

Objective

Students will order and graph the stages of insect growth.

Materials

Introduction

- Balloon
- TMs-4.4A–B Growing Up, Parts 1–2

Directed Instruction

- Crayons

Preparation

Obtain a **BALLOON** for a demonstration. *(Introduction)*

Select **TMs-4.4A–B Growing Up, Parts 1–2** for display. *(Introduction)*

Write the definitions of *metamorphosis* and *graph* on the board. *(Directed Instruction)*

Have **CRAYONS** available for students. *(Directed Instruction)*

Content

Metamorphosis is essentially a developmental change of shape, form, or structure. Metamorphic change does not cause one insect to become another kind of animal; it is the process by which an insect grows into an adult. Many species of insects, such as butterflies, flies, and moths, undergo the four stages of complete metamorphosis—egg, larva, pupa, and adult. Insects such as the grasshopper and termite undergo incomplete metamorphosis—egg, nymph, and adult. Some species, like butterflies, exhibit the head, thorax, and abdomen only as an adult. Although the larva, or caterpillar, of a butterfly lacks the three main body sections, it has them when the process of metamorphosis is complete.

A common misconception is that larvae are worms. Worms are in a different phylum from insects. Instead, larvae represent the second, or larval, stage in an insect with complete metamorphosis. A common name for a butterfly larva is *caterpillar*; a housefly larva is *a maggot*. The third stage of complete metamorphosis is the pupa. In insects like the butterfly, the pupa is encased in a chrysalis, while the pupa of a moth is encased in a cocoon.

Introduction

Brainstorm with students ways they have changed since they were a baby. (**Possible answers: grown taller, can talk and walk, can eat different foods, have more hair, have teeth**) List some of the ideas on the board. Mention that some children grow more slowly than others and that this is normal.

Demonstrate blowing up a **BALLOON**. Show the first stage when the balloon is void of air. Blow it up slightly and make the point that the balloon has changed shape. Blow up the balloon a little more and again state that the balloon is yet a different shape. Lastly, blow the balloon until it appears full. Ask a volunteer to describe the different stages from the balloon being void of air to being filled with air.

Display **TM-4.4A Growing Up, Part 1** to help students understand that living things change as they grow. Discuss the growth order from bulb to plant sprout, young plant, and mature plant. Display **TM-4.4B Growing Up, Part 2** and have student volunteers number the pictures 1–4 to show growth order.

Directed Instruction

- 1 Convey that, just like people and plants, God designed different kinds of insects to grow up in different ways. Some grow from an egg and look like a small adult right away; others grow from an egg and look very different from the adult they will become.
- 2 Direct students to turn to their first page. Read the information at the top about the butterfly and state that this process shows a way that some insects grow up. Have students place a finger on each stage as it is discussed. Ask which picture shows the way it looks first, after its mother lays it. (**egg, its first stage of growing up**) Which picture shows the way it looks next? (**caterpillar, its second stage of growing up**) Convey that the next thing that happens to this butterfly is that it grows a coat, or a chrysalis, around itself. When the butterfly is in the chrysalis, it waits and grows. (If students call the chrysalis a cocoon, clarify that the butterfly makes a chrysalis and the moth makes a cocoon.) The insect in this third stage is changing again. Ask students what the next stage is. (**adult**)

butterfly, its fourth stage of growing up). Now it is all grown up. Have students carefully move their arms to represent an adult butterfly moving its wings. Emphasize that the caterpillar is not one type of insect that changes into another; rather it is a young age of the adult butterfly.

3 Read the definition of **metamorphosis** from the board: *the change of shape of an insect as it goes through stages of growth*. Teach the class that insects and some other animals go through metamorphosis. Divide *metamorphosis* on the board into syllables (*me-ta-mor-pho-sis*). Repeat the term with the class. Have volunteers describe the shape of the insect in each of its four stages. (**Answers will vary.**) Allow time for students to number the pictures to show the order in which this butterfly grows. To reinforce the new vocabulary word, lead students in the following song to the tune of “Bingo.”

Metamorphosis

An insect’s body changes shape
 In each stage of growth.
 Me-ta-mor-pho-sis, me-ta-mor-pho-sis, me-ta-mor-pho-sis,
 That’s how an insect grows.

4 Read the definition of **graph** from the board: *a chart that shows and compares information*. Direct students to turn to the second page. Read about Diego’s photos. Then explain that every picture is an insect in one of the four stages of a butterfly’s metamorphosis. Distribute **CRAYONS**. For each picture, have students color one space on the graph. Then count how many insects there are in each stage in Diego’s photo collection.

+ Extension

Materials

- BLMs 4.4A–B Metamorphosis Wheel, Parts 1–2; scissors; brass fasteners
- Crayons, paper plates, glue, dried beans, assorted pasta

Make copies of **BLMs 4.4A–B Metamorphosis Wheel, Parts 1–2**. Distribute them along with scissors and brass fasteners. Demonstrate how to rotate the top circle to reveal each stage of growth.

Direct students to use crayons to draw 4 leaves on a paper plate, one on each one-fourth section of the plate. Ask students to glue on dried beans and pasta for each stage of the butterfly’s metamorphosis and to label each stage (*egg*: white bean; *caterpillar*: spiral pasta; *chrysalis*: shell pasta; *adult*: bow-tie pasta).

Insects Grow 4.4

Insects change as they grow up. See how this insect changes.

Metamorphosis is the change of shape of an insect as it goes through stages of growth.

Number the pictures above 1 through 4 to show how the butterfly grows. Start with the egg.

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A **graph** is a chart that shows and compares information.

Diego took pictures of a butterfly at each stage of its metamorphosis. Observe Diego’s photos. Color one space on the graph for each copy of each photo.

Diego's Photos				How Many?	
				2	
				1	
				3	
				2	

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Objective

Students will apply knowledge of wheels and axles to create a machine that makes a task easier to accomplish because of the work the machine performs.

Materials

Introduction

- Cart, mystery box assembled in Lesson 6.1

Directed Instruction

- TM-6.2A Wheel and Axle or CP-6.2 Simple Machines Theme Park
- BLM 6.2A Sciencemobile, crayons, scissors, tape, straws, circular holed candy

Preparation

Place the **CART** holding the **MYSTERY BOX** assembled in Lesson 6.1 in the hallway by the classroom door. (*Introduction*)

Select **TM-6.2A Wheel and Axle** or **CP-6.2 Simple Machines Theme Park** for display. (*Directed Instruction*)

Assemble one Sciencemobile from **BLM 6.2A Sciencemobile**. Obtain the materials needed for each student to make a Sciencemobile: **CRAYONS, SCISSORS, TAPE, 2 STRAWS, 4 CIRCULAR HOLED CANDIES**. (*Directed Instruction*)

Alternatives

Instead of circular holed candies, use 2 toothpicks and 4 jelly beans. Cut the ends off the perpendicular straw halves and put a toothpick through each straw half. Push the end of a jelly bean into the toothpick ends.

Content

The combination of a wheel and an axle is a simple machine that turns the rotation of the wheel into a force on the axle. This machine consists of two circular objects: the wheel, which is a larger circle, and the axle, which is a small circular rod or bar. The axle is attached to the center of the wheel and turns the wheel by exerting effort or force. The wheel by itself is not a machine, but a friction-reducing device. The wheel helps reduce the friction of the work done, but it needs the axle to create a force. The wheel and axle helps move and lift objects. Pushing a box along a floor can be made easier by placing the box on a cart that has wheels and axles.

Introduction

Push the **CART** and **MYSTERY BOX** into the room. Mention that the wheels on the cart make pushing the mystery box around much easier. If possible, push the cart around the room and allow students to view the movement of the cart. Encourage students again to wonder what might be in the box.

Directed Instruction

- 1 Ask students what helped you bring the mystery box into the classroom. (**the cart**) How was the cart designed to help people use less energy when pulling or pushing? (**It has wheels.**) Explain to students that the wheels are attached to an axle, a small bar that allows the wheels to spin. A wheel and an axle together is a machine that turns to make things move.

Display **TM-6.2A Wheel and Axle** or present the slides about wheels and axles from **CP-6.2 Simple Machines Theme Park**. Point out the wheels. State that each wheel has an axle that it turns around to help it move. Have students identify axles.

- 2 Direct the class to turn to the first student page. Read the information regarding the wheel and axle. Have students place a finger on one of the wheels of the cart. Ask and discuss the question on the top of the page, and reinforce that something is moving in all these pictures. Help students understand that the wheel and axle makes moving things easier. Ask and discuss the question in the middle of the page. Then allow time for students to finish the page.
- 3 Guide students' attention to the second page and point out the chariot. State that wheels and axles are even mentioned in the Bible. Inform students that in Exodus the Israelites were slaves to the Egyptian people. God wanted to release the Israelites from slavery. He allowed them to escape, but then the Egyptians followed them. Point out that God gave Moses, the Israelite leader, the power to part the sea so the Israelites could pass through. But the Egyptians followed them. Read **Exodus 14:23–28** to share how God kept the Israelites safe. Elaborate on the fact that God made the wheels of the Egyptian chariots come off so that the Egyptians had difficulty driving and the Israelites could get away. Discuss how wheels and axles help vehicles move quickly.

Discuss the rest of the vehicles on the page. Ask students which vehicles they have seen or ridden in. Reiterate that wheels and axles make tasks easier to do by performing work. People use less energy riding in a truck than walking.

4 Prepare the class to make a Sciencemobile. Display the sample Sciencemobile that was made in advance. Distribute **BLM 6.2A Sciencemobile**, **CRAYONS**, **SCISSORS**, and **TAPE**. Read the following directions and assist students as needed:

1. Write your name on the bottom section of the Sciencemobile.
Color and cut out the pattern. Fold on the gray lines. Tape the flaps together.
2. Cut a **STRAW** in half and tape each half parallel to the longer edges of the bottom of the Sciencemobile pattern. Cut the second straw and tape those halves perpendicular to the first straw halves.
3. Slide **2 CIRCULAR HOLED CANDIES** onto both of the perpendicular straw halves. Wrap a piece of tape around each end of the straw (near the place where you want the candy to stay) so that the candy does not fall off. Be sure that the four pieces of candy are level. (Point out that the straws are the axles that help the wheels move. Without the straws, the candies could not move on their own. A wheel by itself is not a machine.)

Direct students to test their car in a manner that suits the classroom space. Ask students where the energy comes from to move the car. **(from me)** What forced the car to move? **(a push or a pull)** Reiterate that work was done because the car moved. Retain Sciencemobiles for reuse in Lesson 6.3.



+ Extension

Materials

- Book about machines
- "Little Red Wagon"

Read and discuss a book about machines with students, such as *Move It! Work It! A Song About Simple Machines* by Laura Purdie Salas (Picture Window Books, 2009).

Obtain and play an audio recording of the traditional children's song "Little Red Wagon." Point out the wheel and axle in the song. Reiterate that the wagon cannot move as easily with a broken wheel and axle. Have students brainstorm ways to fix the wagon.

Wheel and Axle 6.2

A wheel and axle together form a simple machine. Find the wheels and axles on the cart. What task do they make easier to do?

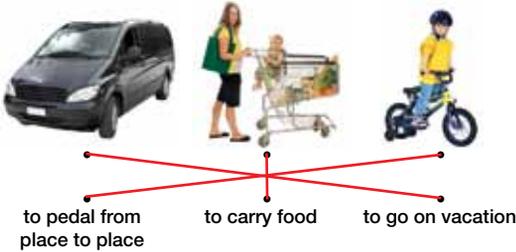
pushing a box or other items



Who uses the wheel and axle?
a child on a bike, a child in a wheelchair




Draw a straight line from the wheel and axle to the task it makes easier to do.



to pedal from place to place to carry food to go on vacation

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God made the wheels of the Egyptian chariots come off so the Israelites could escape. (Exodus 14)



Count how many wheels are on each machine. Can you see the axles?



4



1 or 2



4



8



18

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