

The Puddle Portal Field Map

Move your feet. Remap the sky.



VIEWPOINT • REFLECTION • EVIDENCE					OUTDOOR FIELD RUN
ACT-2026-09-18 ACCESSION	OUTDOOR SETTING	AGES 3+ WITH ADULT AGE	30-45 MIN TIME	LOW PREP	\$0-\$8 COST

TODAY'S WONDER

Why can a puddle show the sky when the sky is above it?

A puddle can act like a flat mirror. Light from the sky and nearby objects hits the smooth water and reflects toward your eyes. Incoming and reflected light follow matching angles, so moving your head changes which rays reach you—and which part of the world appears in the puddle. Ripples tilt the surface into many tiny angles, breaking one clear picture into shifting pieces. The puddle does not keep one picture. It changes its answer when you change the question—and the question is where you stand.

FIELD PROMISE	Keep the tray and landmarks still. Let the observer move. Record what enters the water—not what you hoped would appear.
BUILDS	prediction • spatial mapping • perspective • measurement • evidence-based explanation

Build the portal before the picture

FAIR-RUN CONTROLS			
VARIABLE	KEEP	CHANGE	WHY IT MATTERS
Portal	Same tray, depth, place	Still water / one ripple	Separates surface motion from viewpoint.
World	Landmarks stay fixed	Observer station / height	Only the receiving light path changes.
View	Same frame opening	What enters the frame	Makes station maps comparable.
Evidence	Sketch what is visible	Prediction may change	A mismatch is data, not failure.

MATERIALS

- 1 shallow dark unbreakable tray or roasting pan; 1-2 cm clean water
- Sidewalk chalk or 4 paper station markers; masking tape if chalk is unsuitable
- 2-4 full-size visual landmarks: cloth flags, cone, bright towel, branch, or building edge
- Kraft cardboard viewfinder with a large adult-cut window
- Clipboard or notebook, pencil/crayons, timer, wooden spoon or dropper
- Absorbent towel; optional ruler, measuring tape, string, crumpled foil

PREPARATION

- Adult chooses a flat, stable, non-slip outdoor site with open sky or nearby scenery.
- Set tray where nobody must step over it. Fill shallowly; place towel within reach.
- Plant landmarks beyond different tray edges. Mark four distinct stations around the tray.
- Adult cuts the viewfinder; test one station without revealing the answer map.

SAFETY GATE

- Adult supervision is continuous; use no glass or breakable container.
- Never look at the Sun or deliberately search for its reflection; choose soft shade if glare is strong.
- Keep water shallow. Wipe spills at once. Do not stand, sit, or lean on the tray.
- Use full-size materials; keep dropper caps and chalk pieces from mouths. Empty water after use.

STATION BLUEPRINT • TOP VIEW

LANDMARK 1 • CORAL FLAG

LANDMARK 2 • BRANCH / ROOF EDGE

STILL-WATER PORTAL

A • HIGH

C • LOW

D • NEAR

B • SIDE

PRE-RUN CHECK

☐ tray stable

☐ water shallow

☐ glare safe

☐ stations distinct

☐ towel ready

☐ world stays fixed

Run the Puddle Portal Field Map

1 SITE

Stand at the chosen site and scan for open sky, branches, flags, rooflines, or clouds. Adult confirms glare is safe.

2 BUILD

Set the dark tray flat and add 1-2 cm of water. Wait until the surface becomes still enough to hold a readable picture.

3 PLANT

Place two bright landmarks beyond different tray edges. Nobody moves the tray, landmarks, or water between station maps.

4 MARK

Create stations A-D around the tray. Give each a body cue—high, side, low, or near—without prescribing the answer.

5 PREDICT

At each station, name or draw what you expect inside the water. Add an eye-height mark: low, middle, or high.

6 MAP

Look through the cardboard frame. Sketch only what appears. Circle one surprise and one feature that stayed identifiable.

7 SEEK

Partner names one landmark. Without touching the setup, move your body until it appears in the portal. Mark the found station.

8 RIPPLE + CLAIM

Touch one edge once with spoon or dropper. Count until the image is readable again. Explain what position and ripples changed.

WHAT TO NOTICE

- A tiny head movement can trade sky for branch, flag, or roofline.
- The water may look like a deep window even though the image is virtual.
- Still water organizes one crisp path; ripples redirect many small patches.
- A wrong prediction becomes a better station map after observation.

WHY IT WORKS

Light from the sky and landmarks strikes the water and reflects toward the observer. At each smooth patch, the incoming angle equals the reflected angle. Moving the eyes selects a different path. A ripple tilts many patches, so neighboring rays travel in different directions and the single image fragments or shimmers.

MECHANISM MAP

SKY / LANDMARK → SMOOTH WATER → EYES • MOVE EYES = NEW PATH • RIPPLE = MANY TILTED PATHS

Make the portal prove its claim

STATION MAP • RECORD BEFORE EXPLAINING				
STATION	PREDICTION	ACTUAL WATER PICTURE	EYE HEIGHT	SURPRISE / EVIDENCE
A • HIGH				
B • SIDE				
C • LOW				
D • NEAR				

RIPPLE RECOVERY TRIALS <table><tr><th>TRIAL</th><th>TOUCH</th><th>READABLE AGAIN</th><th>WHAT CHANGED?</th></tr><tr><td>1</td><td></td><td></td><td></td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td>3</td><td></td><td></td><td></td></tr></table>	TRIAL	TOUCH	READABLE AGAIN	WHAT CHANGED?	1				2				3				CLAIM BUILDER At station ____ I could see _____. When I moved _____, the picture _____. One ripple made _____. This is evidence that _____.
TRIAL	TOUCH	READABLE AGAIN	WHAT CHANGED?														
1																	
2																	
3																	
QC • ACCEPTANCE CRITERIA • Tray and landmarks remain fixed through all four station maps. • Each station has a prediction and an observation made through the same frame. • At least one viewpoint change produces a clear image change or an honest no-change result. • Ripple trial uses one controlled touch; recovery is counted consistently. • Final claim names a station, observation, and mechanism—not merely ‘it reflected.’	TROUBLESHOOTING • No image: darken the tray, wait for still water, lower the eyes, or add a bright landmark. • Only sky: move closer/lower or place a landmark beyond the far edge. • Too much glare: relocate to shade; never chase the Sun’s reflection. • Windy surface: use a sheltered site or wait; log wind as a variable. • Maps look identical: spread stations farther apart and hold the frame at the same distance.																
PORTAL PASSPORT	☐ predicted ☐ mapped four stations ☐ found a landmark ☐ timed one ripple ☐ made an evidence claim																

Leave the field ready for the next question

YOUNGER INVESTIGATORS

- Adult handles tray and water; child points to sky / not-sky, still / wiggly, same / different.
- Use two stations instead of four and one bright cloth landmark.
- Invite a color hunt: 'Move until coral enters the portal.'
- Let the child make one gentle edge ripple; adult counts aloud.
- Accept pointing, matching, gesture, or a single mark as a valid field note.

ACCESS ADAPTATIONS

- Bring the tray to a table or raised stable platform for seated access; never balance it on a lap.
- Use high-contrast station cards, tactile markers, or spoken station names.
- Offer a phone camera only as a fixed framing aid; direct observation remains primary.
- For low vision, use a vivid close landmark and compare brightness or color blocks.
- For sensory comfort, skip splashing; use a dropper and quiet countdown.

EXTENSIONS • OLDER MINDS

- Ray-string model: stretch two strings from landmark to one water point and onward to the eye; compare the angles.
- Coordinate map: measure station distance and eye height; graph where each landmark becomes visible.
- Surface comparison: place safely crumpled foil beside the tray and compare one ordered image with scattered highlights.
- Ripple dose: compare one, two, and three equal drops; time recovery and discuss fair testing.
- Portal atlas: repeat at morning, noon, and late day without seeking the Sun; map how the scene changes.
- Reverse challenge: start from a reflection target and predict where the observer must move before testing.

CLEANUP

Pour water onto appropriate soil or drain; dry tray and site; collect chalk, flags, frame, notes, spoon, and towel.

VERIFIED REFERENCES • OPENED SEPTEMBER 18, 2026

PRIMARY • Science Learning Hub, University of Waikato — Reflection of light

<https://www.sciencelearn.org.nz/resources/48-reflection-of-light>

SUPPORTING • OpenStax Physics — 16.1 Reflection

<https://openstax.org/books/physics/pages/16-1-reflection>

BENCH NOTES

The observer belongs in the system. Preserve unexpected station maps; they reveal where the model needs to grow.

OPEN BENCH • NOTES, QUESTIONS, NEXT TEST

CLOSE-OUT ☐ water emptied ☐ site dry ☐ materials returned ☐ map saved ☐ next question captured