



# The Book Planter



## Ag in the Classroom

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*How to Grow an Apple Pie*

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It's easy to make an apple pie, but what does it take to make the apples? Sophie is about to find out! First, the apple trees need to be about six years old—just like Sophie. Next, they need to be pruned, and the bees have to pollinate their blossoms! After that, the tiny apples grow through the summer until they're ready to pick in the fall. Finally, it's time for Sophie to make the perfect pie!

### Before Reading

#### Ask Questions

- What do you think the book will be about?
- Why do you think that?

#### Make a Connection

- What do you know about the topic of this book?
- Does the topic of this book remind you of anything you know or have done?

### Picture Walk

- Show students the front and back covers of the book.
- Pick one to two pages in the book to preview.
- Have students describe what they see in the pictures.
- Have students answer, Who, What, Where, When, and Why questions.
- After students preview the pictures, have them predict what they think the story will be about.

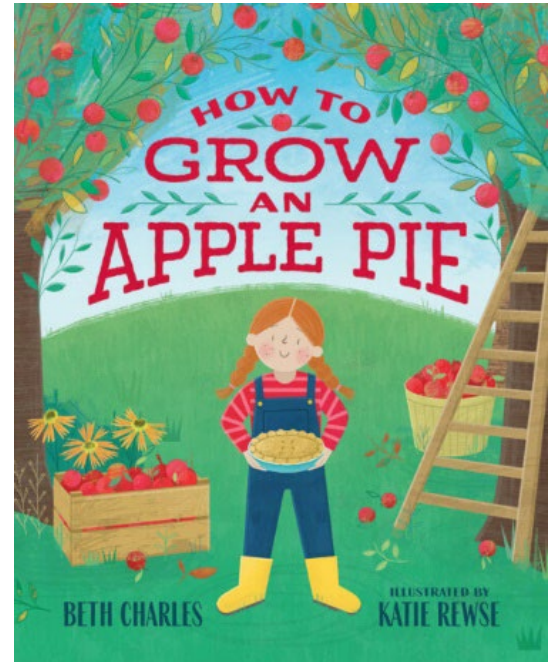
### During Reading

#### Plan to Pause

- Plan ahead where you will ask questions.
- Add a sticky note to that page and remind yourself to pause.
- Plan 1-2 pauses that will not interfere with the flow of the book.

#### Discuss

- What do you think will happen next? Why?
- Why do you think the \_\_\_\_\_ did \_\_\_\_\_? How do you know?
- What would you have done if you were \_\_\_\_\_?



- If you were in the story, what would you hear, taste, smell or feel?

## Engage

1. Show students a red apple and a red onion. Ask, “Which one would you like to eat in a pie? How can you tell the difference between the apple and the onion?”
2. As a class, list the physical characteristics of the apple and the onion. Point out that many of these characteristics are heritable traits that can be used to tell apples from onions.
3. Optional: Show other types of fruits and vegetables that have both similar and different characteristics. Have students observe, record, and discuss the similarities and differences.

## Activity 1: Apple Exploration<sup>1</sup>

### Materials:

- Gala apples (or other slow-to-brown variety like Empire or Cortland), 1 per group
- Granny Smith apples (or other tart, green variety like Crispin or Pippin), 1 per group
- McIntosh apples (or other soft-flesh variety like Braeburn or Red Delicious), 1 per group
- Measuring tapes, 1 per group
- Scales that weigh in grams, 1 per group
- [Apple Data Sheet](#), 1 per student (full url in **Links** section)

### Procedures:

1. Divide the students into small groups. Provide each group with a Gala, Granny Smith, and McIntosh apple (or other similar varieties); one measuring tape; one scale; and an [Apple Data Sheet](#) for each student.



2. Have students record the color and smell of each apple variety on their data sheets.
3. Have students predict each apple’s weight in grams and circumference in centimeters.
4. Teaching Tip: When students make predictions, encourage them to use a known variable for comparison. For example, if you are using gram weights, have a student place 100 grams in one hand and an apple in the other. This way, the student has a known quantity against which to compare the apple’s weight and a basis for making his/her prediction. As soon as one apple’s mass is known, the apple can then become the next known quantity.
5. Have students measure the actual weight and circumference of each apple.

6. Have students make a prediction about how many seeds are in each apple.
7. Cut each apple open for the groups, designating one slice for observing how long it takes the apple to turn brown. Ask students to observe the inner characteristics of the apple and record on their data sheets the color of the inside flesh and the actual number of seeds inside each apple.
8. Cut each apple into small sections and allow students to taste the differences among the apples. As they are tasting, remind them to pay attention to the texture (crunchy, juicy, etc.) of the apple as well as the flavor. Be sure to follow proper health and safety regulations for step 7, or ask the cafeteria workers to slice the apples for tasting. Have students record their observations on the data sheet.
9. Using the background information, explain to students why apples turn brown after they are cut. If any of their apples have started to turn brown, have them record on their data sheets that these varieties are fast to brown. Ask them to continue observing their cut apples to compare their rate of browning as you do the next activity.
10. Discuss the variation that students observed between different apple varieties. Explain to students that these variations are examples of traits that can be passed from parent to offspring.

## Activity 2: Apples in the Orchard<sup>1</sup>

### Procedures:

1. Show students the [How Does it Grow? Apples](#) video (full url in **Links** section).
2. Use the following discussion questions to explore the video:
  - Why don't farmers grow apples from seed? (*Each seed is genetically unique, meaning that when it grows into a mature tree, the apples it produces will be different from those produced by its parent trees.*)
  - What is grafting? (*The process of joining a cut stem—or bud—with the trunk of another tree so that the two grow together.*)
  - Why do apple farmers graft their trees? (*Grafting allows farmers to “clone” the apple trees that produce the fruit they want. A grafted branch has the same genetic makeup as the tree it was taken from.*)
  - Do all apple varieties ripen at the same time? (*No, some varieties ripen earlier than others, so planting different varieties allows farmers to extend their length of harvest.*)
3. Explain to students that apples have been selectively bred for thousands of years to produce the varieties that we know today. Apple breeders, unlike farmers, plant apple trees from seed in order to find and develop new traits. Under human cultivation, the traits that give apple trees a survival advantage are the traits that are most useful and desirable to people. Ask students to brainstorm all the different traits they can think of that might be desirable in an apple tree (e.g., pest resistant, grows fast, has strong branches, produces big apples, juicy apples, sweet apples, crisp apples), and write them on the board.
4. Circle all the traits that are directly related to the fruit of the apple tree (e.g., produces big apples, juicy apples, sweet apples, crisp apples). Point out that these are like the characteristics that students observed and recorded on their [Apple Data Sheets](#) (from **Activity 1**).

- Based on the information from their data sheets, ask students to vote on which apple variety was their favorite. Imagine that an apple breeder crossed the two favorite class varieties. What characteristics might the resulting apple have?

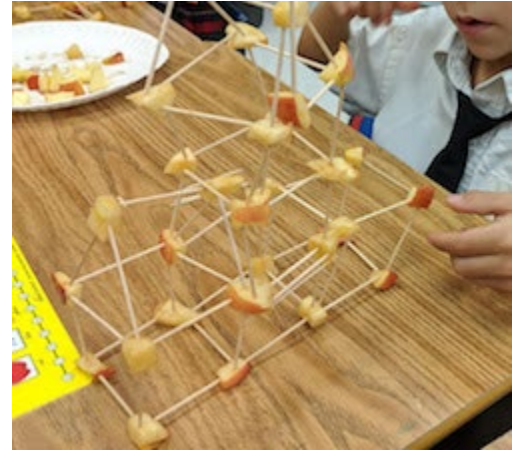
### Activity 3: Building with Apples

#### Materials:

- Apples cut into small pieces
- Toothpicks, at least 15 per student
- Paper plates, 1 per student
- Plastic knives for students to adjust the size of their apple pieces (optional)
- Wax paper or paper towel for base (optional)

#### Procedures:

**Teacher Note:** Wash hands and sanitize desks prior to this activity, then apples can be eaten after building. Students may also build on top of a sheet of wax paper or paper towel if you prefer not to work directly on the surface.



- Demonstrate the basic building process—sticking apple pieces to the ends of toothpicks, then building upward or outward. Explore and explain 2D vs. 3D structures.
- Have the class develop challenge criteria. Examples include, the structure must be at least 6 inches high and 6 inches wide, you can only use 10 apple chunks and 15 toothpicks, etc.
- Encourage the students to get creative and build.
- After the structures have been built, facilitate a gallery walk that allows all groups to showcase their structures, share how they developed the idea, and communicate what changes they might make if they had another chance to build with apples.

#### Extension Activities<sup>1</sup>

- Grocery Store Fruit and Vegetable Characteristics**  
Many grocery stores have informational sheets on fruits and vegetables. Have students go to the grocery store with a parent or other adult and find out information about a particular fruit or vegetable from the manager of the Produce Department. For example: How many kinds of apples are carried by the grocery store? Which apples are best for cooking, eating or storing? Which apple has the shortest growing season, the longest growing season? Which apple sells the best? Which are the most expensive and why? Where do apples grow in your state?
- Browning Apples**  
Students observed browning in different varieties of apples, but what about browning under different conditions? Have your students think of ways they might slow the browning of apples (add lemon juice, wrap apple slices in plastic, put them in the freezer, etc.). Cut slices of apples, and compare the rate of browning under the different conditions suggested by the students. Make observations over two or three days. Don't forget to provide a control slice (a sliced apple with nothing done to it).

- **Testing Apple Ripeness.**

Apple growers try to pick their apples at precisely the right time. They have several ways to test for ripeness that students can try in the classroom. These observations will work best with apples picked in the early fall when you can find varying stages of ripeness—they will not work well with apples from the grocery store.

Seed Color Test

Rate the color of the seeds in the apple. A ripe apple has brown seeds. Apple growers use the following scale:

- 1 = clear (no color)
- 2 = trace of color (tips of seeds are brown)
- 3 = 1/4 color
- 4 = 1/2 color
- 5 = 3/4 color
- 6 = fully brown

Flesh Color Test

Check the flesh color of the apple by holding a very thin slice—about 1/16th of an inch (1.58 mm)—up to a bright light. A ripe apple has almost no green flesh. Apple growers use the following scale:

- 1 = flesh all green
- 2 = some loss of green from center of fruit
- 3 = heavy green band 1/2 inch (1.27 cm) thick under skin
- 4 = heavy green band 1/4 inch (6.35 mm) thick
- 5 = heavy green band 1/8 inch (3.17 mm) thick
- 6 = green essentially gone from under skin

Have students give their apple a rating from 1 to 6. Remind students that these tests for ripeness involve a skill that scientists must develop—the ability to make careful observations.

Starch Test

Divide the class into groups. Give each group an apple, and have them cut the apple in half at a right angle to the core. Apply iodine to the cut surface, drain away any excess, and allow it to stand for a few minutes. (Emphasize that iodine is poison and is not to be taken internally.)

The apple will turn a dark purple or blue-black wherever starch is present. Remind students that in a ripe apple the starch has changed to sugar, so a ripe apple will have very little dark stain. Have students give their apple a rating from 1 to 6 based on the amount of dark stain on the apple. A rating of 6 indicates a perfectly ripe apple. *Note: This test works well at any time of year with bananas, which are commonly available at varying stages of ripeness.*

Apple growers commonly use the following rating system:

- 1 = all blue-black (full starch)
- 2 = all blue-black except in seed cavity and halfway to vascular area (oval area around core)
- 3 = all blue-black except in seed cavity and vascular area

- 4 = half blue-black
- 5 = blue-black just under skin
- 6 = no blue-black (free of starch)

## Links

### Activity 1:

- Apple Data Sheet  
[https://cdn.agclassroom.org/media/uploads/2016/12/06/apple\\_science\\_datasheet.pdf](https://cdn.agclassroom.org/media/uploads/2016/12/06/apple_science_datasheet.pdf)

### Activity 2:

- How Does It Grow? Apples video <https://www.youtube.com/watch?v=UWLMeh1HIBw>

## Sources

1. <https://agclassroom.org/matrix/lesson/538/>

## K-5 Subject Areas: English Language Arts, Math, and Science

### English Language Arts (Reading and Writing)

- RI.K.1 With prompting and support, ask and answer questions about key details in a text.
- RI.K.2 With prompting and support, identify the main topic and retell key details of a text.
- RI.K.3 With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.
- RI.1.1 Ask and answer questions about key details in a text.
- RI.1.2 Identify the main topic and retell key details of a text.
- RI.1.3 Describe the connection between two individuals, events, ideas, or pieces of information in a text.
- RI.1.4 Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.
- RI.1.5 Know and use various text features to locate key facts or information in a text.
- RI.1.6 Distinguish between information provided by pictures or other illustrations and information provided by the words in a text.
- RI.1.7 Use the illustrations and details in a text to describe its key ideas.
- W.1.5 Participate in shared research and writing projects.
- RI.2.4 Determine the meaning of words and phrases in a text relevant to a grade 2 topic or subject area.
- RI.2.5 Know and use various text features to locate key facts or information in a text efficiently.
- RI.2.7 Explain how specific images contribute to and clarify a text.
- W.2.2 Write informative /explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section. a. With guidance and support from adults, organize information and ideas around a topic to plan and prepare to write. b. With guidance and support from adults and peers, focus on a topic and strengthen writing as needed by revising and editing.
- W.2.5 Participate in shared research and writing projects.
- W.2.6 Recall information from experiences or gather information from provided sources to answer a question.
- RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea.
- RI.3.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic or subject area.
- RI.3.5 Use text features and search tools to locate information relevant to a given topic efficiently.
- RI.3.7 Use information gained from illustrations and the words in a text to demonstrate understanding of the text.
- W.3.5 Conduct short research projects that build knowledge about a topic.
- RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI.4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.
- RI.4.4 Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.
- RI.4.5 Describe the overall structure of events, ideas, concepts, or information in a text or part of a text.
- RI.4.7 Interpret information presented visually, orally, or quantitatively and explain how the information contributes to an understanding of the text in which it appears.
- W.4.5 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

- RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI.5.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.
- W.5.2 Write informative /explanatory texts to examine a topic and convey ideas and information clearly.
- W.5.3 Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.

## Math

- NC.K.MD.1 Describe measurable attributes of objects; and describe several different measurable attributes of a single object.
- NC.K.MD.2 Directly compare two objects with a measurable attribute in common, to see which object has “more of”/“less of” the attribute, and describe the difference.
- NC.K.G.1 Describe objects in the environment using names of shapes, and describe the relative positions of objects using positional terms.
- NC.K.G.2 Correctly name squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres regardless of their orientations or overall size.
- NC.K.G.3 Identify squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres as two-dimensional or three-dimensional.
- NC.K.G.4 Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, attributes and other properties.
- NC.K.G.5 Model shapes in the world by: • Building and drawing triangles, rectangles, squares, hexagons, circles. • Building cubes, cones, spheres, and cylinders.
- NC.K.G.6 Compose larger shapes from simple shapes.
- NC.1.G.1 Distinguish between defining and non-defining attributes and create shapes with defining attributes by: • Building and drawing triangles, rectangles, squares, trapezoids, hexagons, circles. • Building cubes, rectangular prisms, cones, spheres, and cylinders.
- NC.1.G.2 Create composite shapes by: • Making a two-dimensional composite shape using rectangles, squares, trapezoids, triangles, and half-circles naming the components of the new shape. • Making a three-dimensional composite shape using cubes, rectangular prisms, cones, and cylinders, naming the components of the new shape.
- NC.1.G.3 Partition circles and rectangles into two and four equal shares. • Describe the shares as halves and fourths, as half of and fourth of. • Describe the whole as two of, or four of the shares. • Explain that decomposing into more equal shares creates smaller shares.
- NC.2.MD.1 Measure the length of an object in standard units by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
- NC.2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.
- NC.2.MD.3 Estimate lengths in using standard units of inches, feet, yards, centimeters, and meters.
- NC.2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.
- NC.2.G.1 Recognize and draw triangles, quadrilaterals, pentagons, and hexagons, having specified attributes; recognize and describe attributes of rectangular prisms and cubes.
- NC.3.MD.2 Solve problems involving customary measurement. • Estimate and measure lengths in customary units to the quarter-inch and half-inch, and feet and yards to the whole unit. • Estimate and measure capacity and weight in customary units to a whole number: cups, pints, quarts, gallons, ounces, and pounds. • Add, subtract, multiply, or divide to solve one-step word problems involving whole number measurements of length, weight, and capacity in the same customary units.
- NC.3.G.1 Reason with two-dimensional shapes and their attributes. • Investigate, describe, and reason about composing triangles and quadrilaterals and decomposing quadrilaterals. • Recognize and draw examples and non-examples of types of quadrilaterals including rhombuses, rectangles, squares, parallelograms, and trapezoids.
- NC.4.MD.1 Know relative sizes of measurement units. Solve problems involving metric measurement. • Measure to solve problems involving metric units: centimeter, meter, gram, kilogram, Liter, milliliter.
- NC.4.MD.4 Represent and interpret data using whole numbers. • Collect data by asking a question that yields numerical data. • Make a representation of data and interpret data in a frequency table, scaled bar graph, and/or line plot. • Determine whether a survey question will yield categorical or numerical data.

## Science

- 1.L.1 Understand characteristics of various environments and behaviors of humans that enable plants and animals to survive.
- 1.L.2 Summarize the needs of living organisms for energy and growth.
- 4.L.1 Understand the effects of environmental changes, adaptations and behaviors that enable animals (including humans) to survive in changing habitats.
- 5.L.2 Understand the interdependence of plants and animals with their ecosystem.

# Apple Data Sheet

OUTER CHARACTERISTICS	Color	Smell	Predicted weight (grams)	Actual weight (grams)	Predicted circumference (cm)	Actual circumference (cm)
Variety name:						
Variety name:						
Variety name:						

INNER CHARACTERISTICS	Color of inside flesh	Predicted number of seeds	Actual number of seeds	Taste	Texture	Slow or fast to brown after cutting
Variety name:						
Variety name:						
Variety name:						