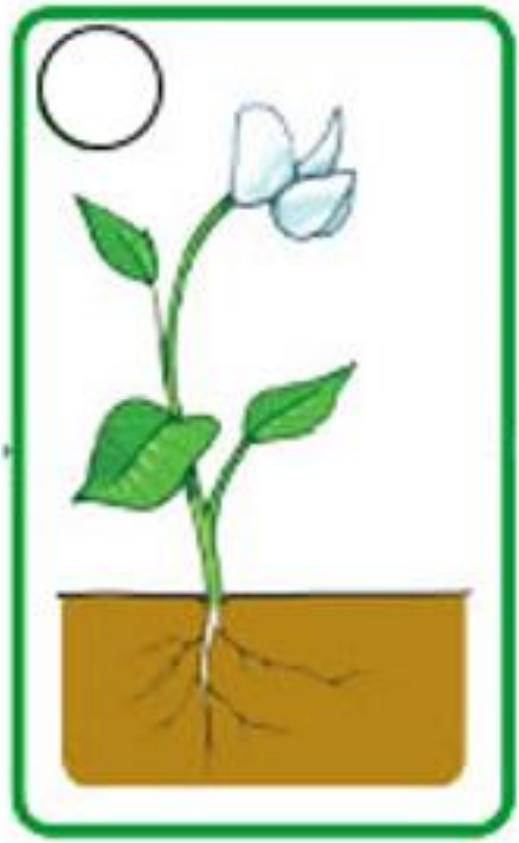


From a seed grows a plant.

In its fruits, seeds are formed.



The seed falls on the wet soil.



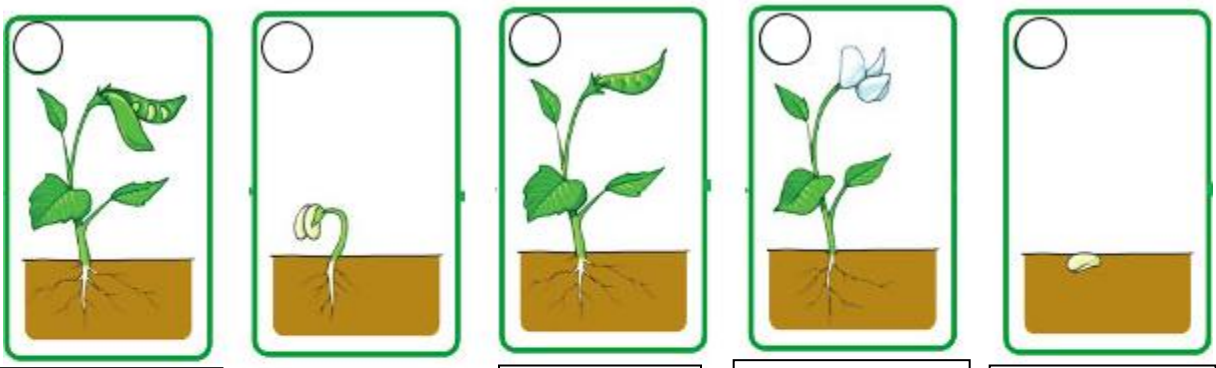
The plant grows and becomes an adult plant, which grows flowers.

These flowers then turn into fruits.

Additional Worksheet

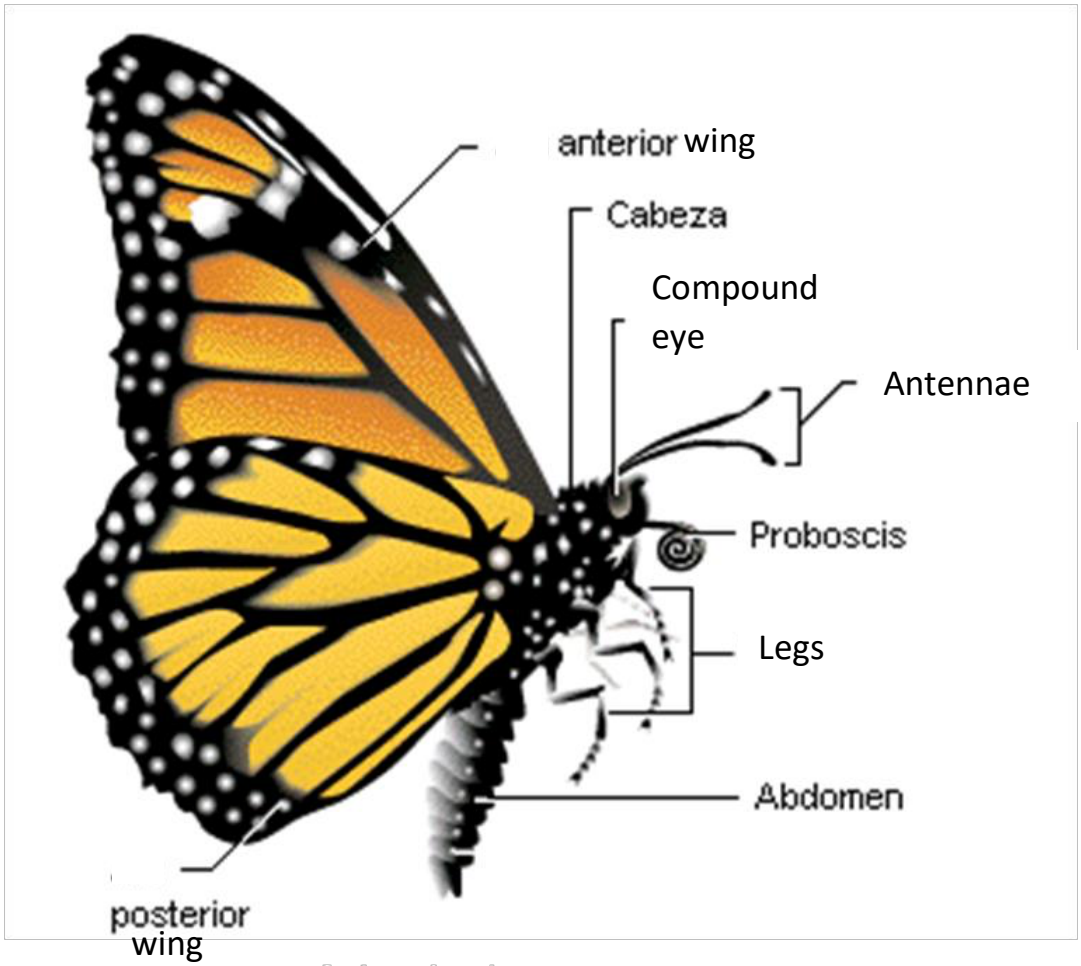
Lesson # 4: What structures do we need to grow and survive?

Watch and read carefully. Arrange the shapes to represent the life cycle of a plant. Write the numbers from 1 to 5 in the circle that appears in each figure to indicate the correct order. Then cut out the shapes and use arrows to form your plant life cycle.



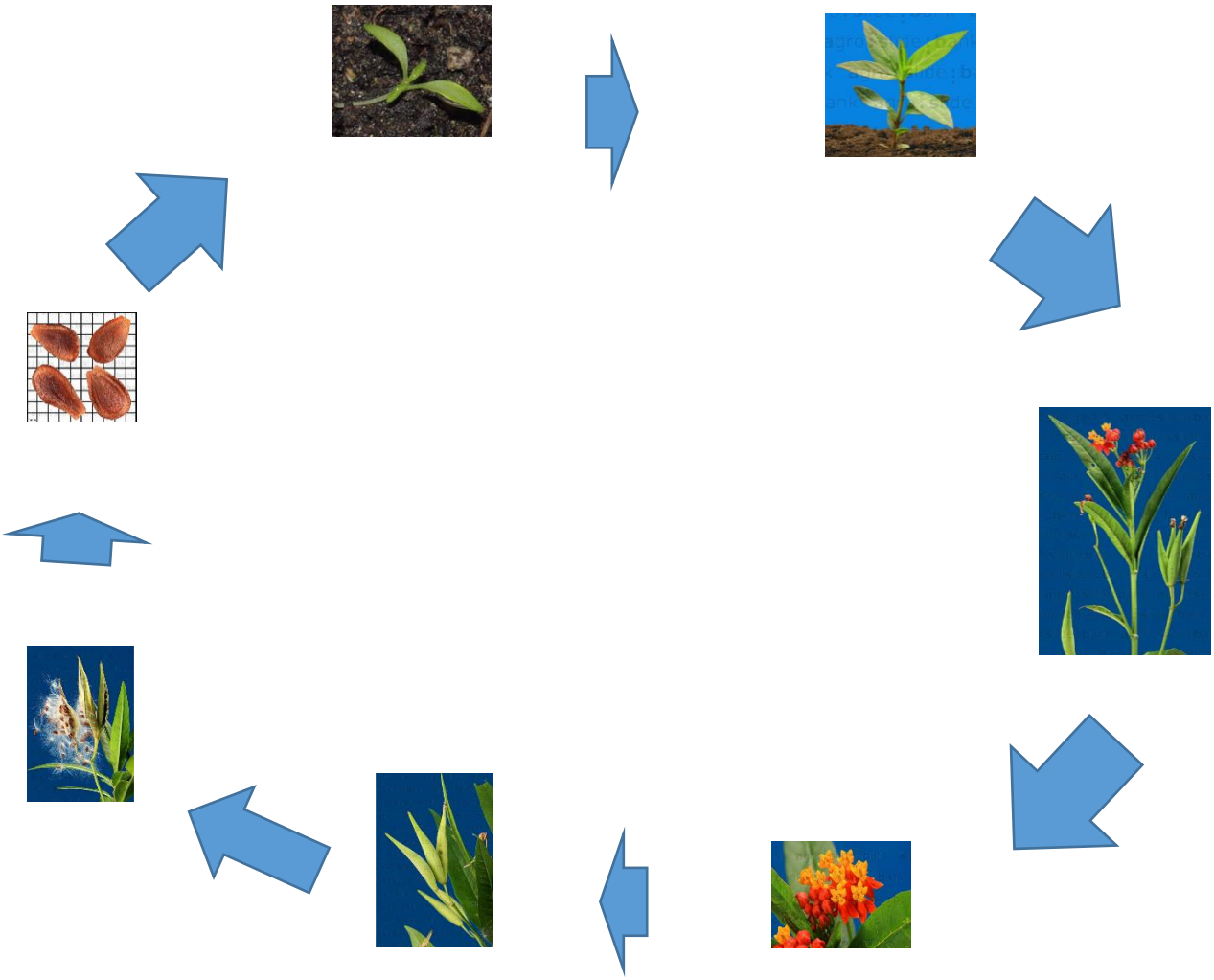
In its fruits, seeds are formed.	From a seed grows a plant.	These flowers then turn into fruits.	The plant grows and becomes an adult plant, which grows flowers.	The seed falls on the wet soil.

Butterfly Morphology



Morfología de una mariposa

Reproduction cycle of the *Asclepias curassavica* plant, host of the Monarch Butterfly.



Parts of a flower