

Did the pencil bend?

Ages 4–7 with a grown-up · 5–10 minutes · Check an appearance

<https://kiddos.ai/explorations/learning-with-gina-and-ollie/did-the-pencil-bend>

Wonder together

Just add water? Gina leans a pencil in an empty cup. Will adding water change how it looks?

Materials

A clear smooth-sided unbreakable cup, room-temperature water, an unsharpened pencil and a tray.

Adult setup – read before trying

An adult rests the pencil diagonally, then fills the cup about two thirds full. Handle the pencil away from faces; no detachable eraser, lasers or bright lights into eyes. No tasting; wipe spills and empty the cup.

Try together

1. Adult angles an unsharpened pencil in an empty clear plastic cup.
2. Predict; adult adds water to about two thirds full. Look from the side near the waterline.
3. Adult removes pencil; compare its straight shape. Change viewpoint and repeat.

Keep the comparison clear

Keep fixed: Cup and straight pencil; keep its position while adding water.

What changes: Water around the lower part, then your viewpoint.

Look for: Look near the waterline, then remove and dry the pencil to check its shape.

Explain with care

Light from the submerged pencil changes direction across material boundaries on its way to your eye, making part look shifted.

Cup walls also affect the image. The simple diagram omits those boundaries; different viewing angles need not show the same apparent bend.

Talk about it

Just add water? Gina leans a pencil in an empty cup. Will adding water change how it looks?

Answer cue: Welcome a guess before reading the result. No correct prediction is required.

Where does the pencil seem shifted?

Answer cue: Near the boundary between its submerged and above-water parts.

What can we do to check whether it really bent?

Answer cue: Take it out, dry it and look along its straight length.

A parent move: Separate “looks bent” from “is bent” without dismissing what the child sees.

Start simply: An adult adjusts the viewing height while the child points to the apparent change.

Explore further: Compare two viewing positions with the same cup and pencil.

Return to it: Ask how checking an object another way helped you understand its appearance.

In the classroom

Flexible 20-minute small-group session; pause or shorten as needed.

3 min · Wonder

Read pages 1–2. Invite a prediction with words, pointing or a sketch; keep the result hidden.

4 min · Notice the story

Read pages 3–5. Where does the pencil seem shifted? Separate the observation from the explanation.

9 min · Try together

Use the materials and adult setup on this guide, then follow the activity steps in this guide. Look near the waterline, then remove and dry the pencil to check its shape.

4 min · Make meaning

What can we do to check whether it really bent? Invite a drawing, a description or an adult-written note. Separate “looks bent” from “is bent” without dismissing what the child sees.

Understanding check

What can we do to check whether it really bent?

Answer guidance: Take it out, dry it and look along its straight length.

Participation choices: An adult adjusts the viewing height while the child points to the apparent change. Accept pointing, words, a drawing or adult-directed action. Use the story alone if the activity is unsuitable.

Words to explore

refraction — A change in light’s direction as it passes between materials.

Full adult notes and honest limits

Set a clear, smooth-sided, unbreakable plastic cup on a stable tray or mat. Use ordinary room-temperature water and one straight unsharpened pencil, preferably without a detachable eraser. An adult rests the pencil diagonally in the empty cup with its lower end supported by the base and upper shaft resting on the rim. Invite a prediction before adding water. The adult slowly fills the cup about two thirds full without changing the pencil position; part must remain above the water. View from the side, near the waterline, and gently vary viewing angle until the submerged portion looks shifted. The adult then lifts the pencil out, dries it, and lays it alongside the cup so the child can look from end to end. It is still straight. The observed bend or break is an optical effect, not damage or a change in pencil shape. Light from the submerged part changes direction as it crosses material boundaries on its way to the eye. Curved cup walls also refract and can magnify or shift the image; the simple page-5 diagram isolates one water-to-air boundary rather than tracing the full cup geometry. Its arrows show direction toward the eye, not light emitted by the eye or a visible beam. Refraction depends on angle; light entering square-on need not change direction. Invite the child to point, describe, choose a new viewpoint or direct the adult. Ask "What changed when we added water? What stayed the same?" Repeat at a different viewing angle, keeping the same cup and pencil. If the effect is faint, try a smoother clear cup, a different pencil angle or a different viewing height; do not promise every view looks identical to the illustration. For a small group, collect different guesses and draw the observed pencil before and after; independent reading is unnecessary. The adult pours and handles the pencil away from faces; keep experiment materials out of mouths, wipe spills, and empty the cup afterward. Use ambient room light; no lasers or bright lights aimed into eyes. The activity takes only a few minutes and needs no special equipment. Gina and the Light Chase is related reading about light, shadows and reflection; the shipping story does not contain this pencil experiment. No live family trial or measured learning outcome is claimed.

Related reading

Gina and the Light Chase explores shadows and reflection. Refraction in this pencil activity is another light discovery, absent from the story.

Scientific sources

ingenium-broken-pencil — <https://ingenium.ca/en/learn/science-at-home/broken-pencil-illusion/>

aps-bendy-light — <https://www.aps.org/learning-resources/bendy-light>

openstax-physics-refraction — <https://openstax.org/books/physics/pages/16-2-refraction>

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App Store: <https://apps.apple.com/app/id6720721998>

Available physical books: <https://www.amazon.com/author/kiddos-books>