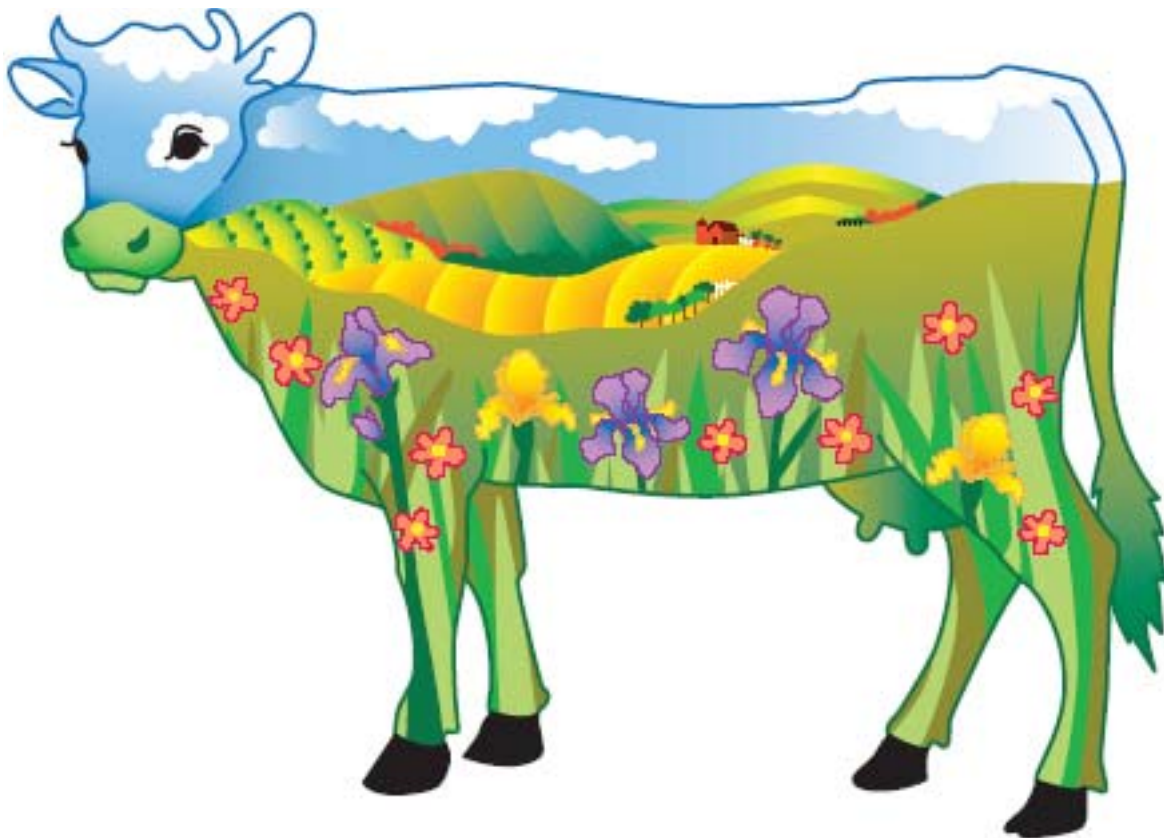


SOLE
Sciences of Life Explorations:
Through Agriculture
Grades 4 and 5



Teacher Guide
Unit: Metamorphosis

UNIT PLAN

UNIT TITLE

Metamorphosis

MONTH

March

GOAL

In this lesson, students will learn about the life cycles of insects and the differences between complete and gradual metamorphosis.

OBJECTIVES

Students will:

1. Rearrange a sequencing activity to demonstrate understanding of the chronological order of metamorphosis (NYS Learning Standard 1: Language for Information and Understanding, Elementary 2)
2. Recognize and define vocabulary relating to insect metamorphosis and demonstrate this understanding through the construction of both simple and complex sentences in past, present, and future tenses (NYS Learning Standard 1: Communication Skills, Checkpoints A and B)
3. Question why insects grow and change through metamorphosis, and why there are different kinds of metamorphosis (gradual and complete). (NYS Learning Standard 1: Analysis, Inquiry, and Design, Elementary 1)
4. Describe characteristics of ladybugs, butterflies, grasshoppers and aphids and explain the variations between them (NYS Learning Standard 4: Science, Elementary 1)
5. Identify the natural life cycles of ladybugs, butterflies, grasshoppers and aphids, illustrating the variations between the types of metamorphosis (NYS Learning Standard 4: Science, Elementary 4; Food and Fiber Systems Literacy III: Science, Technology, and Environment, A K-1)
6. Compute answers to mathematical problems using the operations of subtraction, multiplication and division for both whole numbers and fractions. (NYS Learning Standard 3: Mathematics, Elementary 3, NYS Learning Standard 3a: Universal Foundation Skills, Elementary 1)

TERMS

Vocabulary words are highlighted in bold throughout the student lesson pages.

Aphid - a small, soft-bodied insect that feeds by sucking sap from plants

Chrysalis - The cocoon of a butterfly

Cocoon - the silky case spun by the larva; it serves as a covering while the larvae develop

Complete metamorphosis - the life cycle of some insects; they change from eggs through the stages of larvae, then pupae to become adults (four stages)

Exoskeleton - a hard covering on the outside of an insect that provides structural support and protection.

Gradual metamorphosis - insects hatch from eggs looking like a small adults called nymphs. They shed their exoskeleton as they grow until they reach adult size. (three stages)

Infested - inhabited by so many organisms that it becomes a problem

Insect - an animal that has three body regions (head, thorax, and abdomen) and three pairs of jointed legs; also called an arthropod

Larva - the newly hatched form of some insects that are wingless, such as a caterpillar or a grub. This is the stage when the insect hatches from the egg and spends all its time eating before it develops into a pupa. (Plural larvae)

Life cycle - a series of stages which something passes through during its lifetime

Metamorphosis - the series of changes in shape and function that certain animals go through as they develop from an immature form to an adult. Metamorphosis can be gradual or complete

Molt - to shed an outer covering that is replaced by a new one. Birds molt feathers, snakes molt skins, and insects molt exoskeletons

Nutrient - any substance that can be used to support life

Nymph - the immature form of insects that go through gradual metamorphosis. They look like small adults that do not have fully developed wings and develop into adults without going through a pupal stage. Examples are dragonflies and grasshoppers.

Organism - a living thing that is made up of body parts which help it function.

Ornamental - used specifically to decorate or enhance

Pupa - the non-feeding stage in the insect life cycle between larva and adult during complete metamorphosis. A larva goes through a complete change inside a hard case. A chrysalis is the pupa of a butterfly encased in a cocoon. (Plural pupae)

Pupate - to become a pupa

Varied - different, not all the same

Integrated Pest Management is a specialized form of environmental management wherein scientific research and real world application work together to reduce pests such as insects, diseases or weeds.

- 1. Properly identify pests*
- 2. Learn the pest/ host biology*
- 3. Sample the environment for pests*
- 4. Determine an action threshold*
- 5. Choose the best tactic*
- 6. Evaluate results*

SAFETY

Safety precautions with using scissors and staplers, in addition to routine classroom safety practices.

Standards Matrix for this Lesson:

Standards:

Month	Unit	Math/Science/and Technology	English Language Arts	Social Studies	HEALTH	ARTS	Food & Fiber Literacy	CDOS	Other Languages	Interconnectedness
3	Metamorphosis	1:7 e1	1:3 e2				III A K-1			
		4:10 e1	1:6 A							
		4:10 e4	1:6 B							
		3a:2 e1								
		3:9 e3								

Matrix Key:

NYS Learning Standards arranged by Standard: Category, Level

e = elementary i = intermediate

Categories:

- | | |
|---|--|
| 1 Career Development | 10 Science |
| 2 Universal Foundation Skills | 11 Technology |
| 3 Language for Information and Understanding | 12 Interconnectedness: Common Themes |
| 4 Language for Literary Response and Expression | 13 Interdisciplinary Problem Solving |
| 5 Language for Social Interaction | 14 History of the United States and NY |
| 6 Communication Skills | 15 World History |
| 7 Analysis, Inquiry, and Design | 16 Geography |
| 8 Information Systems | 17 Economics |
| 9 Mathematics | |

ADDITIONAL RESOURCES

Backyard Insects by Milicent Selsam and Ronald Goor. ISBN# 0590422561

Bugs by Nancy Parker and Joan Wright. ISBN# 0688082963

Bugs and Other Insects by Bobbie Kalman and Tammy Everts ISBN-10: 0865057133

Eyewitness Books: Insects by Laurance Mound. ISBN# 0756606926

Nature Scope Discovery Pac. National Wildlife Federation. ISBN# 0945051352

The Butterfly Book: A Kid's Guide to Attracting Raising, and Keeping Butterflies by Kersten Hamilton ISBN-10: 156261309X ISBN-13: 978-1562613099

The Family Butterfly Book by Rick Mikula. ISBN-10: 158017292X ISBN-13: 978-1580172929

The Life cycle of a Butterfly by Bobbie Kalman ISBN-10: 077870680X

SUPPLIES AND EQUIPMENT

General classroom art supplies

BACKGROUND FOR TEACHERS

Metamorphosis is a biological process by which an animal physically develops after birth or hatching. It is part of the life cycle of the most insects. A life cycle is a period involving one generation of an organism. The term metamorphosis refers to the way that insects develop, grow, and change form, usually (but not always) accompanied by a change of habitat or behavior. There are two types of metamorphosis: complete and gradual.

Complete metamorphosis

Most insects go through the four stages of complete metamorphosis, including the ladybug, housefly, and butterfly.

1. Egg - A female insect lays eggs.
2. Larva - Larvae hatch from the eggs but do not look like adult insects. For instance, the larvae of butterflies are caterpillars. Larvae grow quickly enough to have to molt their exoskeletons a few times before they pupate. Sometimes, these stages of growth in larvae are called "instars."
3. Pupa - Larvae make cocoons around themselves, and become busy changing into their adult forms. They do not eat during this time. This can take a few days, or in some cases months.
4. Adult - After a period of time, the larva is nothing like it was, and exits the cocoon or larval body as an adult. The life cycle starts over again.

Gradual metamorphosis

About 12% of insects go through the three stages of gradual metamorphosis, including the mayfly, cicada, grasshopper, aphid, and cockroach.

1. Egg - A female insect lays eggs. Sometimes the eggs are in a group and protected by a covering or case.
2. Nymph - The eggs hatch into nymphs. Nymphs look like small adults, but usually don't have wings. They eat, grow, and change. Nymphs molt their exoskeletons as they grow. As this occurs, they gradually begin to look more and more like the adult.
3. Adult - Once the nymph has grown to an adult size, they stop molting. Generally adults are the only stages in an insect's life when it has wings. Adults' primary interest is mating.

QUESTIONS FOR STUDENTS

What is a life cycle?

What is metamorphosis?

Do all insects have the same metamorphosis?

What insects have a complete metamorphosis?

What insects have a gradual metamorphosis?

INTEREST APPROACH ACTIVITIES

Butterfly Life cycle Mobile (Estimated time to complete: 30 minutes)

<http://www.enchantedlearning.com/crafts/butterfly/lifecyclemobile/>

Make a mobile that shows the complete metamorphosis of a butterfly from egg to larva (caterpillar) to pupa to adult (the butterfly).

Materials:

Many colors of construction paper, oak tag, or gift wrap

Pencil

Scissors

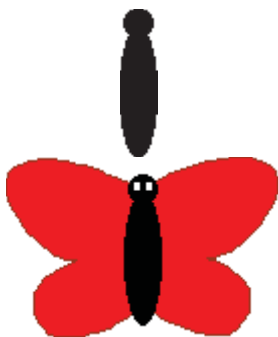
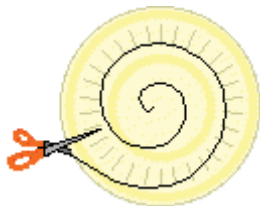
Yarn or string

Glue stick

A sturdy paper plate

Markers, crayons, or paint

Stapler or tape



Procedure:

1. Draw a spiral on a paper plate. Cut along the line.
2. Decorate the paper plate using markers, crayons, or paint.
3. Using green construction paper, draw a leaf and cut it out. Either draw tiny butterfly eggs on it or glue on tiny paper circles (either cut them out or use a hole punch). A cluster of butterfly eggs are usually laid on the underside of a leaf; the eggs are usually white or yellow or greenish, and are circular to oval.
4. Draw and cut out a caterpillar (the egg hatches into a caterpillar, which spends its entire time eating leaves). Decorate it.
5. Draw and cut out a pupa (the stage during which the caterpillar makes a protective case around itself and turns into a butterfly). Decorate it.
6. To make butterfly wings, fold a small piece of paper in half, and draw half a butterfly along the fold line.
7. Using dark paper, make a body for your butterfly (it's basically a long oval with a circular head).
8. Glue the body to the wings and decorate your butterfly.
9. Staple or tape the stages in the butterfly's life cycle to string and then to the paper plate. Attach another short length of string to the center of the plate; it will be used to hang the mobile. You now have a great butterfly life cycle mobile.
10. Another option: Use a straw for a flower stem and make paper leaves and a tissue paper flower and attach your life cycle stages to it. Why are plants important in the life cycle of the butterfly?



(For related activities, refer to student worksheets #3, #5, #6, & #7)

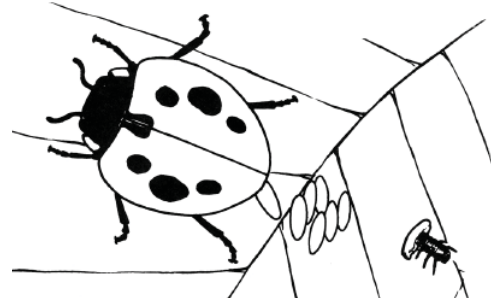
MATH MORPH BRAINTEASERS

1. If a ladybug lays 40 eggs and 32 hatch, how many did not hatch?

___ eggs - ___ hatched = ___ unhatched

2. What is the fraction of eggs that hatched? $\frac{\text{ (hatched) }}{\text{ (total) }}$

3. What is the percentage of eggs that hatched? _____%



4. If 24 hatchlings make it to adults, what is the percentage of adults, out of those that hatched?

___ adults / ___ hatchlings = ___%

5. What is the percentage of the total number of eggs that make it to adults?

___ adults / ___ eggs = ___%

6. How many eggs (#) did not become adults?

___ eggs total - ___ adults = ___ eggs



7. A monarch is an egg for a period of 3-6 days. After hatching, a caterpillar will eat about 30 milkweed leaves. If it eats three leaves every day, how many days will it take until it has eaten all 30 leaves?

___ leaves total / _____ leaves per day = ___ days



Larva = Caterpillar

The caterpillar eats and grows a tremendous amount.

Eventually, the caterpillar will weigh 3000 times as much as it did when it hatched! As the caterpillar grows, it molts, or sheds its skin, four times.

The first time, it is about 3/16" long.

The second time it is about 3/8" long.

The third time it is 3/4" long.

The last time it molts, it is 1 1/4" long (5/4").

How much does its size increase:

8. From the first to second length? _____ - _____ = _____

9. From the second to third? _____ - _____ = _____

10. From the third to fourth? _____ - _____ = _____



SUMMARY OF CONTENT

- I. Metamorphosis: What is it?
 - A. Explains metamorphosis (complete and gradual)
 - B. Discusses life cycles, such as that of the chicken.
- II. Metamorphosis
 - A. Questions to get students thinking about metamorphosis.
 - B. Word activity
- III. What is a life cycle?
 - A. Cut and paste activity using the life cycle of the ladybug
- IV. Ladybug life stages
 - A. Illustration depicts the stages of the ladybug, showing how a larva will increase in size forcing it to molt.
- V. Butterflies and moths
 - A. Illustrates the complete life cycle of the butterfly
 - B. Introduces the term chrysalis.
- VI. The Painted Lady
 - A. Reading and a short sequencing activity
 - B. Introduces the terms molt, pupa, and chrysalis
- VII. Adult Butterfly
 - A. Color distribution and major body regions of the Painted Lady butterfly.
- VIII. Metamorphosis: Complete or Gradual?
 - A. Uses the sphinx moth to illustrate four stages of complete metamorphosis
 - i. Egg
 - ii. Larva
 - iii. Pupa
 - iv. Adult
 - B. Uses the grasshopper to illustrate the three stages of gradual metamorphosis
 - i. Egg
 - ii. Nymph
 - iii. Adult
 - C. The aphid is mentioned as a pest which feeds on ornamentals and vegetables
 - D. Introduces the term varied.

TEACHING- LEARNING ACTIVITIES

- I. Metamorphosis: What is it?
 - A. Read this page as a class to introduce the ideas of metamorphosis and the life cycle.
- II. Metamorphosis
 - A. Use the questions to stimulate class discussion.
 - B. Students could work individually or in groups to create words.
- III. What is a life cycle?
 - A. Have students complete this lesson individually
 - B. Provide scissors and glue.
- IV. Ladybug life stages
 - A. Have students color in the page.
 - B. Use the illustration to reinforce the stages of the life cycle and complete metamorphosis.
- V. Butterflies and moths
 - A. This page could be used as a class discussion starter.
- VI. The Painted Lady
 - A. Read individually or in groups.
 - B. Students should do sequencing individually.
- VII. Adult Butterfly
 - A. This page can be used to review the anatomy of the butterfly or as a coloring or painting activity.
- VIII. Metamorphosis: Complete or Gradual?
 - A. This page can be read aloud by students taking turns.
 - B. Use metamorphosis as a starting point for comparisons (grasshopper/human, etc.)

SUMMARY OF CONTENT

IX. Aphids

- A. Explains the gradual metamorphosis of aphids and their effect on the plant on which they feed.
- B. Once a plant is infested with aphids, there will usually be adults and nymphs on the plant at the same time.

X. Grasshopper Life Stages

- A. Basic illustrations of a grasshopper's metamorphosis.

XI. Test your knowledge

- A. Label the stages of ladybug metamorphosis
- B. Four yes/no questions
- C. Three short answer questions.

XII. Vocabulary

- A. Provided for student reference.

TEACHING- LEARNING ACTIVITIES

IX. Aphids

- A. This page could be read aloud as a class.
- B. It could serve as a reminder of ways to use integrated pest management.
- C. Maybe students have seen aphids on the undersides of leaves in vegetable gardens, orchards, flower gardens or greenhouses.

X. Grasshopper Life Stages

- A. Remind students that complete metamorphosis has four stages and gradual has three.
- B. Students write in the name of the life stage of the grasshopper.
- C. Nymphs resemble small adults but are not the same. Have students find one major difference between nymphs and adults (wings).

XI. Test your knowledge

- A. Have students complete these pages individually and review the answers as a class.

XII. Vocabulary

- A. Students can use this page for reference.

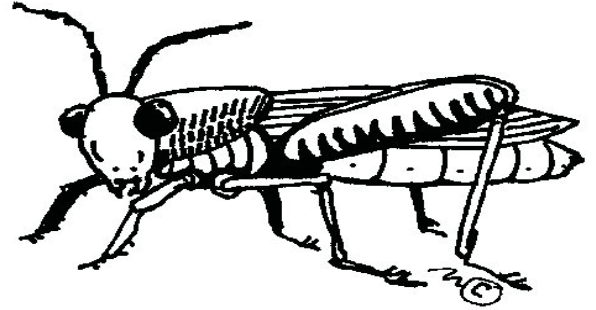
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Student Lesson: Metamorphosis

What is it?

What do you know about metamorphosis? It's a word that describes a life cycle, especially for insects.

We get the word "morph" from metamorphosis. Do you know what morph means?



METAMORPHOSIS

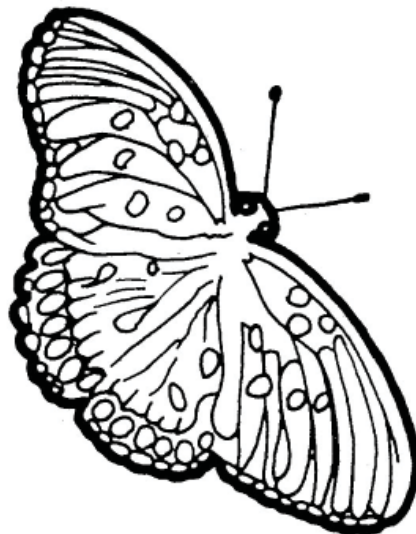
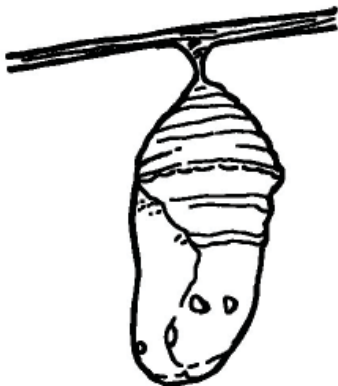
Can you think of a life cycle you already know about?

One example is the chicken. During its lifetime, a chicken becomes:

1. Egg
2. Hatchling (chick)
3. Adult chicken

Life cycles are all around us.

Plants, animals and all living things have life cycles. This lesson will help you understand the life cycle of insects, called metamorphosis. It can be complete (four stages) or gradual (three stages). Either way, it involves some big changes for the insect!



name _____

Student Lesson: Metamorphosis

What is a life cycle?

What is metamorphosis?

Do all insects have the same metamorphosis?

What insects have a complete metamorphosis?

What insects have a gradual metamorphosis?



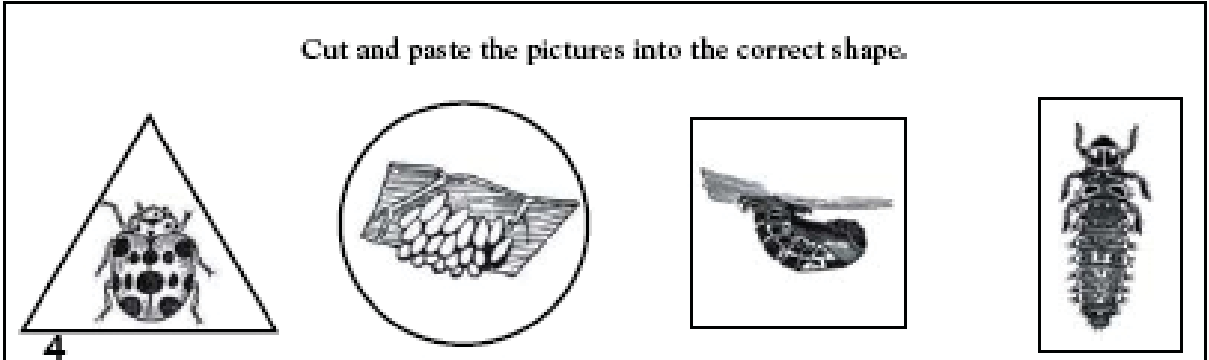
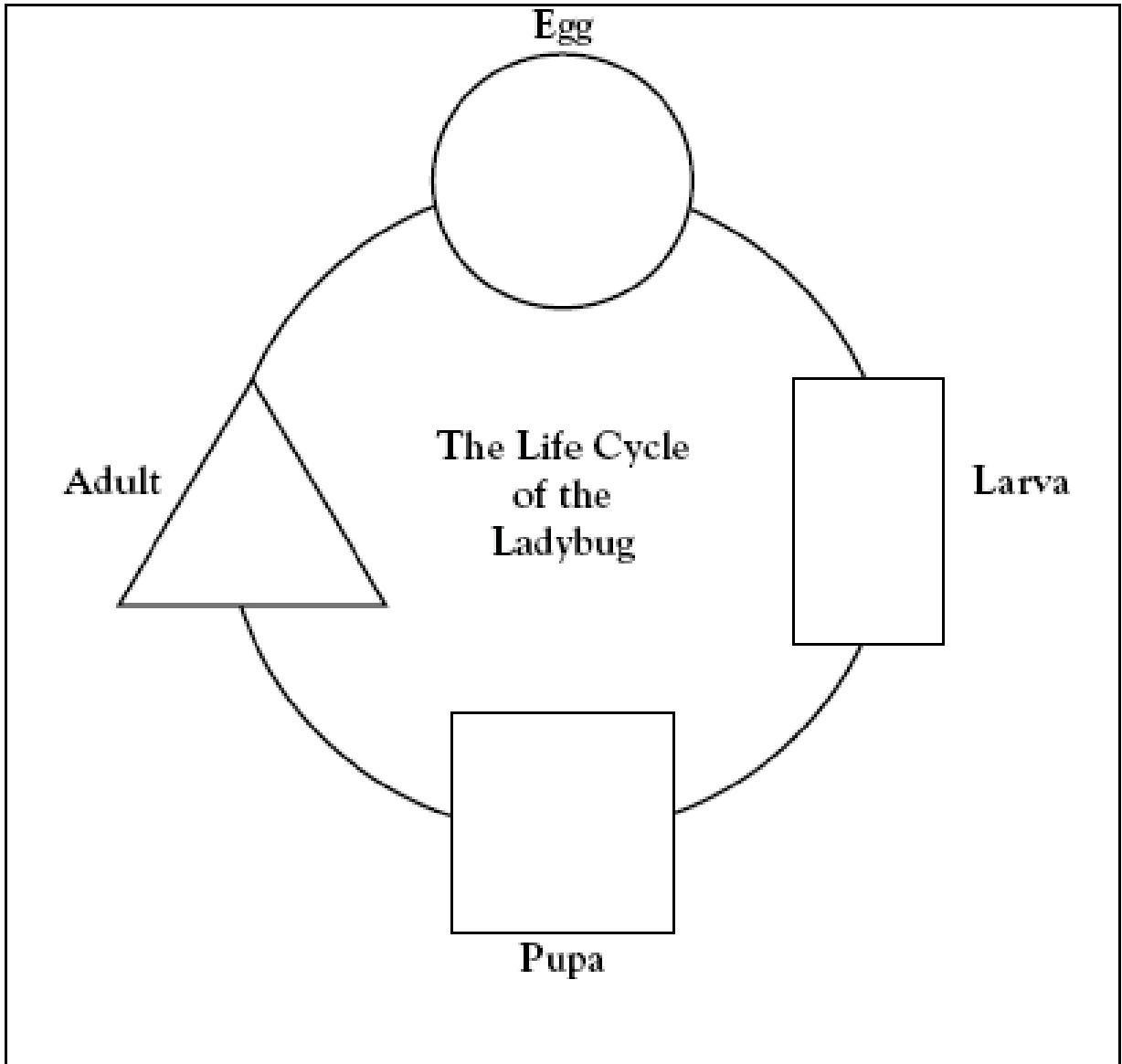
Metamorphosis

How many words can you make out of metamorphosis? List as many words as you can using the letters above. Use another sheet of paper if needed. Ask your teacher to collect all the words that your class finds that are five letters or more!

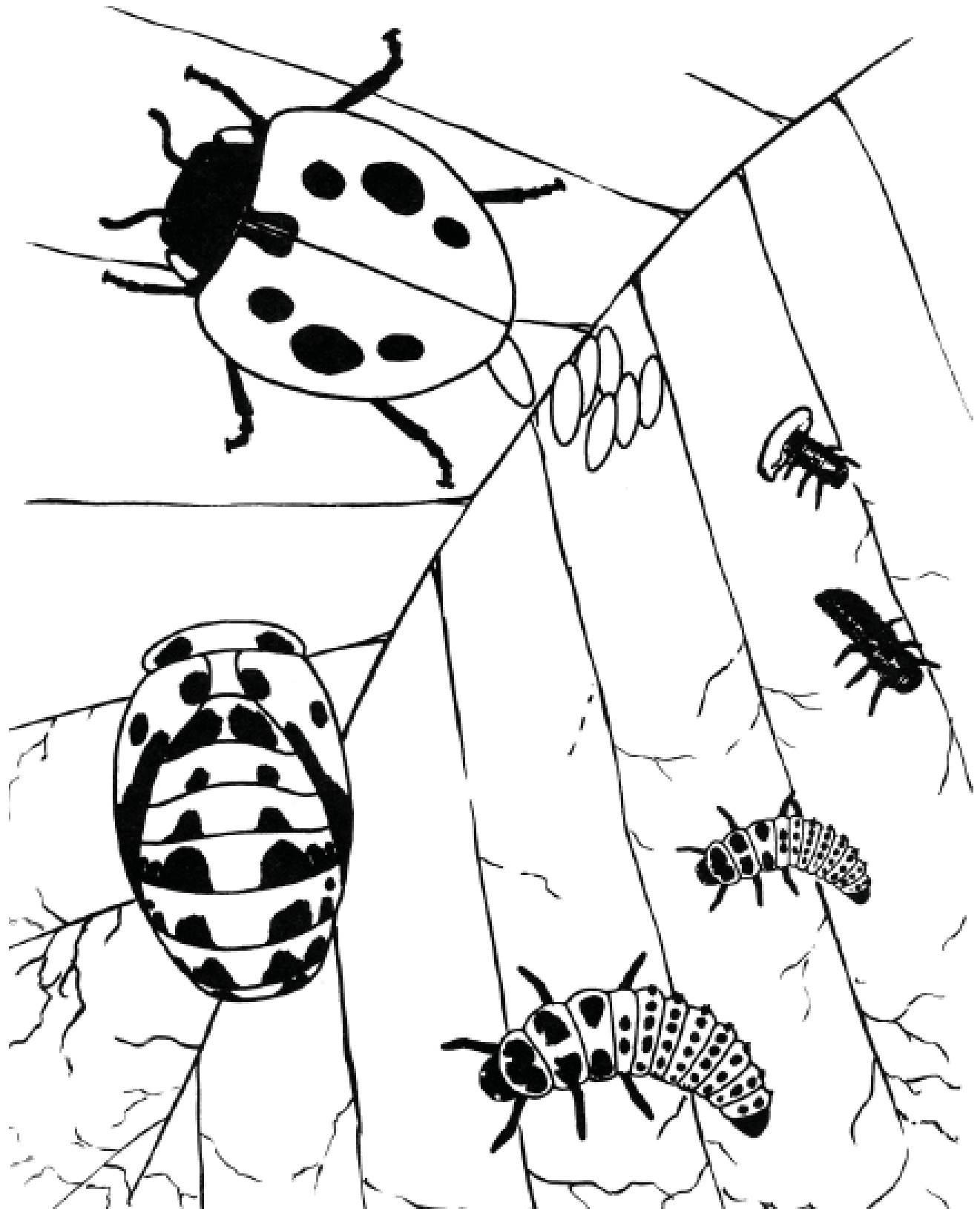
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_____	_____	_____

Student Lesson: Metamorphosis: What is a life cycle?

Here's a chance to start practicing what you just learned about insect metamorphosis. We will study the complete metamorphosis of the ladybug in this lesson. Cut out the adult, eggs, larva and pupa at the bottom of the page and paste them on to the correct shape in the life cycle. Do you notice that a life cycle is a circle?



Student Lesson: Metamorphosis:
Ladybug life stages



Student Lesson: Metamorphosis: Butterflies and Moths

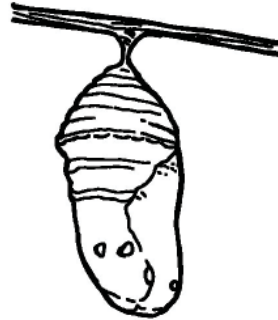
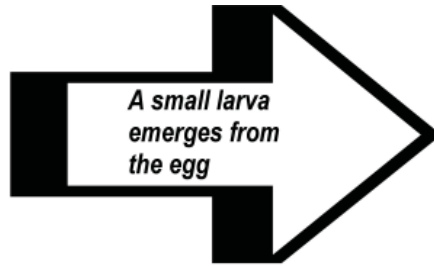
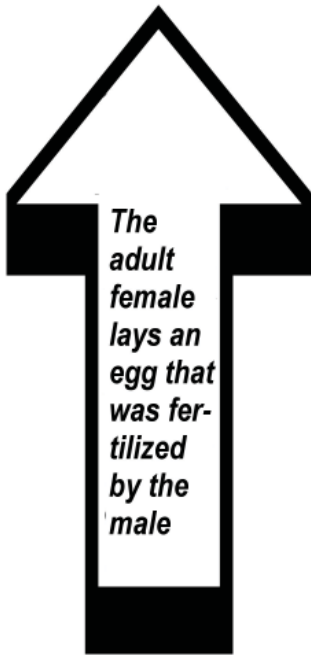
Butterflies and moths are two more insects with a complete metamorphosis. The job of a larva is to eat! If you like butterflies in your garden, remember that they will be eating your plants when they are caterpillars.

Egg

- Pale green
- The size of a pin head

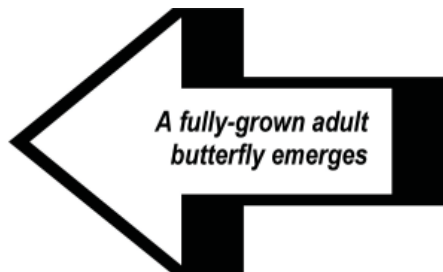
Larva (Caterpillar)

- Black to purple with yellow-green stripes and long spines
- The caterpillar eats and grows a tremendous amount



Adult (Butterfly)

- Adults live only for a short time
- They cannot eat solid food; they can only drink through their straw-like spiral proboscis
- They will fly, mate, and reproduce



Pupa (Chrysalis)

- Reddish-brown
- Inside the chrysalis, the pupa changes into a butterfly

Student Lesson: Metamorphosis: The Painted Lady

Read about the Painted Lady Butterfly and number its complete metamorphosis in order.

___Egg

___Larva

___Pupa

___Adult

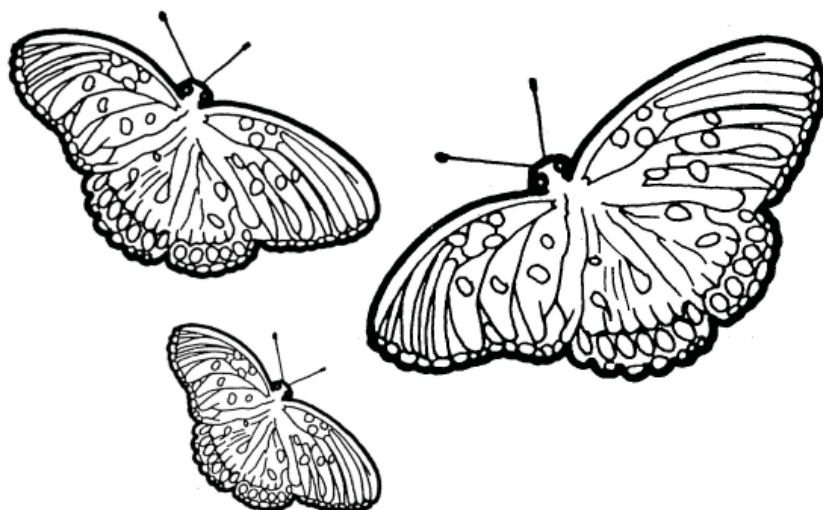
The Painted Lady butterfly can be found on five continents because it adapts to many climates. Many in North America migrate and overwinter in Mexico!

The Painted Lady's eggs are light green and very small. After 3 to 5 days, they hatch.

Butterfly larvae are called caterpillars. Painted Lady larvae are dark with yellowish stripes. Since they eat all the time, caterpillars and other larvae outgrow and shed their skin (molt).

After a week or so, they pupate. A butterfly pupa is called a chrysalis. It hangs upside-down from a leaf or branch, and attaches itself with a single silken string. Inside the cocoon, the pupa is becoming an adult in just seven to ten days.

When an adult emerges, it hangs upside down until its wings are strong enough to use. It can fly a few hours after emerging. The adult Painted Lady is mostly black, brown, and orange with some white spots; the underside is gray with white and red markings.

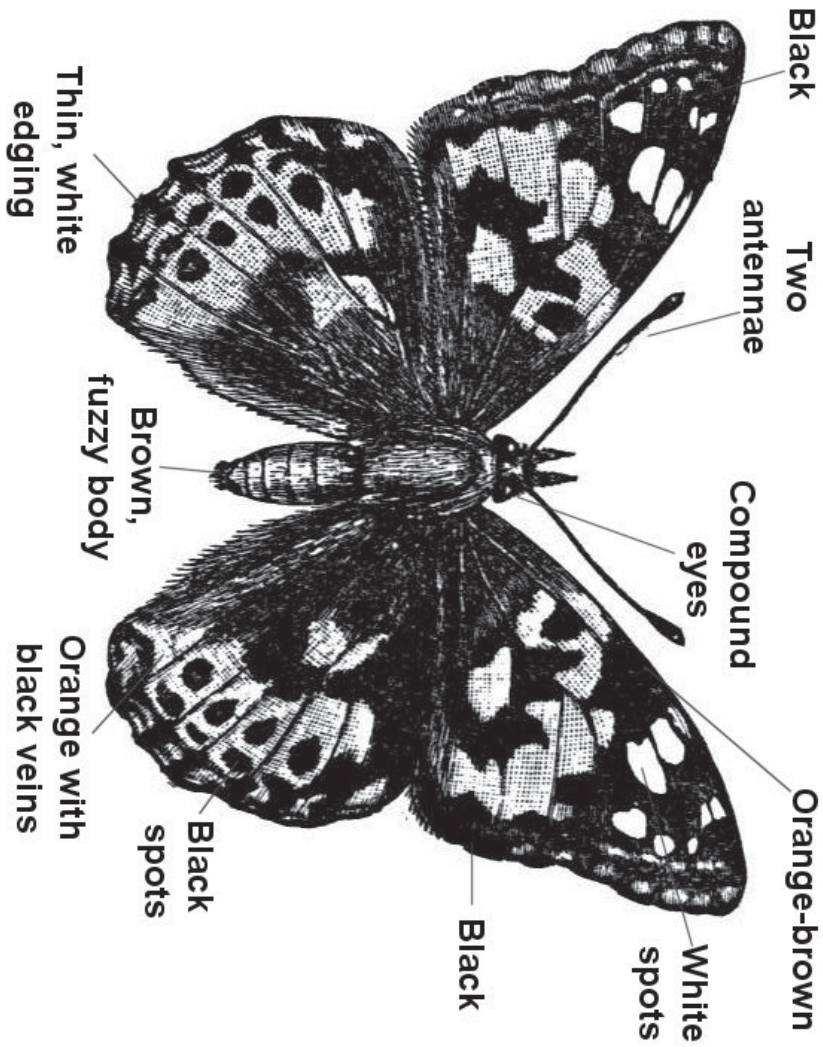


name _____

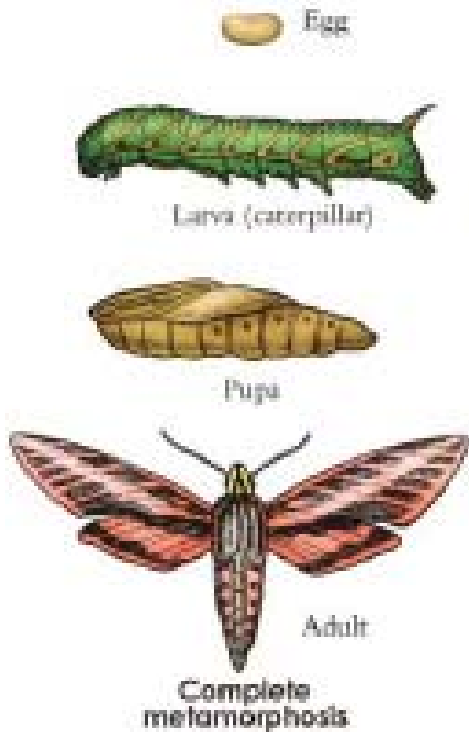
Student Lesson: Metamorphosis:
Adult Butterfly

Painted Lady Butterfly

Scientific name: *Vanessa Cardui*



Student Lesson: Metamorphosis: Complete or Gradual?



You have learned that the ladybug and the butterfly have a complete metamorphosis. Here is an illustration of a moth life cycle. Is it the same life cycle as a butterfly?

This is a sphinx moth. Its caterpillar is large and can eat a lot of leaves in one day.

Complete metamorphosis or gradual metamorphosis?

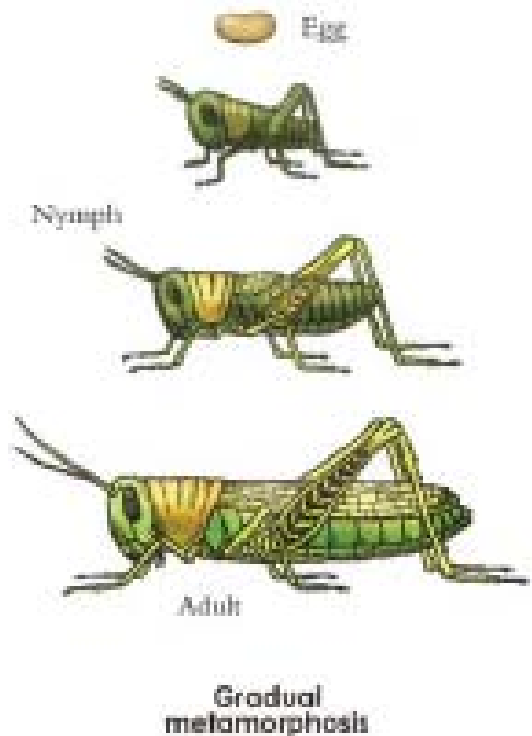
Most insects have a complete metamorphosis, but not all. Insects are varied, aren't they? We will now learn about two insects that have a gradual metamorphosis.

One is the grasshopper.

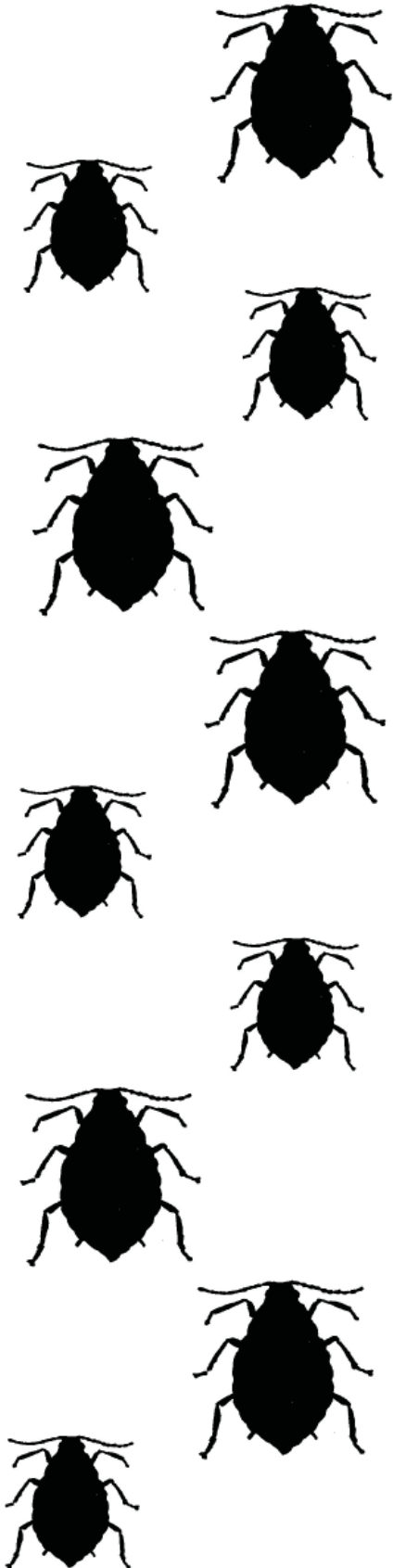
Grasshoppers and ladybugs both have chewing mouthparts, but they do not have the same life cycle.

Grasshoppers have three stages: egg, nymph and adult. Notice how the nymph stage shows much change in size. Also, nymphs never have wings.

We will also learn about the aphid, a pest insect that feeds on plants in our vegetable and ornamental gardens.



Student Lesson: Metamorphosis: Aphids



Aphids are a favorite meal of ladybugs, and there are plenty of aphids to eat. There are about 4,000 species of aphids in the world. They reproduce rapidly. Once a plant is infested with aphids, there will usually be adults and nymphs on the plant at the same time.

Aphids have a gradual metamorphosis:

1. The egg hatches.
2. The nymph emerges and starts to eat. It looks kind of like a small adult.
3. The nymph becomes an adult.

Unlike the ladybug, an aphid nymph will not become a pupa or make a cocoon to change into its adult form. Nymphs often look like small versions of the adult, but they change in more ways than just size.

Aphids have sucking mouthparts instead of chewing mouthparts. They use their mouth like a straw and place it directly into the plant to suck out the juices. This juice contains water, nutrients and vitamins that the plant needs to live.

What do you think happens when a plant does not get its nutrition?

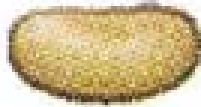
If you guessed that aphids can make plants very sick, you're right!

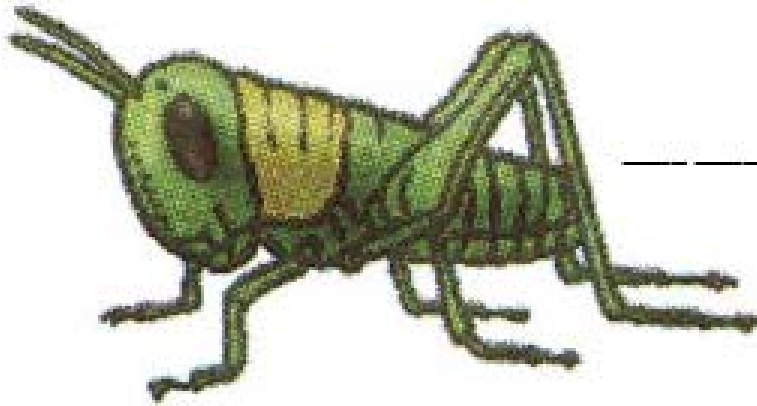
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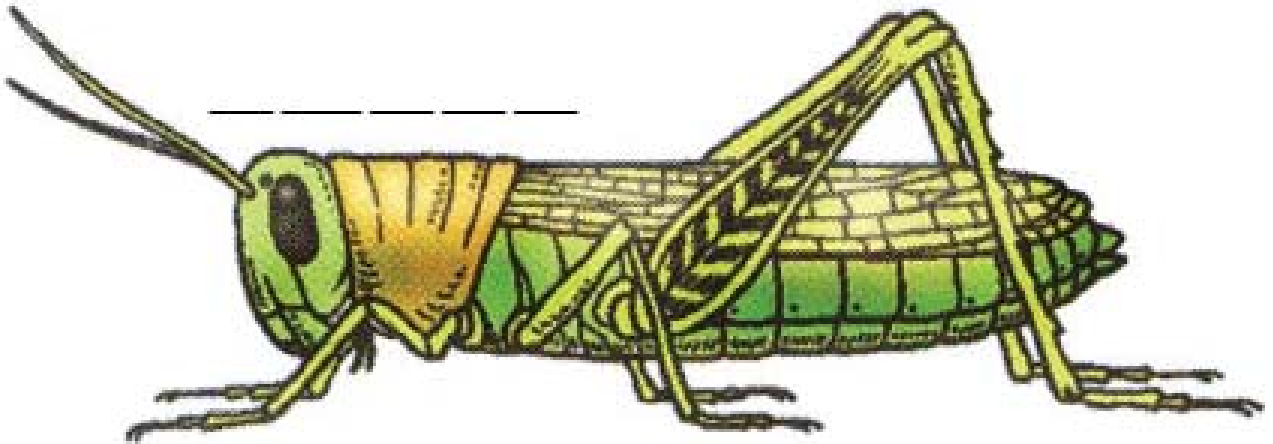
Student Lesson: Metamorphosis

Grasshopper Life Stages

Label the stages of gradual metamorphosis.

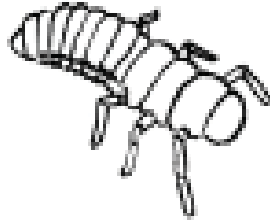
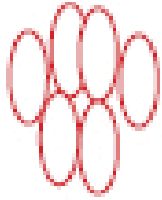






Student Lesson: Metamorphosis:
Test your knowledge

1. Label the staades of the complete metamorphosis of the ladvbua.



2. Metamorphosis is how scientists describe the life cycle of insects.

_____yes

_____no

3. Do all animals have a life cycle?

_____yes

_____no

4. Do all insects have the same kind of metamorphosis?

_____yes

_____no

5. Name an insect with a complete metamorphosis.

6. Name an insect with a gradual metamorphosis.

7. The pupal stage of the butterfly is called a chrysalis.

_____yes

_____no

8. Pupae outgrow and shed their exoskeleton as they grow. What is the term for this process?

Student Lesson: Metomorphosis

Vocabulary

Aphid - a small, soft-bodied insect that feeds by sucking sap from plants

Chrysalis - The cocoon of a butterfly

Cocoon - the silky case spun by the larva; it serves as a covering while the larvae develop

Complete metamorphosis - the life cycle of some insects; they change from eggs through the stages of larvae, then pupae to become adults (four stages)

Exoskeleton - a hard covering on the outside of an insect that provides structural support and protection.

Gradual metamorphosis - insects hatch from eggs looking like a small adults called nymphs. They shed their exoskeleton as they grow until they reach adult size. (three stages)

Infested - inhabited by so many organisms that it becomes a problem

Insect - an animal that has three body regions (head, thorax, and abdomen) and three pairs of jointed legs; also called an arthropod

Larva - the newly hatched form of some insects that are wingless, such as a caterpillar or a grub. This is the stage when the insect hatches from the egg and spends all its time eating before it develops into a pupa. (Plural larvae)

Life cycle - a series of stages which something passes through during its lifetime

Metamorphosis - the series of changes in shape and function that certain animals go through as they develop from an immature form to an adult. Metamorphosis can be gradual or complete

Molt - to shed an outer covering that is replaced by a new one. Birds molt feathers, snakes molt skins, and insects molt exoskeletons

Nutrient - any substance that can be used to support life

Nymph - the immature form of insects that go through gradual metamorphosis. They look like small adults that do not have fully developed wings and develop into adults without going through a pupal stage. Examples are dragonflies and grasshoppers.

Organism - a living thing that is made up of body parts which help it function.

Ornamental - used specifically to decorate or enhance

Pupa - the non-feeding stage in the insect life cycle between larva and adult during complete metamorphosis. A larva goes through a complete change inside a hard case. A chrysalis is the pupa of a butterfly encased in a cocoon. (Plural pupae)

Pupate - to become a pupa

Varied - different, not all the same

Integrated Pest Management is a specialized form of environmental management wherein scientific research and real world application work together to reduce pests such as insects, diseases or weeds.

1. Properly identify pests
2. Learn the pest/ host biology
3. Sample the environment for pests
4. Determine an action threshold
5. Choose the best tactic
6. Evaluate results



Teacher Information for Student Worksheets

Interest Approach Activity

Brainteasers

1. $40 - 32 = 8$ unhatched eggs
2. $32/40$ or $4/5$ hatched
3. $4/5 = 80\%$ hatched
4. $24 \text{ adults} / 32 \text{ hatchlings} = 3/4$ or 75%
5. $24 \text{ adults} / 40 \text{ eggs} = 3/5$ or 60%
6. $40 \text{ eggs total} - 24 \text{ adults} = 16 \text{ eggs}$
7. $30 \text{ leaves} / 3 \text{ per day} = 10 \text{ days}$
8. $3/16''$ to $3/8''$, $3/8'' - 3/16'' = 6/16'' - 3/16'' = 3/16''$ (size doubled)
9. $3/8''$ to $3/4''$, $3/4'' - 3/8'' = 6/8'' - 3/8'' = 3/8''$ (size doubled again)
10. $3/4''$ to $1 \frac{1}{4}''$ (or $5/4''$), $1 \frac{1}{4}'' - 3/4'' = 5/4'' - 3/4'' = 2/4''$ or $1/2''$

Student Worksheet 1

What is it?

What is it? Metamorphosis means change, especially change in shape. It is the way scientists describe the changes insects go through during their lives. First, have students consider life cycles. All living things have a life cycle. Trees and plants create seeds, which develop, grow and change into a mature form which starts the cycle again.

Student Worksheet 2

Questions and Word List

We suggest you discuss the essential questions as a class. Students will learn that all insects go through metamorphosis. They may be surprised to find out there are two types of metamorphosis: complete and gradual. As they go through the activities, discuss the life cycles of other organisms.

When using IPM, it is important to understand the life cycle of the pest in question. Understanding when the pest is most vulnerable makes treatment most efficient.

Student Worksheet 3

What is a Life cycle?

The ladybug gives a great example of a complete life cycle. We offer a complete companion lesson to raising ladybugs in the classroom. It's easy and fun, and can be done any time of the year.

Ask students to cut out the four shapes at the bottom of the page and paste them in the appropriate areas on the page. Emphasize the fact that life cycle is indeed a circle. Ask them to consider where the beginning of the circle is. This is no easier than the classic "chicken versus egg" debate! Scientists generally use the egg as the first step.

Student Worksheet 4

Ladybug Life Stages

Students can color the four stages of the ladybug's complete metamorphosis. Remind students there are four stages: egg, larva, pupa, and adult.

This illustration shows how a larva will increase in size, forcing it to molt. Larvae is the plural of larva, just as pupae is the plural of pupa. Ladybug larvae and pupae are black and orange or red, just like the adult. Encourage your students to look for photographs of ladybug adults and larvae before they color.

Student Worksheet 5

Butterflies and Moths

Butterflies and moths also have complete metamorphosis, and are also easy to raise in the classroom or at home. Our example of the Painted Lady butterfly shows students that the larvae of butterflies are called caterpillars, and the pupa is called a chrysalis.

Student Worksheet 6

The Painted Lady

Read about the life cycle of the Painted Lady butterfly and have students number the stages of its complete metamorphosis starting with the egg. (1: Egg, 2: Larva, 3: Pupa, 4: Adult)

It is important to be able to identify an insect so that you know if it is a pest or a beneficial insect. Many times, people forget that the larval stage of an insect may still be a beneficial insect in the yard, garden or field. Often, insect larvae are important predators of pests.

Student Worksheet 7

Adult Butterfly Coloring Page

The adult Painted Lady gets its name for good reason. Do you love butterflies and butterfly gardens? Remember that butterfly larvae (caterpillars) are voracious feeders on some of your favorite garden flowers. When choosing plants for a butterfly garden, remember that they will be eating them, not just looking at them! Many native plants which we consider weeds are important food sources for butterflies.

Student Worksheet 8

Complete or Gradual?

Estimates are that 88% of insects go through a complete metamorphosis (four stages), leaving 12% to undergo gradual metamorphosis. The term "incomplete" may be used instead of gradual, but scientists now prefer the term gradual to describe the 3 stages of change: egg, nymph, and adult. The grasshopper, cricket, and aphid are three insects with a gradual metamorphosis.

Insect nymphs look a bit like small adults, whereas insect larvae bear little resemblance to the adult insect. How does this compare to the human life cycle? Do babies, toddlers and children look like small adults?

Student Worksheet 9

Aphids

Ladybugs love to eat aphids; aphids love to suck sap from plants! Aphids can be found in large clusters, if you can see them at all. They are each about 1/16" long, and are often light-colored, so it is easy to miss them. They secrete a substance called honeydew; it is a sweet, sticky residue which encourages black sooty mold fungus. Sometimes the presence of ants on plants will lead you to aphids. Look on the undersides of leaves in your vegetable garden, orchard, flower garden, or greenhouse.

Student Worksheet 10

Grasshopper Life Stages

These illustrations of a grasshopper's metamorphosis are very basic. To help students retain this information, remind them that complete metamorphosis has four stages, while gradual metamorphosis has three. In this activity, students write in the name of the life stage.

Nymphs resemble small adults but are not exactly the same. Have students find one major difference between nymphs and adults (wings).

Student Worksheet 11

Test Your Knowledge

Students can use these questions to reinforce their lesson activities.

1. Egg, Larva, Pupa, Adult
2. Yes
3. Yes
4. No
5. Ladybug, Butterfly, Moth
6. Grasshopper, Cricket, Aphid
7. Yes
8. Molt, Molting

Student Worksheet 12

Vocabulary

Provided for students to reference