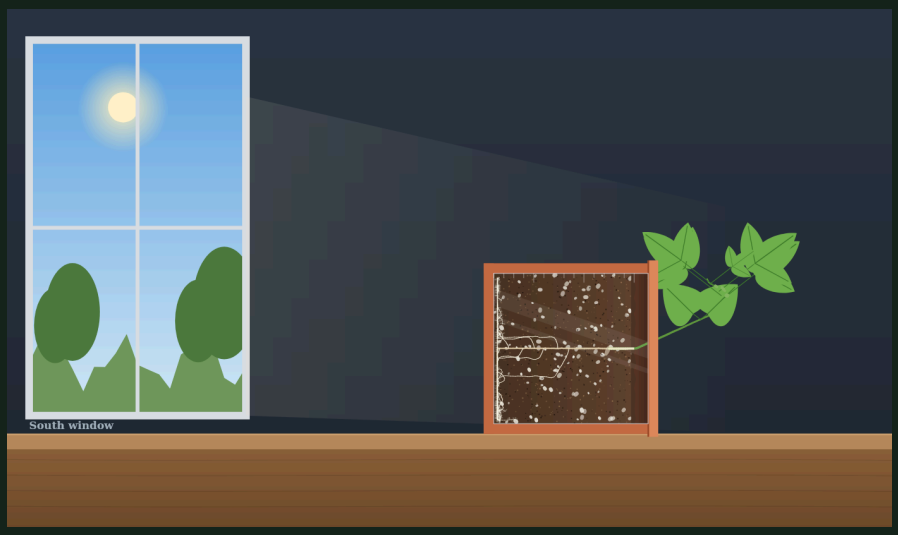
mytekDev

Seed Lab: Which Way Is Up?

Grades 3-5 · 45 minutes

Life science



Slides, rubric and answer key **Print and go** **No student accounts**

Chromebook friendly

What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 45-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a drawing table
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grades 1 and 2 and in middle school life science
- Standards: NGSS

Seed Lab: Which Way Is Up?

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Students plant a bean upside down in a dark closet. Its first root comes out going up, curves around and grows down. On Day 11 it comes up anyway, pale and hooked: seeds do not need light to sprout. They move it to a sunny window, where it opens green leaves and leans toward the light. Then they turn the pot, and lay it on its side: within a day the top curves up again, and the roots turn down.

At a glance

ESSENTIAL QUESTION

How does a plant know which way is up?

OBJECTIVES

Students will be able to:

- observe that a root grows down and a shoot grows up, whichever way the seed lies
- show that a seed sprouts in the dark but a seedling needs light to turn green
- describe how a stem bends toward light and away from gravity
- explain how these responses help a plant survive

VOCABULARY

Gravity, Respond, Shoot, Root, Sprout

STANDARDS

4-LS1-1, SC.3.L.14.2

TIME AND MATERIALS

45 minutes, grades 3-5.

- One computer or Chromebook per student
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work

PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/seedlab?lesson=which-way-is-up&ref=tpt-seedlab-3 once on a student computer: a bean is planted upside down in a closet. Run it yourself, about ten minutes: Next stage to the first root (it comes out going up, then curves down), Next stage to up (Day 11, pale and hooked), South window, run to about Day 20, then Lay it on its side and run one more day.

ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet, scored with the rubric.

TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 5	**Warm-up** Hook	Show the title, essential question and Today I can slides (about 1 minute). Then the warm-up: plant a seed upside down, which way does its root grow?	Answer the warm-up on the worksheet.
5 to 12	**Direct instruction (I do)** Model it	Project the app with the starter open. Point out that the bean is upside down and the closet is dark. Press Next stage until the first root shows (Day 4): it comes out going up and starts to curve. Show the upside-down slide. > **It's working when:** Roots sense gravity with tiny grains in their tips. In the dark there is no light to follow, and the root still finds down.	Watch, and fill in the vocabulary on the worksheet.
12 to 22	**Guided practice (We do)** Up in the dark	Students open the link or scan the QR code. A short guide takes them to up (Day 11) in the dark, then to the window. Ask: did the seed need light to sprout? > **Watch for:** Students who say seeds need light. The closet seedling came up anyway; it is pale because it has not had light yet.	Draw the plant in the dark and after a few days in the light.
22 to 38	**Independent practice (You do)** Tip it over	Students run to about Day 20, lay the pot on its side, run a day, stand it up, then turn the pot so the leaves face the room. Walk the room with the What to look for questions. > **If they ask:** "You turned the pot. Which way does the new growth bend over the next few days, and why?" Turned around	Draw each change in the drawing table.
38 to 45	**Closure** Showcase and exit ticket	Show the Showcase slide. Two students explain how growing down and growing up help a plant, then go back to the warm-up answers. Hand out the exit ticket.	Answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/seedlab?lesson=which-way-is-up&ref=tpt-seedlab-3. A short guide opens over the app. A bean is planted upside down, 2.5 cm deep, in a closet: the stage is dark.

1. **The root.** Press `Next stage`: the first root comes out on Day 4 going up, and curves around to grow down.
2. **Up in the dark.** Keep pressing: the shoot comes up on Day 11, pale yellow with its hook still bent. The guide asks for light.

3. **Light.** Pick `South window` and run to about Day 20: the seed leaves open green, the first leaves open, and the stem leans toward the window.
4. **Tipped over.** Press `Lay it on its side` and run one day: the top curves up. `Stand it up`: the bend stays. Then `Turn the pot`: over a few days the new growth bends back toward the window.

> The moment that lands is the root curving around. Students expect an upside-down seed to grow upside down.

Background for the teacher

Roots grow toward gravity and shoots away from it, sensed by tiny grains in the root tip and the stem. Shoots also bend toward light: the shaded side grows more, so the stem leans to the bright side. Only the young growing part near each tip bends; older stem stays where it grew.

A seed needs water, warmth and air to sprout, not light. In the dark, a bean seedling grows tall and pale on the food stored in its seed, with its hook still bent, and dies when that food runs out (about Day 19). Given light, it opens green leaves and makes its own food.

Common mistakes: seeds need light to sprout; a root grows whichever way the seed points; plants cannot move. The app grows one model plant, the same way every time, so two students with the same settings get the same numbers. Real plants vary from seed to seed; a real bean in a bag beside the app shows that.

What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- Which way did the root first come out, and which way did it end up?
- Did the seed need light to sprout? How do you know?
- Why was the seedling pale in the closet?
- What happened to the top when you laid the pot on its side?
- How does growing down help a root? Growing up help a shoot?

> The second question is the real test: a student who uses the closet seedling as evidence has the idea.

Cross-curricular extensions

- Real plants: tape bean seeds to a damp paper towel in a clear CD case, stand it up, and turn it a quarter turn after the roots show.
- Art: draw the upside-down seed's root as a comic strip, one frame a day.
- English: explain to a younger student how a plant knows which way is up.
- Math: how many hours did it take the top to turn up after the pot was laid down?

Vocabulary

Gravity	The pull that makes things fall down.
Respond	To change because of something around you.
Shoot	The part of a young plant that grows up out of the soil.
Root	The part of a plant that grows down into the soil and takes in water.
Sprout	When a seed starts to grow: the root comes out first.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the screen as you say each word: the jars, the roots and the stage chips carry the meaning.
- Pair each learner with a partner; up and down show on the screen without words.
- Accept the drawing table as drawings with arrows.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students for the independent part, one at the app and one drawing.
- Zoom the browser to 125%.
- Allow two drawings instead of four, where the IEP allows a modified assignment.

STUDENTS WHO NEED MORE SUPPORT

- A sentence starter: "The root grows ___ because ___."
- A check-in when the plant is up: every student has moved it to the window before anyone tips it.
- Ask only: which way did the root go?

STUDENTS READY FOR MORE

- Leave a second bean in the closet. What happens to it by Day 19, and why? (Read the card.)
- Try a pea, which leaves its seed below the soil. How is its seedling different?
- Grow a sunflower outdoors and pause on Day 40 in the morning and the evening. Which way does its bud lean?

Adapting for other grades

Younger students: In grades 1 and 2, do it together on the projector: plant upside down, press Next stage, and ask which way the root went. Skip the turning and the drawing table.

Older students: In middle school, name the responses (gravitropism and phototropism) and explain them with growth on one side of the stem (MS-LS1-5: an environmental factor changes how a plant grows).

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/seedlab?lesson=which-way-is-up

Essential question: How does a plant know which way is up?

Warm-up: If you plant a seed upside down, which way will its root grow? _____

1. **Vocabulary.** Gravity, respond, shoot, root, sprout: write each in your own words.

2. **The drawing table.** Draw the plant: upside down when the root first shows; up in the dark; after a few days in the light; laid on its side for a day. Add an arrow for which way it grew.

1. Did the seed need light to sprout? What is your evidence?

2. How do roots growing down and shoots growing up help a plant survive?

Seed Lab: Which Way Is Up?

Exit ticket

Name: _____

1. A bean seed is planted upside down. Its root will grow (A) up, the way it points (B) down, toward gravity (C) sideways

2. A seed in a dark closet (A) never sprouts (B) sprouts and comes up pale (C) comes up green

3. A potted plant is laid on its side. Describe what its top does over the next day, and why.

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Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	The root turns down whichever way it starts, following gravity.
2	B	Seeds do not need light to sprout. The seedling is pale because it has no light yet.
3	It curves up	The growing tip bends away from gravity, so the top turns up. "It moves" alone is half.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
The drawings	Upside-down seed, up in the dark, in the light, and laid down, each with arrows for which way it grew.	Three of the four, with arrows.	Some drawings, no arrows.	No drawings.
Light and gravity	Says the root follows gravity, the shoot grows away from it and toward light, and gives evidence from the app for each.	Says the root grows down and the shoot up, with one piece of evidence.	Says the root grows down, no evidence.	No answer.
Why it matters	Explains how each response helps: roots reach water, shoots reach light.	Explains one of the two.	Says it helps the plant, with no reason.	No answer.

Total: ____ / 12. A score of 9 or more meets the objectives.

Standards

The lesson is built for 4-LS1-1, structures that support survival and growth, and for Florida SC.3.L.14.2, which names stems growing toward light and roots growing down with gravity.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
NGSS	**4-LS1-1**	4	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	Students connect roots growing down and shoots growing up to how each part helps the plant survive.
Florida	**SC.3.L.14.2**	3	Investigate and describe how plants respond to stimuli (heat, light, gravity), such as the way plant stems grow toward light and their roots grow downward in response to gravity.	Students watch the stem grow toward light and the roots grow down, and test both by turning and tipping the pot.

Checked November 2026 against: NGSS 4-LS1-1, From Molecules to Organisms, Florida SC.3.L.14.2 (CPALMS).

Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' work, and see it all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/seed-lab/lessons/which-way-is-up/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

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