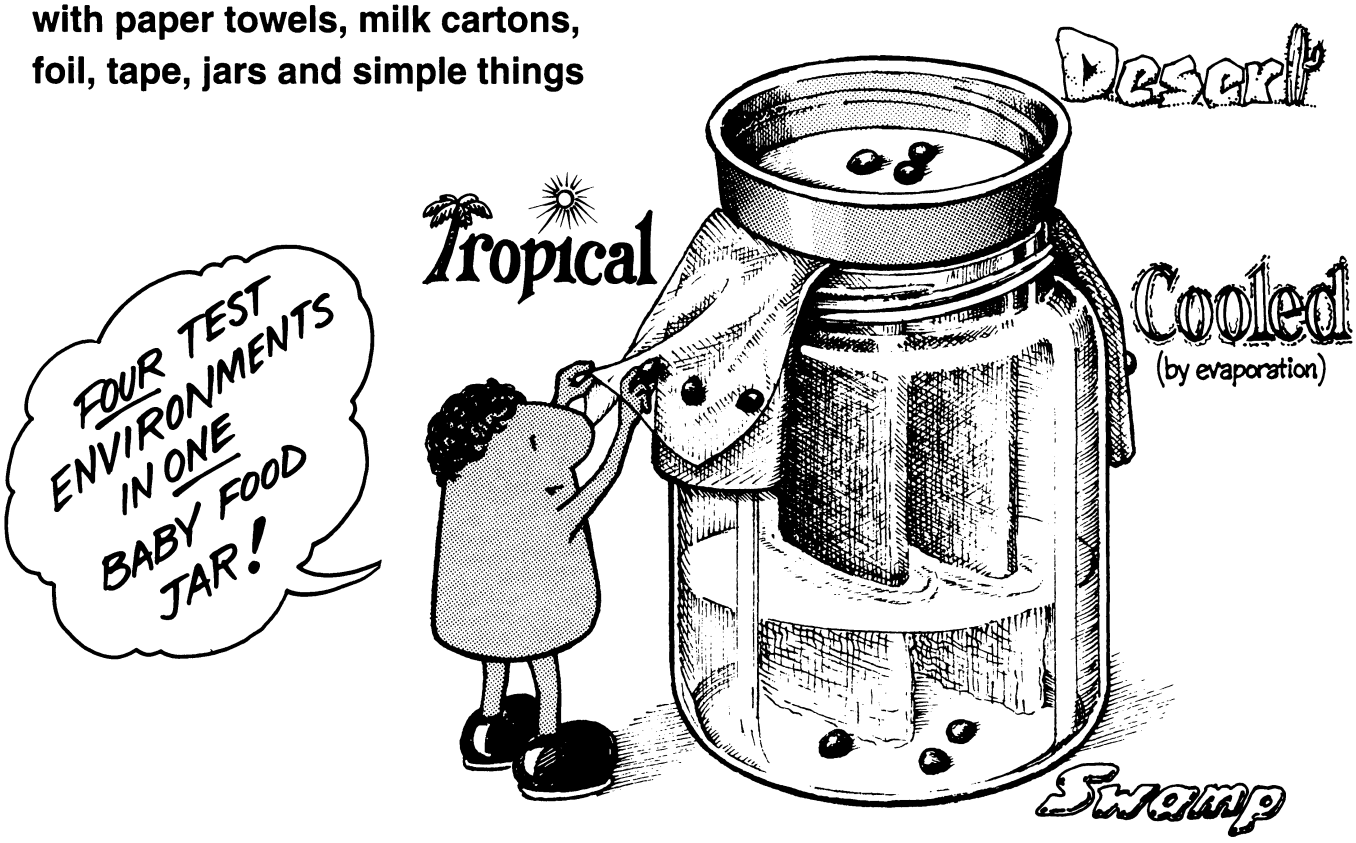
Green Thumbs: RADISHES

with paper towels, milk cartons, foil, tape, jars and simple things



SCIENCE WITH SIMPLE THINGS SERIES

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PREPARATION AND SUPPORT

ACTIVITIES AND LESSON NOTES

SUPPLEMENTARY CUTOUT

Gathering Materials

Listed below is everything you'll need to teach this unit. Buy what you don't already have from your local supermarket, drugstore or hardware store. Ask students to bring recycled materials from home.

Keep this classification key in mind as you review what's needed.

general on-the-shelf materials:	*special in-a-box materials:*
Normal type suggests that TOPS labs use these basic materials often. Keep them where they will be accessible to your students. The next unit you teach may well call for many of these same materials.	Italic type indicates these items are unusual. Keep specialty items in a separate box. After you finish this unit, label any leftovers and store them appropriately until you need them again.
(substituted materials):	*optional materials:
Parentheses suggest a substitute which may work as well as the original. And always, improvise boldly. Perhaps you can make do with what you have, and you'll encourage creativity in your students!	An asterisk marks items that are nice to have, but you can live without them. If you are not planning a trip to the store to gather other materials, consider reasonable substitutions.

Everything is listed below in order of first use. Start gathering at the top of this list and work down. Ask students to bring recycled items from home. The Teaching Notes may occasionally suggest optional *Extensions* or trouble-shooting tips. Materials for these are listed neither here nor under *Materials*. Read the extension itself to determine what new items, if any, are required.

Quantities depend on how many students you have, how you organize them into lab groups, and how you teach. Decide which of these estimates best applies to you, then adjust quantities as necessary:

Q_1 / Q_2

- **Single Student:** Enough for 1 student to do all the experiments.
- **Classroom:** Enough for 30 students when organized into 15 lab pairs.

KEY: *special in-a-box materials* (substituted materials) general on-the-shelf materials * optional materials

Q_1 / Q_2

- 1 / 15 cardboard milk cartons, half gallon
- 1 / 15 pairs scissors, some heavy-duty – see teaching notes 1
- 1 / 3 rolls masking tape
- 1 / 3 rolls soft, absorbent paper towels
- 1 / 15 ballpoint pens
- 1 / 3 *plastic milk jugs, gallon size, for water (pitchers)
- 1 / 2 *packets radish seeds, 4 to 5 grams each* – see teaching notes 1 for tips on storage
- 1 / 30 *file folders (notebooks)
- 1 / 2 rolls aluminum foil
- 2 / 30 index cards, 4 x 6 inch size
- 1 / 15 size-D batteries – dead or alive
- 1 / 3 rolls transparent tape – matte "write-on" type (masking tape)
- 1 / 6 *quarts commercial potting mix* – do **not** substitute garden soil, which will introduce molds/fungi/pests into your growing system
- 1 / 15 styrofoam trays – see teaching notes 2
- 1 / 30 sharp pencils with soft, clean erasers
- 5 / 75 baby food jars with lids – assorted sizes OK
- 1 / 1 roll plastic wrap
- 2 / 30 paper clips
- 1 / 15 jars with lids – pint or quart size
- 1 / 1 box table salt
- 1 / 1 bottle vinegar
- 1 / 5 drinking glasses (beakers)
- 1 / 5 teaspoons
- 1 / 15 *hand lenses

Sequencing Activities

Radishes develop by their own timetable. Their fast growth cycle makes them wonderful subjects for all kinds of classroom investigation. But their speed brings potential problems, too. If you observe them for a lab period, nothing much appears to happen. But if you leave for the weekend, then look again on Monday, what you hoped to see on Friday may already be done and gone.

To study radishes successfully in the classroom, important growing events must occur on weekdays. You must start experiments on a day that will create a future window of opportunity to observe, on a school day, what may be a fleeting event in the life of a radish. You must do activities in a specific order. Fail to start one on time, or do it out of sequence, and the resulting disturbance will ripple through related activities.

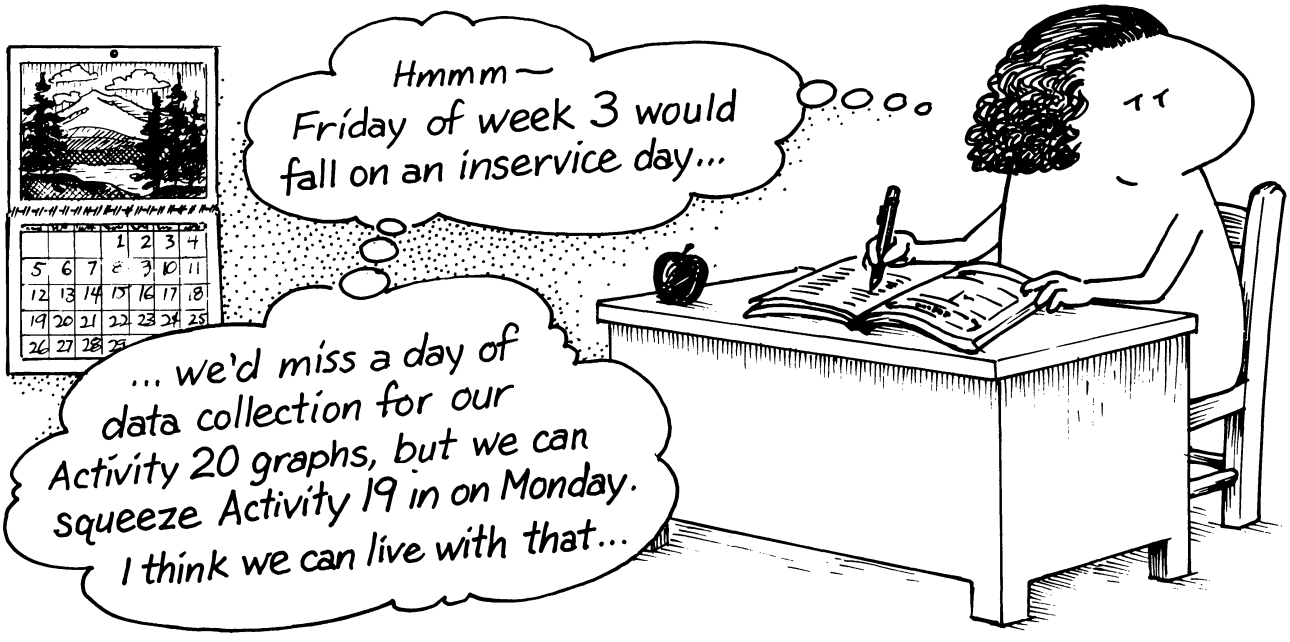
Can you keep your science class in step with radishes? Sure you can! **We've done the planning for you.** Follow the calendar of events on the opposite page, and stay reasonably on schedule.

But what if you teach science only 3 days a week? Or what if your calendar has a hole in it, say an in-service day a week from Friday? Unfortunately, radishes develop too rapidly to be observed only every other day. We hope you can avoid serious interruptions, or plan around them. Changing your teaching schedule is considerably easier than changing the way radishes grow!

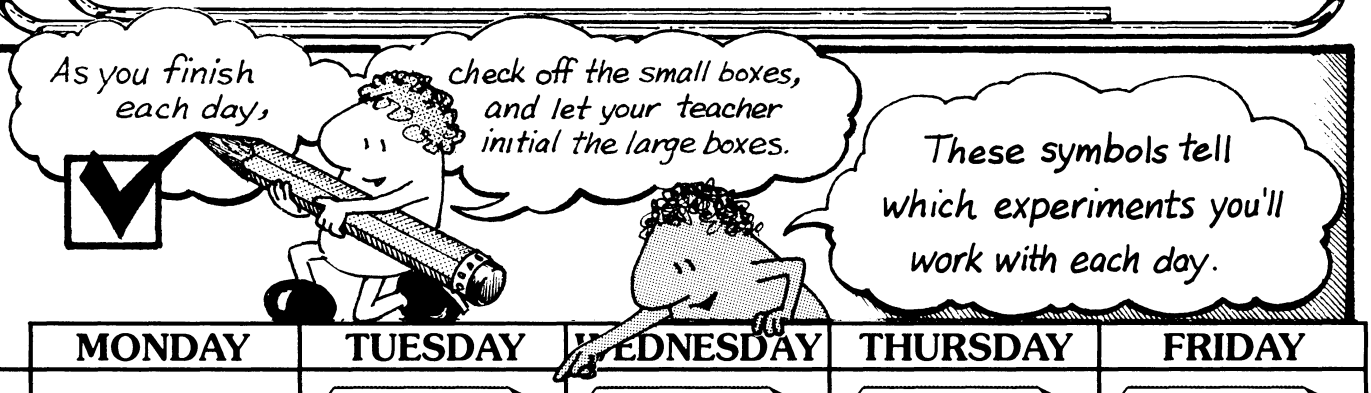
If you must deviate from this calendar, please do so thoughtfully. Look under Scheduling in the teaching notes if you anticipate that a day's activity needs to be moved up or back. This section tells you how each activity is related to all the rest, so you can see where problems will most likely occur. You'll also learn when it's OK to get a bit ahead of schedule, or to fall a little behind.

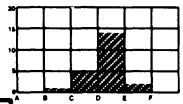
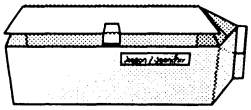
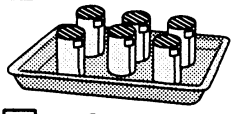
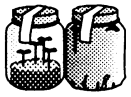
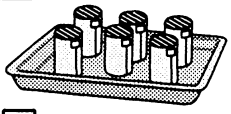
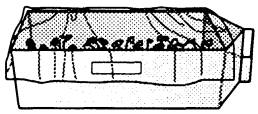
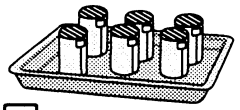
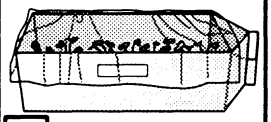
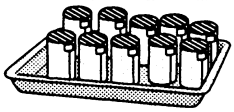
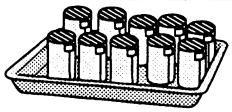
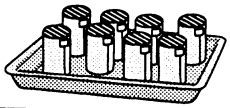
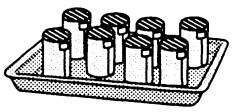
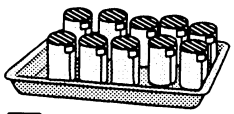
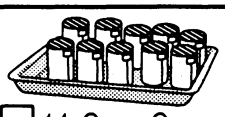
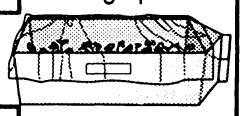
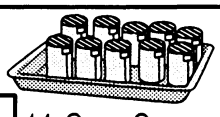
Snow days or flu epidemics are potential problems. What if both members of a lab group miss critical observations? Ask them to review the results of other groups that recorded data accurately, and write a report hypothesizing what their own plants were doing during that time period, complete with extrapolated graphs or drawings. And it's possible, of course, to drop one or two experiments completely, and still offer your students a rich learning experience.

Notice the large and small boxes on the Master Schedule. Each activity has a large checkoff box. A large box means that particular activity, which may have been partially done on previous days, is finished. We recommend that you initial these large boxes yourself as a final teacher-check. A small box means the activity page is still in progress. Students should check off these small boxes themselves as they finish each day's work. In this way you can tell at a glance who is on track and who requires extra supervision.



MASTER SCHEDULE



	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
WEEK 1	☐ 1. Happy Birthday ☐ 2. Mini-Planters	☐ 3. Sprout Drawing ☐ 4. Bar Graphs	☐ 3. Sprout Drawing ☐ 4. Bar Graphs ☐ 5. Four Environmt ***check water***	☐ 3. Sprout Drawing ☐ 4. Bar Graphs ☐ 6. Night & Day	☐ 4. Bar Graphs ☐ 7. Living Space ***water for weekend***
WEEK 2	 ☐ 8. Sprout Graph ***check water***	 ☐ 9. Build Greenhse  ☐ 10. Grid Work	 ☐ 11. Turn on Lights  ☐ 12. Phototropism ***check water***	  ☐ 13. Grnhse Predict	 ☐ 14. Grow, Grow...  ☐ 15. Sun Salad ***water for weekend***
WEEK 3	 ☐ 14. Grow, Grow... ☐ 16. Toxic Stress ***check water***	 ☐ 14. Grow, Grow... ☐ 10. Grid Work ☐ 12. Phototropism	 ☐ 14. Grow, Grow... ☐ 17. Geotropism ☐ 18. Hydrotropism ***check water***	 ☐ 14. Grow, Grow...  ☐ 12. Phototropism ☐ 17. Geotropism	 ☐ 14. Grow, Grow... ☐ 19. Seed Leaf or ? ***water for weekend***
WEEK 4	 ☐ 14. Grow, Grow... ☐ 7. Living Space  ☐ 13. Grnhse Predict ***check water***	 ☐ 14. Grow, Grow... ☐ 10. Grid Work  ☐ 18. Hydrotropism	 ☐ 20. Grow Graphs  ☐ 16. Toxic Stress	**REVIEW** **CLEANUP**	**EVALUATION**

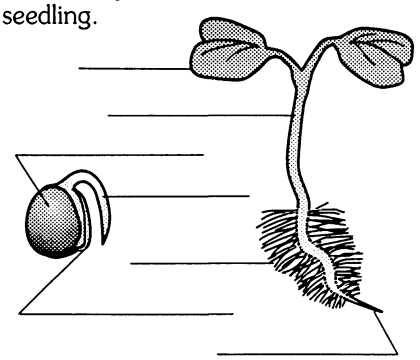
TOPS LEARNING SYSTEMS

Review / Test Questions

Photocopy the test questions below. Cut out those you wish to use, and tape them onto white paper. Include questions of your own design, as well. Crowd them all onto a single page for students to answer on their own papers, or leave space for student responses after each question, as you wish. Duplicate a class set, and your custom-made test is ready to use. Use leftover questions as a class review in preparation for the final exam.

activity 1-4 A

Label the parts of this radish seed and seedling.



activity 3

In a tropical jungle you discover a small rare plant, that no scientist has previously documented (drawn or described). You wish to make an enlarged drawing of this small wonder, sketching its proportions as accurately as you can. How will you do it?

activity 1-4 B

A radish seed finds itself in a warm, moist environment. Describe its development during the first 5 days. Write complete sentences using your own words. Use accurate, well-labeled diagrams.

activity 5

Name 3 things radish seeds need in order to sprout.

activity 6

What does a scientist do when she predicts?

activity 7

Directions on a radish seed package tell you to thin the young seedlings to 5 cm apart in the row. Won't pulling out radishes just reduce your crop? Explain.

activity 8

A tree is losing its leaves as winter approaches. Explain how this process fits a sigma curve. Illustrate your answer with a graph.

activity 9

Why is putting a clear plastic cover over your greenhouse helpful to your radish seedlings?

activity 10

Label the parts of this 3-week old radish.

activity 11

An empty box has been laying in a grassy field for several weeks, open side down. If you lift it up and peek underneath, predict what you might see.

activity 12

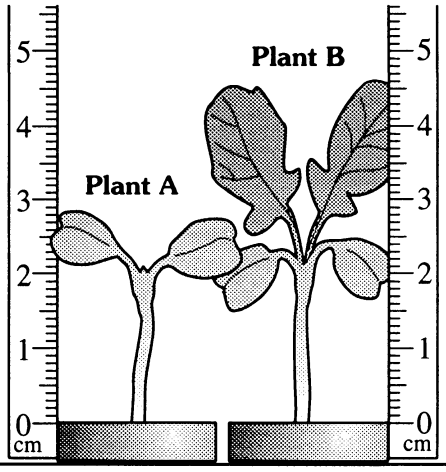
You are growing house plants next to a window. To make these plants grow straight, you need to turn them every few days. Explain why this is necessary.

activity 13

A package of seeds says "store in a cool, dry place." Why is this good advice?

activity 14

Give the height of each plant to the nearest 0.1 cm.



activity 15

Explain how radishes help your body use the sun as an energy source.

activity 16

You suspect water pollution is adversely affecting your crops. Design an experiment to test your hypothesis.

activity 17

Do you think that plants grown under weightless conditions in a space greenhouse would develop an earth-like appearance? Explain.

activity 18

You have a potted plant that can be watered from above, or from a saucer at the base. Where should you water daily in order to develop the deepest root system? Explain.

activity 19

A. What would happen to a newly sprouted radish seedling without cotyledons? Explain.

B. What would happen to a radish plant without leaves? Explain.

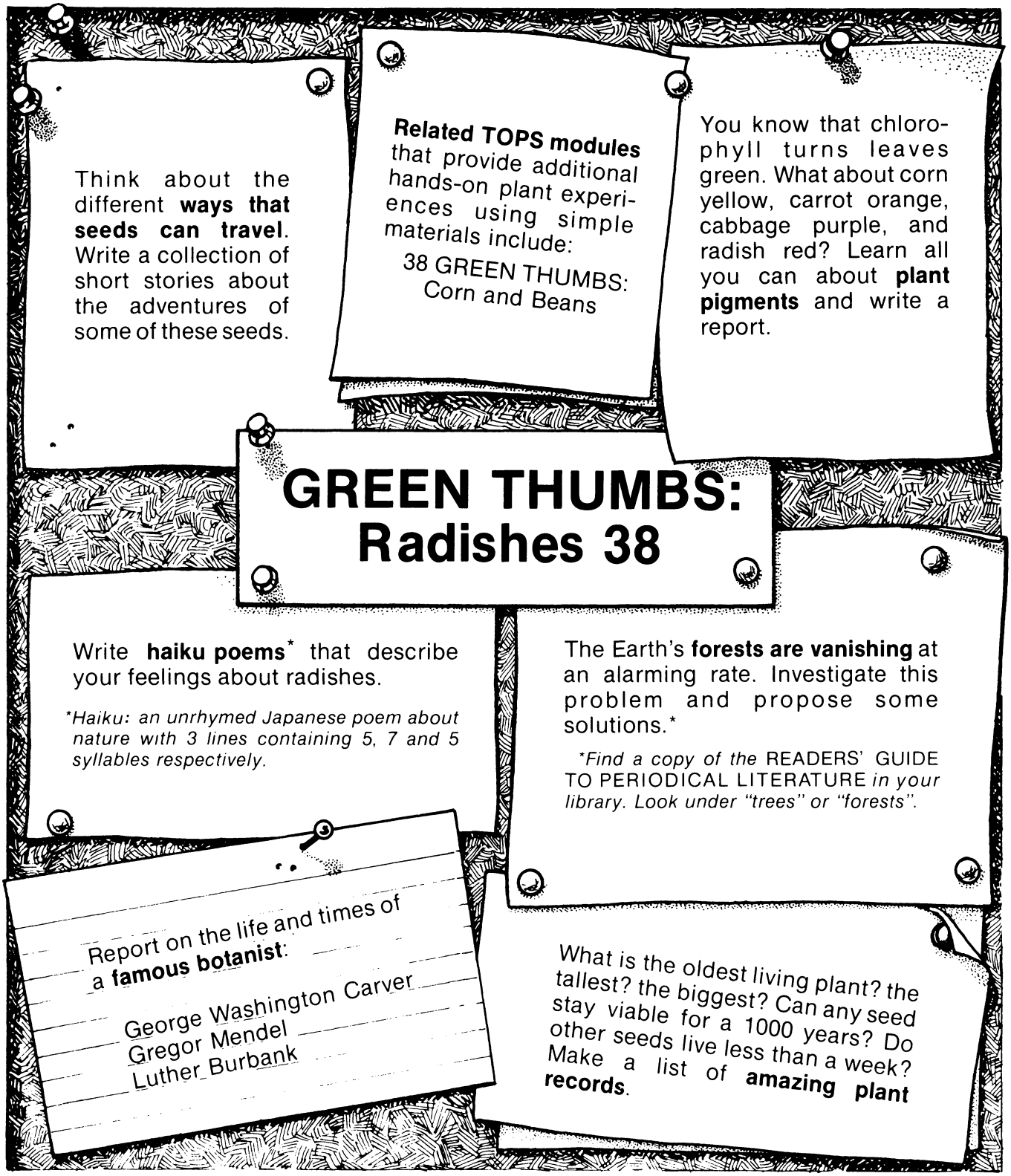
activity 20

Height measurements were taken of two radishes over a period of 1 week. Which one is the older radish? Explain how you know.

	RADISH #1 (cm)	RADISH #2 (cm)
SUNDAY	8.3	6.5
MONDAY	8.5	7.1
TUESDAY	8.7	7.9
WEDNESDAY	8.8	8.9
THURSDAY	8.9	9.9
FRIDAY	9.0	10.7
SATURDAY	9.0	11.3

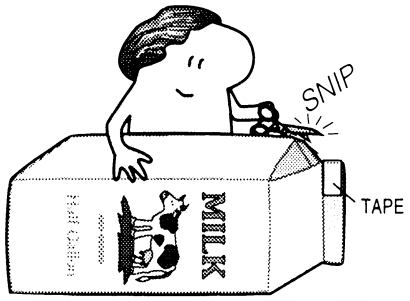
Gaining A Whole Perspective

Science is an interconnected fabric of ideas woven into broad and harmonious patterns. Use "Extensions" in the teaching notes plus the outline presented below to help your students grasp the big ideas – to appreciate the fabric of science as a unified whole.

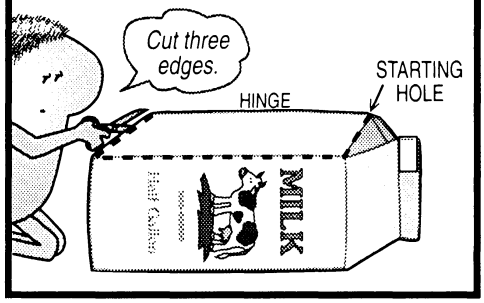


HAPPY BIRTHDAY

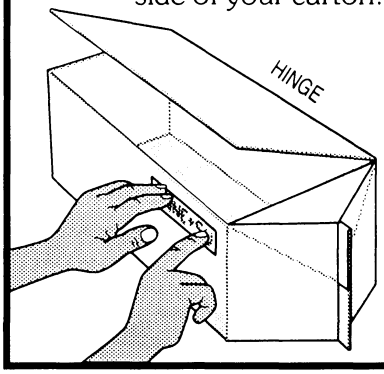
1 Close the spout of a clean, dry milk carton with tape. Then snip off the tip of one corner near the spout.



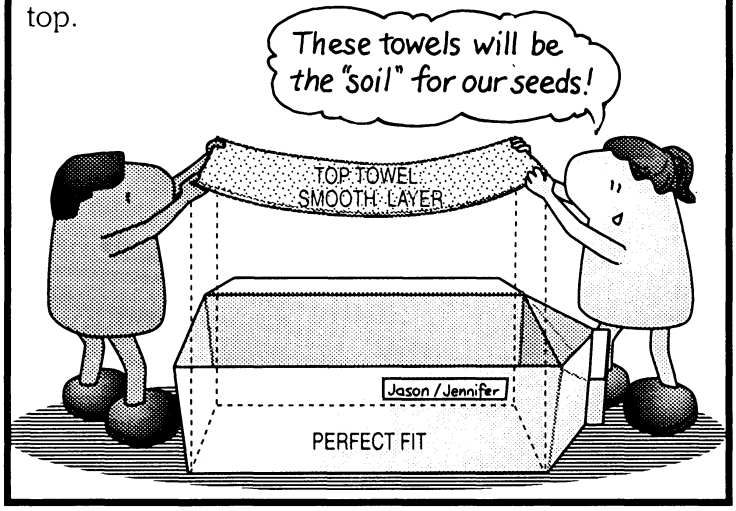
2 Starting in the corner hole, cut along 3 edges as shown. Leave one edge uncut to make a lid with a hinge.



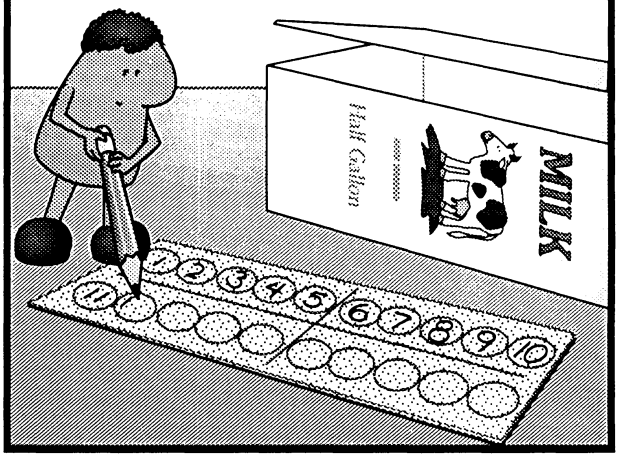
3 Write your name(s) on masking tape. Stick it to the side of your carton.



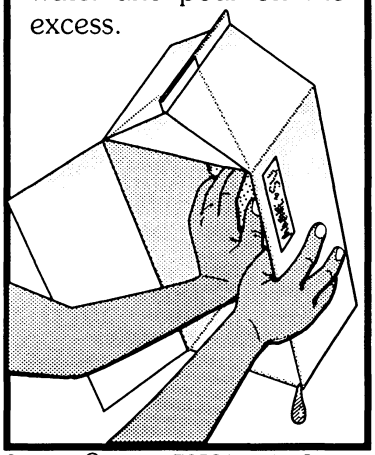
4 Fold 2 paper towels so they neatly cover the bottom of this *sprout tray*. Turn a smooth layer to the top.



5 Divide this top side into fourths with a ballpoint pen. Draw 5 circles in each quarter, and number them 1-20.

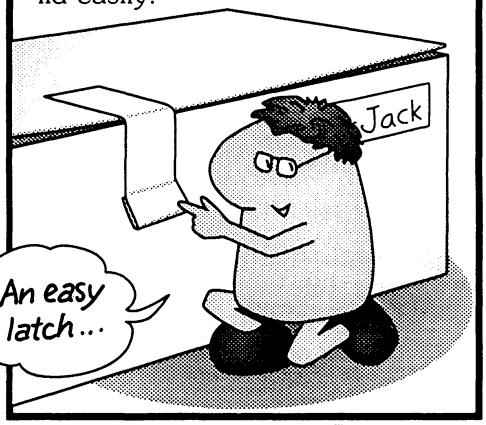


6 Lay the towels in your sprout tray. Soak with water and pour off the excess.



7 Set 1 radish seed in each circle on the towel.

8 Close the lid with masking tape. Fold a small tab at one end so you can open and close the lid easily.



Objective

To sprout radish seeds in a warm, moist environment, and organize them for future study.

Lesson Notes

Welcome to **Green Thumbs: Radishes**, a salad bowl of TOPS activity.

Begin this first lesson by distributing one copy of the Master Schedule to every student (or lab team). Ask them to write their name (and their lab partner's name) at the top.

Locate, with your class, the calendar box at the top of the MONDAY column in the row labeled WEEK 1. This box defines today's assignment. Notice that completing activities 1 and 2 will keep students on schedule.

Distribute a copy of activities 1 and 2 to each lab group. Students can share these instructions between them, since today they will be assembling shared equipment. There are no questions on these pages that require an individual response.

As students finish activity 1 (it takes perhaps 15 minutes), remind them to bring their sprout nurseries to you for a Check Point. Evaluate, and initial your approval in the large box on the Master Schedule, and students can proceed directly to activity 2.

1-2. Hand strength, good eye-hand coordination, and a sharp pair of heavy duty scissors are all needed to make neat cuts along 3 edges of the milk carton. Help younger children as necessary.

8. All lids must remain closed overnight to reduce cooling by evaporation and speed seed germination.

Scheduling

Related activities: **1**---3---4---7---9.

Check Point

Are 20 seeds in the sprout nursery, one inside each numbered circle? Are the towels saturated but free of excess (standing) water?

Materials

☐ A half-gallon (2 liter) cardboard milk carton.

☐ Scissors, sharp and strong enough to cut through the milk carton. Blunt-nosed children's scissors are not up to the job.

☐ Masking tape.

☐ Paper towels. Purchase a soft, highly-absorbent roll from your supermarket.

☐ A ballpoint pen.

☐ A gallon milk jug or large pitcher, filled with water, or a source of running water and containers for carrying it. This item will be assumed from now on.

☐ Radish seeds. Choose any fast-growing summer type, maturing in 3-4 weeks, such as Champion or Scarlet Globe. To estimate quantity, assume that each lab group will need 80 seeds altogether; or 1/10 of a seed packet; or enough to plant a 3.5 foot row; or enough to produce a yield of 3 dozen (seed quantities on different packets will usually be described in terms like these). If you have student helpers, ask them to count 80 seeds into separate envelopes for each lab group. Hand these out with this first activity, and make your students responsible for conserving their own radish seeds.

☐ File folders (optional). Even if students work in lab groups, each individual should still complete a full set of activity sheets and track personal progress on a Master Schedule. These pages are best stored in class, in a folder, with the Master Schedule on top. Students will often need to review directions, or to continue work on experiments still in process.

Important Notes

• **Seed Storage:** Radish seeds are tiny packets of life, and they need reasonable care. They will often stay viable for a year or longer if stored in a cool, dry place. Seal them in a plastic bag and refrigerate them if you won't begin this unit within two or three weeks. The seeds will use up their food reserves and expire if stored too long in a warm and/or moist environment.

If you have purchased this book along with a support kit through a curriculum seller, be aware that TOPS has not assembled that kit, and we are not responsible for its contents or condition. If your radishes fail to begin sprouting within 24 hours of "planting," they are not viable. Purchase some fresh seeds locally, or contact the vendor through which you purchased them for a replacement.

When buying seed, look for an expiration or sell-by date to be sure you're getting this year's stock.

• **Mold and Mildew Control:** Random spores of mold, mildew, and fungi drift through the air and may be present on almost any surface. These can get established in your growing system, particularly if your climate is warm and humid. Small outbreaks are not a worry unless you or your students are allergic, since radishes are vigorous and will usually grow well in spite of fuzzy clumps and weird blotches on paper towels.

If your climate is especially fungus-friendly, you can forestall unwanted growths by rinsing containers in a 10% chlorine bleach solution before using them, and lightly spritzing paper towels with the solution before planting. Students can also dab the solution directly on small outbreaks with a paintbrush or cotton swab. Use chlorine sparingly, though – it can be toxic to young sprouts. An alternative is to use undiluted 3% hydrogen peroxide from the drugstore.