



*Air seems like nothing at all — but air is **real stuff**. It takes up space, it has weight, and it pushes on you from every side, right now.*

THE BIG IDEA

Anything that takes up space and has weight is **matter** — real stuff. Rocks are matter. Water is matter. And air passes both tests too, even though we can't see it. All the air together makes the **atmosphere**, an ocean of air wrapped around the whole Earth, held down by **gravity**. It gets thinner as you go up, until it runs out — and that is where space begins.

THREE PROOFS AIR IS REAL



IT TAKES UP SPACE — the upside-down glass stayed full of air, so the water could not get in and the paper stayed dry.



IT HAS WEIGHT — the balloon full of air pulled its side of the balance down. We even counted its weight in paper clips.



IT PUSHES FROM EVERY SIDE — when the air inside was gone, the air outside crushed a metal can flat. Nobody touched it.

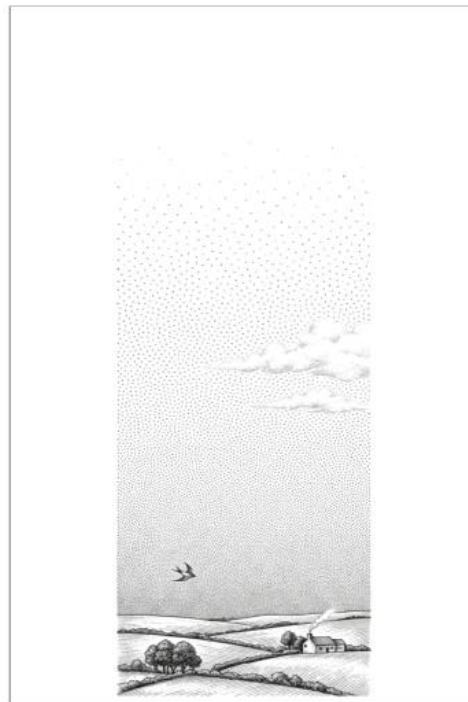


Fig. 1 — **the atmosphere**: you live at the bottom of an ocean of air. It thins as you climb — past the birds, the clouds, the jets — until space, where there is none.

WORDS TO KNOW

air

space

weight

pressure

vacuum

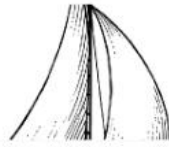
atmosphere

gravity

air — real stuff all around you that you can't see · **space** — the room something takes up · **weight** — how hard gravity pulls something down · **pressure** — air pushing on everything from every side · **vacuum** — a space with the air taken out · **atmosphere** — the ocean of air wrapped around Earth · **gravity** — the pull that holds everything down

WATCH FOR THIS IN EVERYDAY LIFE

- Playing in the bath, push a jar upside-down under the water. *Why won't the water go in?*
- Press a suction cup on the fridge and tug. *Nothing is inside it — so what is holding it on?*
- Squeeze a sealed bag of “nothing” or a pumped-up ball. *What is pushing back at you?*
- Your ears pop on a big hill or a long drive. *What just changed its push on your ears?*
- Feel the wind on your face. *What is bumping into you that you cannot see?*



air

air

space

space

weight

weight



1 • MATCH EACH THING TO ITS HOME IN THE SKY

The air ocean has layers. Draw a line from each picture's little circle to the circle of the layer where it belongs. The dots inside each layer show how much air is there.

SPACE
 no air at all — the black sky begins

THERMOSPHERE
 almost no air left up here

MESOSPHERE
 shooting stars burn up here

STRATOSPHERE
 calm, clear, and very quiet

TROPOSPHERE
 where we live — all the weather is here. Lightly color this layer.

jet plane

shooting star

bird

space station

cloud

weather balloon



Gravity holds the whole ocean of air down onto the Earth — air has weight, so gravity can hold it. That is why it doesn't float away into space.



A guess is never wrong — it's a prediction, and predictions get tested. Circle one picture *before* each experiment.

1 • DRY PAPER UNDER WATER



A dry paper ball is wedged inside the glass. The glass goes upside-down, **all the way under the water**. What happens to the paper?



soaked through



stays dry



glass fills right up

draw what really happened

2 • THE BALLOON BALANCE



Two empty balloons hang level. We fill **ONE** with air and hang it back. What does the balance do? *After: how many paper clips to make it level again?*



full side sinks down



stays level



full side floats up

draw what really happened

3 • THE CANDLE AND THE CUP



A candle burns in a dish of water. We lower a glass right over it, rim under the water. What happens?



flame keeps burning



flame out, water climbs in



the cup pops off

draw what really happened

4 • THE CAN CRUSH



The can is hot and full of steam. We flip it upside-down into icy water. Nobody touches it. What happens?



nothing happens



crushed flat — from every side



pops open bigger

draw what really happened

Think like a scientist: for each experiment, tell someone **WHO** did the pushing. Hint: it is always the same invisible somebody.

**(VERSE 1)**

You can't see it, can't hold it, but it's everywhere
you go,
It fills up your balloon and every bubble that you
blow.
It kept the paper dry inside the glass beneath the
sea —
The glass was never empty... it was full as full can
be!

(CHORUS — CALL AND RESPONSE)

Air is real! (Air is real!)
It takes up space — that's how we know!
Air is real! (Air is real!)
It has a weight — the balance told us so!
It pushes every side of me, it pushes high and low
—
We live down at the bottom of an ocean of air,
heigh-ho!

(VERSE 2)

It tipped the balance over when we pumped one
balloon fat,
It crushed a can of metal — BANG! — as quick as
that!
It squeezes from all around us, but we never feel
it squeeze,
'Cause it pushes up and down and sideways, even
on our knees!

(CHORUS)**(VERSE 3)**

Take the air out of a space and a vacuum's what
you've made —
The marshmallows puff up giant, and the beeper
starts to fade.
And gravity holds our blanket down, way up until
it's gone —
The atmosphere, our ocean of air... so breathe,
and sing along!

(CHORUS — BIG FINISH)

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.