



The Universe and Climate Change! Year 10 Science at Home

You can help! Your child is learning about the biggest picture in science — how the universe, stars and solar system formed — and also about the most pressing issue of our time: how human activities are changing Earth's climate. These are topics that require scientific literacy to engage with as citizens.

Why are we learning this? The universe and our place in it

Aboriginal and Torres Strait Islander peoples developed the world's oldest continuous astronomical tradition — observing the night sky for tens of thousands of years to navigate, track seasons, understand tides, and develop rich cultural knowledge about the stars, moon and planets. The dark constellations of the Milky Way (shapes traced by dark gaps rather than stars) are a uniquely First Nations astronomical tradition, and First Nations astronomical knowledge is now being studied by professional astronomers. In remote northern Australia, away from city light pollution, the night sky is spectacular. This topic connects deep science — the Big Bang, stellar evolution, solar system formation — to Country and cultural sky knowledge.

My child will learn to:

✓ Understand Big Bang cosmology

Describe the evidence for the Big Bang and explain how the universe has evolved from that initial event.

✓ Explain stellar and solar system formation

Describe how stars form from clouds of gas and dust, how they evolve, and how our solar system formed from the debris of a supernova.

✓ Understand evidence for climate change

Describe the lines of evidence that show Earth's climate is changing and that human activity is the primary driver.

✓ Evaluate climate solutions

Describe mitigation strategies (reducing emissions) and adaptation strategies (responding to change) for climate change.

Big ideas to know:

The Big Bang and expanding universe

The universe began about 13.8 billion years ago with the Big Bang — an extraordinarily hot, dense state that rapidly expanded. The evidence: 1) The universe is still expanding — distant galaxies are moving away from us (Hubble, 1929). 2) Cosmic Microwave Background radiation — the faint afterglow of the Big Bang can be detected from all directions in space. 3) The proportions of hydrogen and helium in the universe match exactly what Big Bang theory predicts. The universe was not an explosion IN space — it was an expansion OF space itself.

How stars and solar systems form

Stars form when gravity pulls together vast clouds of hydrogen and helium gas. As the cloud compresses, it heats up. When the core reaches about 10 million degrees, nuclear fusion begins — hydrogen nuclei fuse together to form helium, releasing enormous energy. This is what powers the sun. Massive stars explode as supernovae when they run out of fuel, scattering heavier elements (like iron, carbon and oxygen) into space. Our solar system formed about 4.6 billion years ago from a cloud of gas and dust enriched by previous supernovae. You are literally made of stardust.

Human-caused climate change — the evidence

Multiple independent lines of evidence confirm that Earth's average temperature has risen about 1.2 degrees C since the Industrial Revolution, and that human greenhouse gas emissions are the primary cause: rising CO₂ levels matching fossil fuel emissions; temperature records from weather stations, ocean buoys and satellites; melting ice sheets and glaciers; rising sea levels; shifts in species ranges and behaviour; and isotopic analysis showing the carbon in the atmosphere comes from fossil fuels. The scientific consensus on human-caused climate change is as strong as the evidence for evolution or the age of the universe.

Big Bang — Timeline of the Universe



Evidence: cosmic background radiation, red-shift of galaxies, abundance of elements (*the gold standard*)

Climate Change — Key Indicators

Evidence: cosmic background radiation, red-shift of galaxies, abundance of elements

Rising temperatures
+1.5°C since 1900

Rising sea levels
+24cm since 1900

Ice caps melting
(Arctic, Antarctic)

More extreme weather events

Cause: burning fossil fuels increases CO₂, trapping more heat (greenhouse effect)



Evidence for human-caused climate change

Type of evidence	What it shows	How reliable?
Temperature records (1880-present)	Global average temperature has risen ~1.2°C since 1880; 19 of the 20 hottest years on record occurred after 2000	Multiple independent datasets all show the same trend
Atmospheric CO2 levels	CO2 has risen from ~280 ppm (pre-industrial) to over 420 ppm — the highest in at least 800,000 years from ice core records	Directly measured at Mauna Loa since 1958; ice cores confirm pre-industrial levels
Carbon isotope analysis	The extra CO2 in atmosphere has less C-14 — proving it came from ancient fossil fuels, not natural sources	Chemically identifies the source of the carbon
Sea level rise	Global average sea level has risen ~20 cm since 1900; rate is accelerating — threatens low-lying coastal communities	Measured by tide gauges and satellites since 1993
Arctic sea ice extent	Arctic summer sea ice has declined by ~40% since 1980	Satellite data since 1979; consistent with all climate models
Species range shifts	Hundreds of species moving poleward or to higher altitude as temperatures rise	Long-term biological surveys confirm species responding to warming

Think Like a Scientist — Climate Evidence Audit

Look up the latest global temperature data and CO2 levels (NASA or NOAA websites are great). Graph the annual average temperature anomaly for the last 50 years. Can you see the trend? When was the hottest year on record? What is the current CO2 concentration in the atmosphere?

Ask: "What is a temperature anomaly and why do scientists use it instead of actual temperature? What would you expect to see in the data if climate change were NOT happening? How would you design a study to prove (or disprove) that humans caused the warming?" This is exactly the kind of critical thinking scientists use!

Current climate data to look up together:

1. NASA GISS Surface Temperature Analysis: search "NASA global temperature"
2. Current CO2 level: search "Mauna Loa CO2 current" — updated daily!
3. Sea level change: search "NASA sea level change"
4. Australian Bureau of Meteorology climate data for your region
5. Search "CSIRO climate change Australia" for impacts specific to northern Australia

Questions to ask your child

1. What are three pieces of evidence that support the Big Bang theory?
2. Why do scientists say "you are made of stardust" — what is the connection between supernovae and the elements in your body?
3. What is the difference between the greenhouse effect and human-caused climate change?
4. How does carbon isotope analysis (using C-14) prove that the extra CO2 in the atmosphere comes from fossil fuels?

5. What is the difference between climate mitigation and climate adaptation? Give an example of each.
6. Why do scientists consider the scientific consensus on climate change to be very strong — what types of independent evidence converge on the same conclusion?
7. How might climate change affect the communities of northern Australia specifically — what risks are highest in this region?

The BOM (Bureau of Meteorology) website has climate data for your region including temperature trends, rainfall records and climate projections. Looking up your local area's data together makes the science personal and real. How many record temperatures has your area seen in the last 10 years?

Key words to know:

Big Bang	The event 13.8 billion years ago in which the universe began as an extremely hot, dense state and rapidly expanded
Nuclear fusion	The process in which hydrogen nuclei fuse to form helium in the cores of stars, releasing enormous energy
Supernova	The explosive death of a massive star that scatters heavier elements throughout space
Greenhouse effect	The trapping of heat in Earth's atmosphere by greenhouse gases — essential for life, but intensified by human emissions
Climate change	Long-term shifts in global temperatures and weather patterns — currently accelerated by human greenhouse gas emissions
Mitigation	Efforts to reduce greenhouse gas emissions to slow the rate of climate change
Adaptation	Adjustments to systems, communities and practices to cope with existing and future climate change effects

Key words to look up

Big Bang · Nuclear fusion · Supernova ·
Greenhouse effect · Climate change ·
Mitigation · Adaptation

What school will check

By the end of Year 10, your child needs to describe the evidence for the Big Bang and explain the formation of stars and the solar system, and also explain the evidence for human-caused climate change and evaluate responses to it.

Try it at home!

On a clear night away from lights, look at the Milky Way. Ask an Elder or local First Nations knowledge holder if they know traditional stories about the sky — some communities have detailed astronomical knowledge about the constellations, the moon's cycles, and what they mean for Country. Then compare: what does Western science say about what you are looking at?