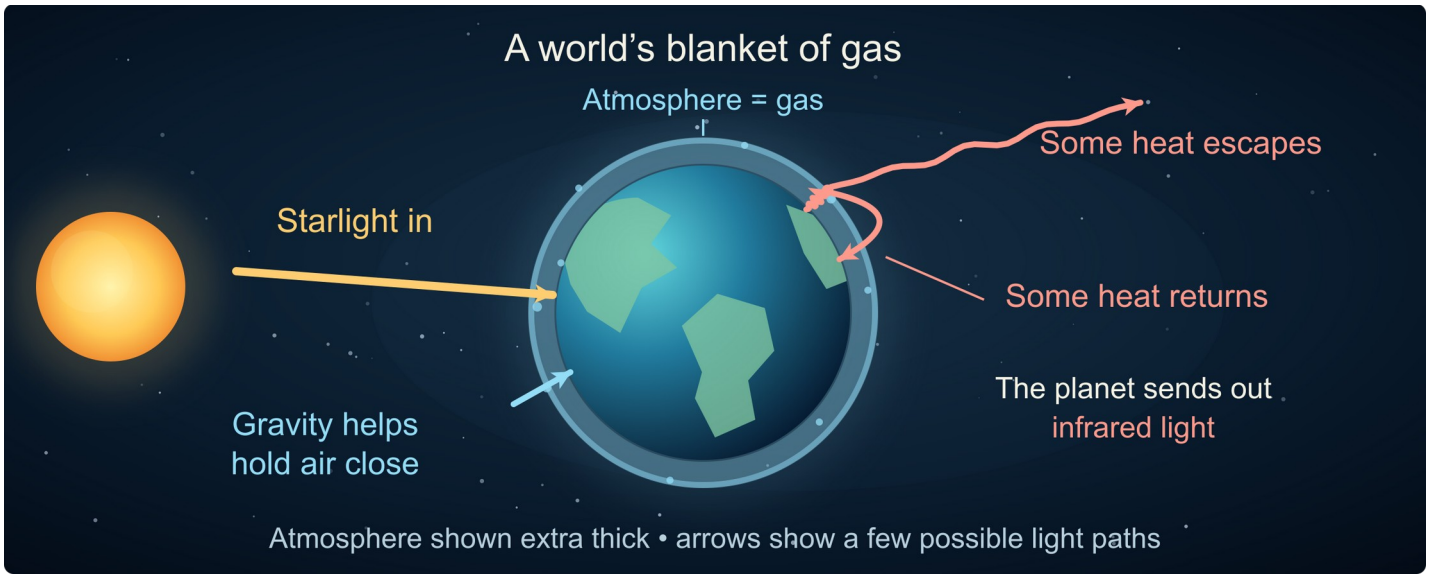
Atmospheres

A World’s Blanket of Gas

Take a breath. You just borrowed a little of Earth’s atmosphere! An atmosphere is gas surrounding a world. Another planet’s blanket could be thin, thick, freezing, or fiercely hot. Let’s peek inside.



Gas and energy around a world. The atmosphere is exaggerated to show the idea; sizes and arrow lengths are not measurements.

What keeps the sky nearby?

Gravity pulls gas toward a planet, helping it hold an atmosphere. The gas usually gets thinner higher up; there is no hard lid where the sky ends. Some gas can escape. A world’s gravity, temperature, and history help shape the atmosphere it has today.

A blanket that handles heat

Sunlight can warm a planet’s surface. The surface sends energy outward as infrared light, which we cannot see. Greenhouse gases absorb some of it and send energy in all directions, including back down. This slows heat loss. Some energy still escapes to space.

Reading air from far away

During some transits, when a planet crosses its star, starlight filters through the planet’s atmosphere. Different gases absorb different parts of that light, leaving clues like fingerprints. Scientists can use those clues to identify gases. Clouds and haze can hide parts of the story.

Your turn to wonder A planet has an atmosphere. Does that mean you could take off your space helmet?

No! Its gases, pressure, and temperature might be dangerous. An atmosphere alone does not tell us whether life is there.

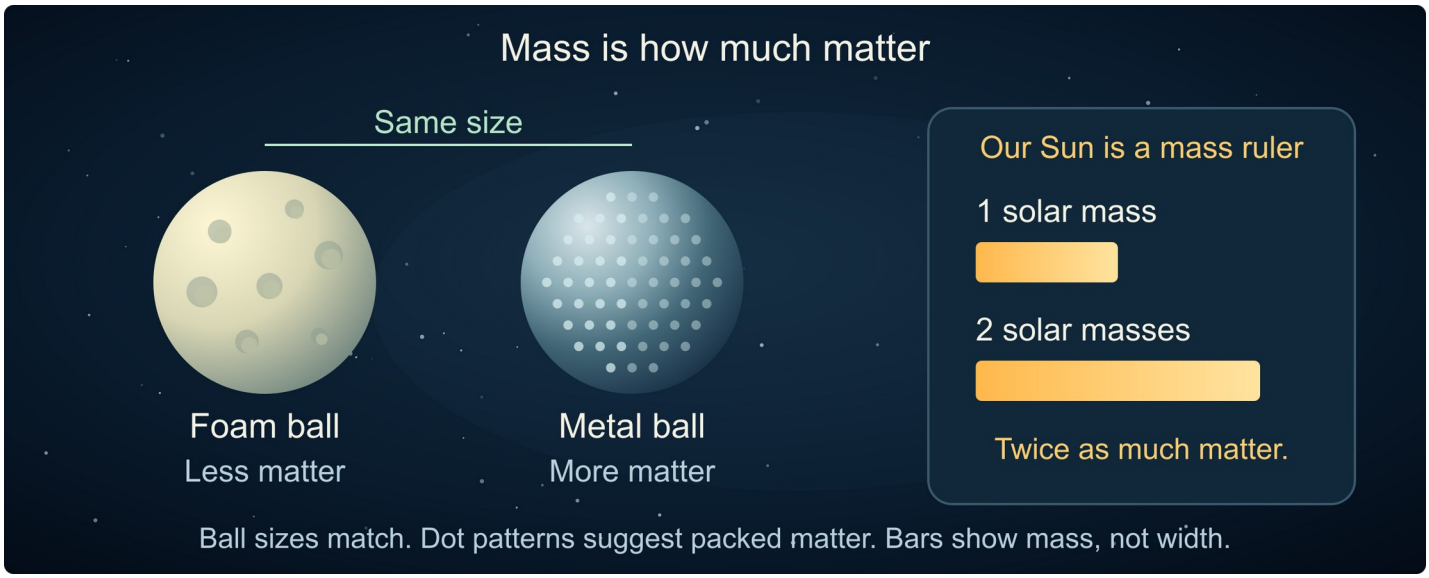
An atmosphere shapes a world’s sky, weather, and warmth.

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Mass

How Much Stuff Is in a Star?

Imagine two balls the same size: one made of foam, the other made of metal. The metal ball would be harder to get moving. Size tells only part of the story. Meet mass, the amount of matter in an object.



Equal-size balls can have different masses. The balls are examples; the bars compare mass, not the sizes of stars.

Size is not the whole story

An object's radius is the distance from its center to its edge. Its mass tells how much matter it contains. Those are different measurements! Two worlds can have similar radii but different masses. The one with more mass has more matter packed into that space.

Same you, different weight

Weight is the pull of gravity on your mass. Stand on the Moon and you would weigh less than on Earth because the Moon's surface gravity is weaker. Your body would still contain the same amount of matter.

Use the Sun as a measuring unit

Star masses make enormous numbers. Astronomers use a handy unit: one solar mass equals the Sun's mass. A star with two solar masses has twice that mass, not necessarily twice the width. Scientists can study orbiting objects to work out masses.

Your turn to wonder A star has half the Sun's mass. Must it be half as wide?

No. Mass measures matter; width measures size. You need another measurement to know its width.

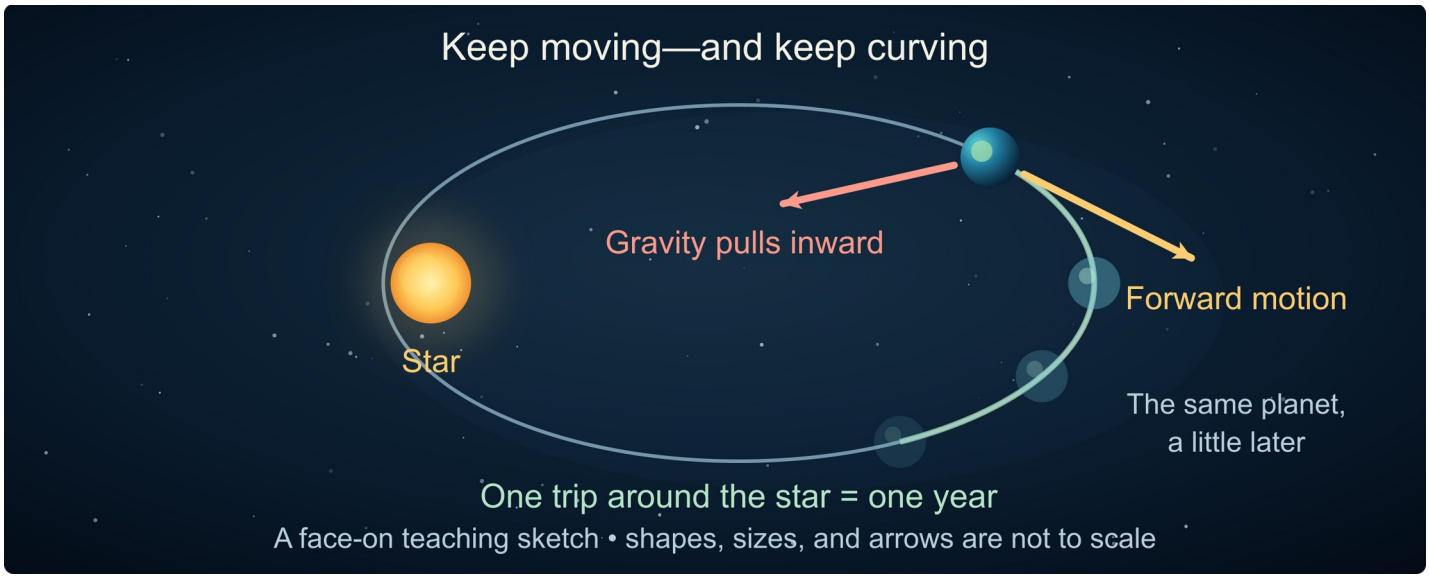
Mass is matter. Weight is gravity's pull. Radius is size.

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Orbits

The Art of Falling Around

Toss a ball and it falls to the ground. Now imagine sending it sideways so fast that Earth curves away beneath it as it falls. It keeps missing the ground! That is an orbit!



Forward motion and inward gravity make a curved orbit. Distances, sizes, and arrow lengths are not measurements.

Forward motion meets gravity

An orbit is a curved path around another object. A planet moves forward while its star's gravity pulls it inward, bending its path. Gravity does not switch off in space. It is the reason the planet keeps turning instead of traveling away in a straight line.

No engine needed to keep going

A planet does not need an engine to keep orbiting. Its motion continues while gravity keeps changing its direction. An orbiting spacecraft coasts, too. Astronauts inside fall along with their spacecraft, so they float. Spacecraft sometimes use engines to change course or overcome drag from thin gas.

A year is one trip around

One complete orbit around a star is a planet's year. Earth takes about 365 days. Planetary orbits can be nearly circular or stretched into oval shapes called ellipses. An orbit is a path through space, not a solid track.

Your turn to wonder Imagine gravity suddenly vanished. Would the planet keep following the same curve?

No. Without another force, it would continue straight in the direction it was moving at that moment.

An orbit is forward motion continually turned by gravity.

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