Activities (full instructions)

Building-inspector round

Each child ties a washer to a string — their own plumb bob to keep. The round: certify walls VERTICAL (bob hangs parallel to the wall), surfaces HORIZONTAL (marble stays put; the torpedo level's bubble centers; a water glass's surface lies flat). Anything leaning goes on the reject list. Tally on the worksheet; most correct certifications earns the inspector badge (the torpedo level, held for the day).

Globe down-under

Figurine stickers stand on the globe here, in Australia, at the poles. Ask each figurine's "down" and let the children reason every arrow to the same center BEFORE confirming. The tricky case: a flying bird — gravity still pulls it down while its wings push air down for lift; BOTH forces present (C-7 callback).

String-swing orbit

Teacher swings a soft ball on a string in a flat circle: the string is the inward pull. LET GO — it flies off straight (C-5's inertia). Earth's gravity is the moon's string: an orbit is falling around, forever, without landing.

Harness flying (rig-dependent)

If the ceiling-hook rig is available, re-rig and REUSE it — do not buy. Adult-run with the standing safety talk. The felt lesson: the rope's upward hold against gravity's constant pull; let go a little slack and the pull answers instantly.

SAFETY

Harness flying is ADULT-run on the proven rig only, safety talk first, one flyer at a time. The drop race lands on bare floor, never near feet. The oil jar rides a tray. Plumb-bob strings stay out of little siblings' reach after the round.

Common Misconceptions

- "People in Australia are upside down" → everyone's down points to the same center; nobody hangs.
- "Heavy falls faster" → the drop race settles it: same instant. (Feathers are C-6's air story, not gravity's.)
- "The balloon escapes gravity" → the heavier air sinks and SHOVES it up; gravity is pulling harder than ever — on the air.
- "The moon just hangs there" → it is falling around us forever; the string-swing release shows what would happen if gravity let go.

STRETCH (ranch, adult-run)

(1) The water-level: 25 ft of clear tubing filled with water — its two ends ALWAYS rest at the same height, around corners, across the yard: horizontal at yard scale, the tool old builders leveled foundations with. (2) Plumb-bob audit of a real outbuilding: is the old barn still vertical? Measure the lean in inches and report. (3) If rigged, harness flying as the day's opener rather than mid-morning.

Review Hooks

- Notebooks: the globe with every down-arrow meeting in the middle.

- All week: certify one wall or shelf a day with the take-home plumb bob.
- Night sky: find the moon and say what it is doing (falling around us, forever).

Prep-Ahead Checklist (night before)

□ tie one washer-and-string plumb bob per child □ check the torpedo level's bubble; marble in pocket □ clear jar of water + A-9 pipette + cooking oil on a tray □ pick the two same-size, different-weight balls and test the tie □ figurine stickers on the globe (here, Australia, poles) □ soft ball on a string for the orbit swing □ if flying: re-rig the harness, inspect every link, rehearse the safety talk

BFSU D-1 · TEACHER

Opening Oration — The Pull With No Off Switch

read aloud, 2–3 minutes • a homemade plumb bob dangles from your fist throughout

PROP: a plumb bob — a heavy washer on a string. Hold it up as you begin and let it hang dead still. Pass it at the marked moment so every child watches it find vertical.

"Right now, this very second, something invisible is holding onto you. It held you all night. It will hold you every day of your life, and it has never once let go of anything. Watch." *(hold up the plumb bob; let it settle)* "See how the string points? Not sideways. Not crooked. Straight down — perfectly — every single time. That invisible puller is called **gravity**, and this little tool is how builders have listened to it for five thousand years."

"But here is the question that puzzled sailors and children forever: down… toward WHERE? If a child in Australia — on the far bottom of the world — drops an apple, which way does it fall? Does she fall off?" *(let them argue a moment)* "She does not. Her apple falls DOWN — and her down and your down both point to the very same place: **the center of the Earth**. Gravity pulls everything toward the middle. That is why the world has no edge to sail off, and no bottom to fall from. Every 'down' on Earth meets at one point, thousands of miles beneath your shoes."

"Today you will become building inspectors. Gravity gives builders their only two honest directions: **vertical** — lined up with this string — and **horizontal** — flat across, the way still water lies. You will certify this house wall by wall. You will weigh gravity's pull on your own body in pounds. You will race a heavy ball against a light one and discover something Galileo had to argue about. And at the end I will tell you the most honest thing in all of science…" *(pass the bob)* "…which is that nobody — nobody in the world — knows WHY gravity pulls. Not yet. Maybe one of you will be the one to find out."

BFSU D-1 · TEACHER

D-1 Supply List — Gravity I

Everything for the full 9:30–2 day. **Almost everything is owned or household** — the level is the one real purchase, and it is a tool for life.

Already Have (owned / household / prior kits)

☐	Item	Used in
☐	**The ceiling-hook climbing-harness rig (owned)**	Harness flying — REUSE; never buy
☐	Globe + figurine stickers	Down-under Socratic
☐	Bathroom scale	The weigh-in
☐	Pipettes (A-9 kit) + clear jar + cooking oil	The oil-drop float
☐	A marble + a water glass	Horizontal certifying
☐	Soft ball + string	The orbit swing
☐	A dozen droppable objects	The oops-drop survey

TO BUY

☐	Item	Qty	~Price	Why	Order ahead?
☐	Torpedo level	1	$8	The inspector's badge — and a real tool for life	No (hardware store)
☐	Heavy washers + string	—	$4	One plumb bob per child, theirs to keep	No
☐	Golf ball + hollow plastic ball	1 pair	$3	The drop race — only if not on hand	No

Total new spend: ~$15.

Check-you-own-it notes

- The harness rig exists and is proven — inspect it, never replace it.
- Drop-race balls must be the SAME SIZE and compact — that keeps air resistance (C-6's story)

out of gravity's experiment.

> Tick the box beside each item as it goes in the box. Anything flagged **order ahead** ships — buy it a week before the lesson.

The Oil Drop Under Water

KIDS HANDS-ON | RUN AT 11:25 | 20 MIN

The point

Gravity never turns off — yet the oil drop RISES. The truth is a seesaw: the heavier water sinks past and **shoves the lighter oil up**. This is the honest explanation for every helium balloon.

Materials

- Clear jar of water on a tray
- Cooking oil in a cup
- Pipettes (A-9 kit)

Steps

1. **PREDICT first** (worksheet): the oil drop will… sink / float up.
2. Each child draws a little oil into the pipette, pushes the tip UNDER the water, and squeezes one drop low in the jar.
3. Watch it wobble upward, join its friends, and settle as a layer on TOP.
4. Circle what really happened. Now the argue question: did gravity let go of the oil?
5. Reason it out: gravity pulls BOTH — but it pulls the heavier water harder; the water sinks past and shoves the oil up. A seesaw, not an escape.
6. Say what is really shoving a helium balloon up. (The heavier air, sinking past it.)

> *Say: "Nothing escapes gravity — not oil, not balloons, not you. When something floats UP, look for the heavier stuff sinking past it and doing the shoving."*

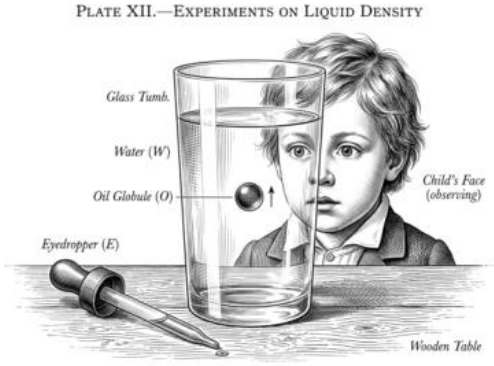


Fig. 1. A Globule of Olive oil rising through Water

TEACHER PREP

Tray under the jar; a drop of dish soap in reserve for cleanup; test the pipette draw with littles' hands in mind.

What to watch for

- The tip must go UNDER the water — a surface drop teaches nothing
- The argue moment before the explanation; let sink/float wrestle

EXPECTED RESULT

Every drop rises and pools on top. Gravity held everything the whole time — the heavier fluid just always wins the bottom.

The Drop Race

KIDS HANDS-ON | RUN AT 11:50 | 15 MIN

The point

A heavy ball and a light ball, same size, same height — and they land **at the same instant**. Gravity pulls all matter alike. Galileo argued this; today the floor settles it.

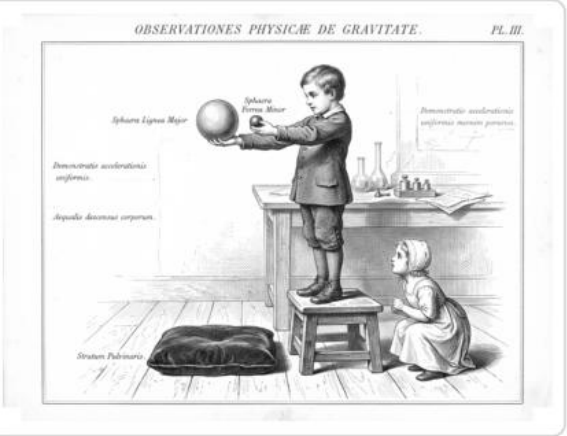
Materials

- Two same-size balls, very different weights (golf ball + hollow plastic)
- A chair or step for height · bare floor landing zone

Steps

1. **PREDICT first** (worksheet): heavy first / same time.
2. One child holds both balls at exactly the same height — knuckles level, a helper checks.
3. A countdown, and release together — not a throw, a release.
4. EARS as well as eyes: one thud or two?
5. Repeat until the release is clean and the single thud is undeniable. Rotate droppers.
6. Circle what really happened. Why same-size balls? (So the air's push-back — C-6's story — stays out of gravity's experiment.)

> *Say: "Four hundred years ago a man named Galileo said heavy and light fall together, and people laughed. You just ran his experiment — and heard one thud."*



TEACHER PREP

Choose compact same-size balls and test the tie yourself; a hollow ball that's too light drags on the air and muddies it.

What to watch for

- Level knuckles at release — the helper's whole job
- Listening for one thud convinces better than watching

EXPECTED RESULT

One thud, every clean release. Heavy and light land together — gravity pulls all matter the same, and a five-year-old can prove it.

Gravity

The pull toward the very center of the Earth — and the two directions it gives us

The Big Idea

***Gravity** pulls everything toward the CENTER of the Earth, constantly, with no off switch. Anything unsupported falls — and "down" in Australia and "down" here point to the same middle, which is why nobody falls off anywhere.*

Weight is gravity's pull on a thing, read in pounds. Gravity also hands builders their two directions: **vertical** is lined up with the pull (the plumb line finds it), **horizontal** lies level across (still water and the rolling marble find it). Heavy and light things fall **together**; balloons rise only because the heavier air sinks past and shoves them up; and the moon is forever **falling around** the Earth — an orbit is gravity's pull bending a straight flight into a circle.

Why does gravity exist at all? Honest answer: nobody knows yet. Science keeps that question open, out loud.

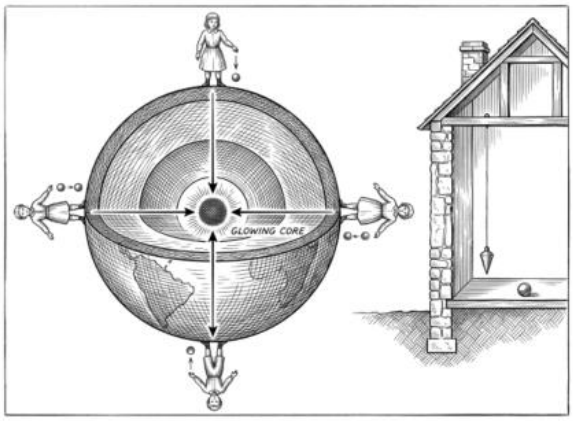


Fig. 1 — four children, four drops, one destination: every "down" runs straight to the Earth's middle — and the plumb line and level floor agree

Words to Know

gravity
the Earth's constant pull toward its center

weight
how hard the pull is on a thing, in pounds

vertical
lined up with gravity — the plumb line finds it

horizontal
lying level across — still water and a resting marble find it

level
the builder's bubble tool that certifies horizontal

orbit
falling around and around without ever landing

Watch For This in Everyday Life

- Hold a weight on a string — *"watch it find vertical, every time."*
- Check any shelf with a marble — *"horizontal, or a reject?"*
- Watch a helium balloon rise — *"what is really shoving it up?"*



gravity

gravity

vertical

vertical

horizontal

horizontal

BFSU D-1

Down Means Toward the Middle

The plumb line, the level floor, and the globe with no edge

WORKSHEET

1 · Draw a line from each tool to the part of the house it checks



the plumb bob, hanging ○



the WALL — standing straight up ○



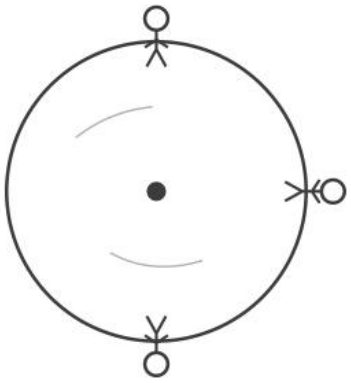
the bubble level, resting ○



the FLOOR — lying flat across ○

2 · Draw every child's "down" arrow on the globe

Three children stand around the Earth. Draw each one's falling-ball arrow — where do all the arrows meet?



3 · Guess first, then circle what really happened

The oil drop under water

The little oil drop will…

(sink to the bottom) (float up)

The drop race

The heavy ball and the light ball will land…

(heavy one first) (at the same time)

BFSU D-1

The Inspector's Report

Weigh it, certify it, and draw the house gravity would wreck

WORKSHEET

1 · The weighing chart — colour the bar to the scale's reading

Say it the scientist's way each time: "Gravity's pull on ___ is ___ pounds." Then circle: would the moon pull harder or softer?

WHAT WE WEIGHED	COLOUR THE BAR TO THE POUNDS	ON THE MOON?
a stack of books		harder · softer
the watering can, full		harder · softer
ME		harder · softer

2 · The inspector's tally

One tally mark for every wall and surface you certified on the inspection round.

VERTICAL — certified	HORIZONTAL — certified	LEANING — reject!

3 · Draw the silly house

Walls leaning, floors tilting — draw what gravity does to the soup, the marbles, and the whole house. Now you know why builders carry a plumb bob.

the house no inspector would certify

BFSU D-1

Down Means Toward the Middle

the lesson's song — sing it, then say what it means

SONG

Verse 1

Let go of a stone and it doesn't just stay,
Everything unsupported falls away.
Not sometimes, not mostly — every single time,
Anywhere on Earth, and that's the rhyme.

Chorus

Gravity! Gravity! Pulling toward the middle!
Down isn't under, down is IN.
Vertical, horizontal, plumb line and level —
There's no edge to fall off. Let's sing it again!

Verse 2

A child in Australia stands upside down to me,
But she feels right side up, as right as can be.
Her down and my down both point the same way:
Straight to the middle, night and day.

(Chorus)

Verse 3

Hang a weight on a string and let it be still,
That's vertical, that's plumb, that's the builder's will.
Lay the bubble flat till it sits in the middle,
That's horizontal, that's level. Solve the riddle!

Verse 4

Step on the scale and read what it said:
Gravity's pull on me is that many pounds instead.
On the moon you'd weigh less, you'd bounce and you'd hover —
Less pull up there, but it's pulling however.

(Chorus ×2)

Tag (spoken, kids): "Gravity... vertical... horizontal... LEVEL!"

How to use it. Play the recording once while everyone just listens. Play it again and join in on the chorus only — that is the part carrying the lesson. By the third time most children have the chorus. Then close the binder and ask what the words actually mean; a child who can sing it and explain it has the idea for good.