

AUTUMN INVESTIGATION · GRADES 2-7 · ABOUT 30 MINUTES, THEN ONE WINTER OF PATIENCE

Which acorns are alive?

The sink-or-float test — and an oak tree of your own

Dear fellow scientist,

Every oak tree you have ever seen began as one acorn that made it. Most acorns never do. Some are hollow. Some have been eaten from the inside by a small grub while they were still on the tree. Some dried out. From the outside, they all look about the same.

Foresters have a quick way to tell which acorns still have a living seed inside: they drop them in water. Today you will play detective first — can your eyes and hands beat the water? — then use the foresters' test, open the evidence to see why it works, and keep the survivors through the winter. If all goes well, in spring you will be growing a tree.

1 INSPECT

Look at, feel and shake ten numbered acorns. Tick the clues you notice.

2 BET

For each acorn, write your bet: sink or float. No changing it later.

3 TEST

Drop them in one at a time and let the water vote.

4 OPEN

Cut one sinker and one floater and see who was right — and why.



Acorns look alike on the outside. Which ones are alive?

What you need

- A handful of acorns — twenty or more, ripe and brown, gathered from under an oak (green ones are not ready). Ten of them will be your numbered suspects; the rest are tested in bulk.
- A clear bowl or a big glass jar of water, and two towels — one for sinkers, one for floaters
- A marker or small sticky labels to number the acorns, a pencil, and this sheet
- A sharp knife and an adult — to open two acorns and look inside
- For the winter part: a paper towel, a zip bag, and a corner of the fridge
- For spring: a small pot and some potting soil

With several children, give each one — or each team — a bowl and ten acorns of their own. Ten is plenty for a satisfying investigation; extra acorns make the winter test stronger.

What to do

1. **Collect.** Pick up brown acorns whose caps come off easily. Leave the green ones for another week. Choose ten and number them 1 to 10 with the marker — these are your suspects.
2. **Inspect.** Before any water touches them, examine each suspect like a detective and tick what you notice in the **lineup** on the record page: a tiny round hole smaller than a pinhead, a crack or a dent, an acorn that feels unusually light in your hand, one that rattles when you shake it gently by your ear — or one that looks perfectly normal. Do not decide too quickly; some of the best clues are small.
3. **Bet.** Now write one bet for each acorn: **sink** or **float**. A scientist writes the prediction down *before* the test — because afterwards, your brain is very good at remembering that you “knew it all along”.
4. **Test.** Drop the suspects into the water one at a time and give each one a minute — some take their time. The ones lying on the bottom are the **sinkers**; the ones at the surface are the **floaters**. Write the water’s verdict beside your bet, and sort the acorns onto the two towels. Then test the rest of your handful in one go and count them.



The test: sinkers on the bottom, floaters at the top.

Quick challenge

Leave the floaters in the water for another ten or fifteen minutes. Does any of them slowly sink? If one does, what might have changed inside it? Keep that acorn apart — it has something to tell you at step 6.

5. **Score.** How many bets did you get right out of ten? Look down the lineup: which clue was ticked most often on the floaters? That is your champion clue. Which clue fooled you? Fill in the summary boxes on the record page.
6. **Open the evidence.** Ask an adult to cut one floater and one sinker in half lengthwise. A living acorn is packed solid with creamy-white food for the baby tree. A floater is different: hollow, dark, dried and shrivelled, or with a tunnel and perhaps a small white grub in it. Draw what you see in the boxes on the record page. Now you know why they float.



Inside: a healthy acorn is solid. A floater has air where the seed should be.

- 7. Keep the survivors.** Wrap the sinkers in a damp paper towel — damp, not dripping — and seal them in a zip bag with today's date written on it. Put the bag in the fridge and leave it there for the winter, at least ten weeks. Check it once a month: if the towel is dry, add a few drops of water; if an acorn has gone mouldy, take it out.
- 8. Plant.** In spring, plant each acorn on its side about as deep as your thumb, in a pot of soil on a bright windowsill. Water it when the soil feels dry. Be patient: the root comes first and grows down where you cannot see it. The shoot follows a few weeks later. Some acorns start growing a root right in the fridge — plant those straight away.

Why do the dead ones float?

Think of an acorn as a small package. A healthy one is stuffed full: the seed inside fills every bit of space, and all that food is heavier than water. A package heavier than water sinks.

Now imagine the same package with the food gone — eaten by a grub, or dried and shrunk away from the shell. What fills the space instead? Air. Air weighs almost nothing, so the package becomes lighter than the water it pushes aside, and up it comes. The water is not looking at the outside of the acorn at all. It is weighing the inside. That is also why it beats most of your clues: a hole or a dent is on the outside, but the water and the rattle both report on what is within.

A word older scientists use

Whether something sinks or floats depends on its **density**: how much stuff is packed into its size. A full acorn is denser than water; a hollow one, taken as a whole, is less dense than water. Same shell outside — very different inside. You will meet density again and again; it is one of the most useful ideas in all of science.

The forester's warning

The float test is good, but it is not perfect. Water gives evidence, not certainty. A grub-eaten acorn with a hole in it can fill up with water and sink like a healthy one — that may be what happened in the quick challenge. A living acorn that has dried out a little can float. Foresters know this, and they use the test anyway — because a test that is right most of the time, and takes one minute, is worth a great deal.

Here is the scientist's move: don't just trust the test — check it. That is what the planting is for. If you have enough acorns, keep five floaters too, in their own bag, treat both bags exactly the same all winter, and plant them in spring side by side. Then you will know exactly how good the water was at telling them apart.

Think like a scientist

Choose the questions that fit you. There is no wrong place to start.

- **Grades 2–4:** A hollow rubber ball floats. A solid rubber ball of the same size sinks. What is the same about them? What is different? Which acorn is like which ball?
- **Grades 4–6:** You tested 30 acorns and 12 floated. What fraction of your acorns is probably dead? If the oak dropped 600 acorns this autumn, about how many of those are alive — and why might that still be plenty for one big tree?
- **Grades 6–7:** Your lineup is data. Was your champion clue right every time, or only most of the time? Which is better: a clue that is always right but rarely shows up, or a clue that shows up often but is sometimes wrong? Then design the fair test of the float test itself: how many floaters and sinkers would you plant, what would you keep the same, and what result would make you doubt the water?

Did you know?

- The tiny hole in a floater is an exit, not an entrance. A weevil laid its egg through the soft young shell in summer; the grub ate the seed, grew up, and chewed its way out to spend the winter underground.
- A big oak can drop many thousands of acorns in one autumn, and then almost none the next year. Squirrels and jays bury far more than they ever dig up — the ones they forget become the forest.
- Why the fridge? Acorns of many oaks will not sprout until they have felt a long cold spell. That is a safety lock: it stops the seed from waking up on a warm week in November and freezing to death in December. Your fridge is a pretend winter.



The pretend winter.



The reward, some months later.

Take care

An adult does the cutting. Wash your hands after handling acorns and grubs. Do not eat acorns — raw ones are very bitter and can upset your stomach. Keep the acorns and small pieces away from little brothers and sisters and from pets.

MY RECORD

Acorn detective record

Name: _____ Date: _____

Oak, if you know it: _____

1 • The lineup

Tick only what you really notice. Then write one bet for each acorn — S for sink, F for float — and do not change it once the water starts.

#	tiny hole	crack or dent	feels light	rattles	looks normal	MY BET sink / float	THE WATER SAID sink / float
1	☐	☐	☐	☐	☐		
2	☐	☐	☐	☐	☐		
3	☐	☐	☐	☐	☐		
4	☐	☐	☐	☐	☐		
5	☐	☐	☐	☐	☐		
6	☐	☐	☐	☐	☐		
7	☐	☐	☐	☐	☐		
8	☐	☐	☐	☐	☐		
9	☐	☐	☐	☐	☐		
10	☐	☐	☐	☐	☐		

2 • The real data

Count the ten suspects first; then add the rest of your handful to the totals if you tested them.

SINKERS	FLOATERS	BETS I GOT RIGHT (of 10)	TOTAL ACORNS TESTED
_____	_____	_____	_____

For grades 5 and up — the share of acorns that sank:

$$\text{sinkers} \div \text{total} \times 100 = \text{_____} \div \text{_____} \times 100 = \text{_____} \%$$

3 • Inside the acorns

Draw what you saw, or glue in a photo. Label the seed, shell, tunnel, grub, empty space.

A sinker, cut open 	A floater, cut open
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4 • The winter and the spring

Date	What I did	What I saw
	Bag into the fridge	
	Checked the bag (month 1)	
	Checked the bag (month 2)	
	Planted the acorns	
	First shoot!	

Testing the test — if you kept a bag of floaters too:

Group	Sprouted	Out of
Sinkers		
Floaters		

So the water was right about _____ % of the sinkers and _____ % of the floaters.

A note from Professor Alexey

You did what real scientists do every day: gathered clues and wrote your prediction down first, let the test give its verdict, opened the evidence to see why it works, and planned a way to check whether it can be trusted. Well done. Keep this sheet — when the first leaf appears, come back and finish it.

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