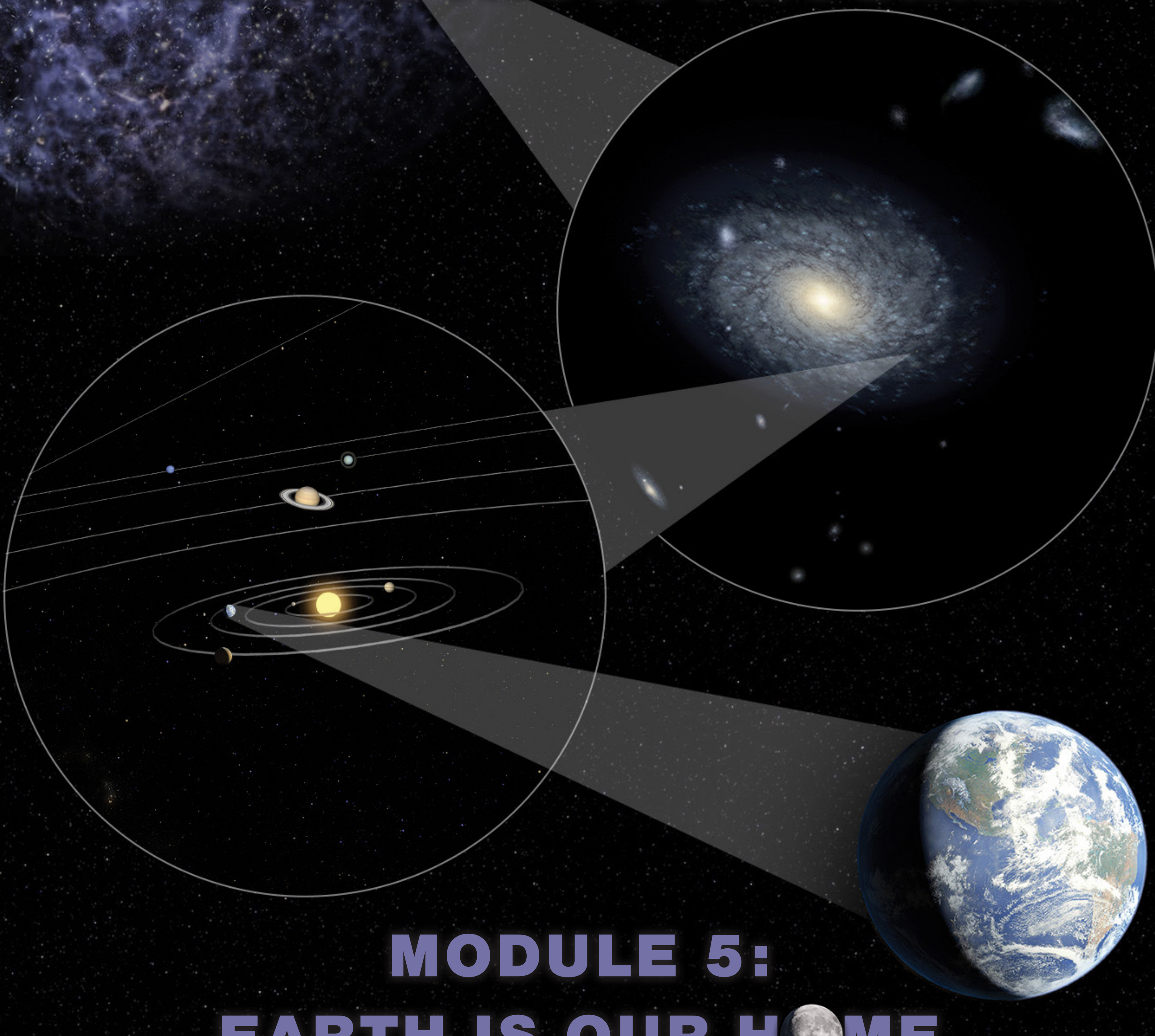
GRIFFITH OBSERVATORY ONLINE SCHOOL PROGRAM



MODULE 5: EARTH IS OUR HOME

STUDENT GUIDE

Preparing for Your Virtual Visit

We are excited that your class will be participating in Module 5: Earth Is Our Home of Griffith Observatory's Online School Program. Together we shall join the tradition of observing. Here are some things you'll need to know before your virtual visit.

- You and your class will experience the entire live program in Zoom. Your teacher will send you the steps to follow to join the Zoom webinar session.
- Before joining the webinar, please set your Zoom name to contain your real first and last name.
- When you are admitted into the Zoom webinar, you will enter muted with your video off.
- You and your class will meet a Museum Guide from Griffith Observatory. The Guide will lead you through the live experience.
- During the program, you will be asked to participate in polls. After a question is asked, a poll will pop up on your screen. Select an answer, and remember to click "Submit!"
- You may use Zoom's chat function to communicate with Griffith Observatory staff if you are experiencing technical difficulties.
- You may submit to the Q&A box any questions about science you might have for Griffith Observatory staff. We shall hold a question-and-answer session at the end of the program and shall try to answer as many of your questions as we can.
- Remember to stay on your best behavior. We encourage you to answer the polls and ask any space or science-related questions you might have, especially those relevant to our discussion. Be polite. Any spamming behavior or inappropriate, rude, or harassing language sent to staff in the chat or Q&A is not tolerated and may result in being dropped from the Zoom session.
- We hope you have a wonderful time!

Program Materials

To get the most out of Module 5: Earth Is Our Home, explore these materials before and after your visit.

Module 5 Glossary

The glossary lists and defines important words used in Module 5: Earth Is Our Home and in the following materials.

Listen to the Glossary

If listening helps you remember, this audio file will help you remember the words and definitions in the Module 5 Glossary.

Intergalactic Pen Pals

In this activity, you will use glossary terms to complete a pretend postcard-exchange with an alien from a neighboring galaxy.

Making Cosmic Connections

In this cut-and-paste activity, you will piece together the timeline of the universe and learn about some stellar scientists and discoveries along the way.

Exploring Environment Evolution

This handout is all about how we make environments livable. What would it take to make a harsh environment like the surface of Mars a good place to live? How can we maintain a healthy relationship with our environment?

The Roll of a Lifetime

Did you know that in a simple batch of bread, a culture of tiny creatures lives out its entire life? It’s sort of gross and also fascinating and delicious. This science-powered recipe for bread rolls will transform you into a biology-backed baker.

Coloring the Cosmos

We have included two coloring book activities for a quiet moment.

A-Z Responsible Disposal

This resource may help you dispose of common household items more responsibly.

Program Materials continued...

Imagining Jobs in Space

In this handout, you'll learn about eco-friendly jobs on Earth and then use your imagination to dream up space versions of these jobs. If we continue to explore space, we'll need a lot of people-power to make space environments livable.

Citizen Science: Help Power Real Research

This page lists Citizen Science projects. Citizen Science is a way for anyone, no matter age or level of experience, to help scientists change the world, and have fun doing it, too!

Surf the Earth-observing Web

This page lists some trusted NASA websites for you to continue your Earth-observing journey and stay up-to-date about the latest climate science.

Internet Resources

The Internet may be helpful. This resource lists a variety of websites that will help you expand your astronomical knowledge and have fun doing it.

Glossary

MODULE 5: EARTH IS OUR HOME

asteroid – a rocky, airless remnant left over from the early formation of our solar system about 4.6 billion years ago. Most asteroids orbit the Sun between Mars and Jupiter within the main asteroid belt.

atmosphere – the layer of gas that surrounds Earth. It is often called air. Other planets, and some of their larger moons, also have atmospheres.

big bang – a theory that describes how the universe we know began expanding rapidly from a very dense and incredibly hot state approximately 13.8 billion years ago.

biosphere – the zone of Earth that includes all living things; the part of the world in which life can and does exist.

climate – the long-term weather pattern in a region or globally. The state of and the interactions between the atmosphere, hydrosphere, geosphere, and biosphere determine climate.

data – factual information (such as measurements or statistics) used as a basis for reasoning, discussion, or calculation.

element – in chemistry, a pure substance containing only one type of atom.

energy – in space, energy is the capacity to cause change or movement within the universe (expressed as light, heat, radiation, motion, and more). Energy is needed for life to carry out essential functions and is gained through consuming food. It originated from the Sun.

galaxy – a massive collection of stars, gas, dust, and other celestial objects bound together into a single system by gravity. A galaxy may contain from ten million stars to one trillion stars. The Sun and Earth are in the Milky Way Galaxy.

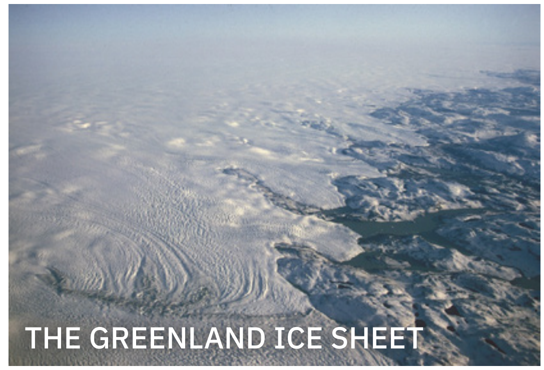
geosphere – the solid part of Earth, including rocks and minerals and towering mountains and grains of sand. It also includes the oceanic crust, Earth's molten rock interior, fossils, and skeletons of once-living organisms.

habitable – capable of being lived in or on (as a house, environment, or planet).

hydrosphere – all of the water on Earth, including water on Earth's surface, underground, in the air, and frozen as solid ice or snow.

ice sheet – a mass of glacial land ice that extends more than 20,000 square miles. Ice sheets are constantly in motion as ice flows outward from the sheet's edges.

Industrial Revolution – starting in the eighteenth century, the period of change from farm-based economy to one dominated by industry and machine manufacturing. Industrialization continues today.



THE GREENLAND ICE SHEET

mammal – warm-blooded animals with fur or hair, backbones, and three middle ear bones. They nourish their young with milk-producing mammary glands. You are a mammal!

matter – any substance that has mass and takes up space by having volume. Matter is made of atoms. You are made of matter!

methane – a chemical compound with the chemical formula CH_4 (one carbon atom bonded to four hydrogen atoms). Methane can be an indication of living things, but it can also be produced by processes that do not involve life.

methanogen – a microscopic life form (microorganism) that produces methane.

nebulae – plural form of nebula. Known as "star nurseries," nebulae are made of large clouds of interstellar gas and dust that look similar to clouds when viewed from far away. Over time, stars and planets can form within some nebulae.

physicist – a scientist who studies the fundamentals of nature, including matter, energy, forces, space and time, and their interactions.

ROSETTE NEBULA

planet – a planet is an object that (a) orbits the Sun, (b) is massive enough to be spherical in shape, and (c) has cleared away its neighboring region of other objects. There are eight planets in our solar system: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.

satellite – an object in space that orbits another object. Natural satellites already exist in space (planets, moons, asteroids, and such), and artificial satellites are made by people.

solar system – a system of planets, moons, asteroids, comets, and other small objects that orbit a star. The Sun is the star in our solar system.

star – a celestial body of hot, dense gas that generates light and other energy and is held together by its own gravity. The Sun is a star. Although stars look like tiny pinpoints of light to us, many are larger than the Sun. They look tiny because they are so far away.

supernova – the dramatic explosion that takes place during the final stages of the death of a super-massive star.

sustainability – the meeting of the needs of the present without compromising the ability of future generations to meet their own needs.

universe – all of space and time and all its contents, including the solar system and all stars and galaxies.

Intergalactic Pen Pals

A GLOSSARY-REVIEW ACTIVITY

INSTRUCTIONS

Fill in the orange-colored blanks in the story with Module 5 glossary terms from the word bank below. Use each glossary term only once and only in ways that make sense.

WORD BANK

Tip: Use a pencil! It might help to cross out the terms as you use them up.

star	methane	physicists	energy	ice sheets	satellites
elements	solar system	hydrosphere	galaxy	mammal	geosphere
biosphere	methanogens	Industrial Revolution	asteroids	Data	
atmosphere	~~habitable~~	sustainable	planet	universe	climate

THE STORY BEGINS...

It's the year 2251, and miraculous advances in science have allowed you to live for hundreds of years and send postcards to possibly *habitable* planets in the Andromeda galaxy! Maybe one of these planets has intelligent life. Maybe you'll get a postcard back. But wait—you accidentally left your postcard in the sanitation chamber for too long and some of your words faded! You better fill them in again using the word bank.

POWERED BY INTER-SPECIES TRANSLATION TECHNOLOGY

WRITE IN THIS AREA

Hello, life in the Andromeda Galaxy!

I am a human from Earth, in the Milky Way Galaxy, where our stable ____________ is maintained mostly by the Sun's ____________. Our climate system contains a diverse ____________, a solid and shifting ____________, a watery ____________ with liquid and solid parts, and an oxygen-rich ____________. Our large ____________ contains our star (Sun), eight planets and many moons, ____________ that orbit Earth, dwarf planets, comets, and ____________! What's your planet like?

Humans usually have four limbs, two-eye vision, big brains, and a developed vocal tract. We have no fur, antennae, or tails. What are you like?

Ever since our planet's ____________, people have been using our natural ____________ at a rate that is not ____________. Do you have any tips?

With astronomical awe,

Your Name:

NAM

TO WHOMEVER THIS REACHES

PLANET VAR

STAR SYSTEM G4-8071

ANDROMEDA GALAXY

LOCAL GROUP

UNIVERSE

THE STORY CONTINUES...

Great news, an intergalactic postcard arrived at your mailbox! Inter-species translation is a new science, however, and some words on the postcard could use some extra help with translation. Can you figure out what your alien pen pal is trying to say?

POWERED BY INTER-SPECIES TRANSLATION TECHNOLOGY

Greetings Earthling! I am from planet Var. It is a joy to share this vast ____________ with you. We Vee-LuLus are warm-blooded, covered in bioluminescent fur, and highly intelligent. You too sound like an intelligent ____________, but without fur...? Shocking.

Our sphere is cloaked in cold, like the ____________ in your Earth's hydrosphere. Our skies weep the chemical compound ____________, a life-giving nectar to the ____________ that live beneath our ice. We live peacefully with these ancient microorganisms as they influence stable temperatures beneath the surface.

We are intrigued by your planet! It is concerning that your natural resources are declining at an unsuitable rate. Here are some "thinkings" from us Vartians:

Try to reuse what exists. Plant green friends. Conserve your drinking liquids. Trust your science humans and stay current on science. ____________ is your greatest ally. Let your ____________ probe the unseen forces binding your system together. Lastly, try to remain unified...you can accomplish more together, holding paws.

Galactically yours,
Vartian Vee-LuLu

YOUR NAME: ____________

SCHOOL: ____________

CITY: ____________

STATE/REGION: ____________

COUNTRY: ____________

____________ : EARTH

____________ : SUN

____________ : MILKY WAY

LOCAL GROUP

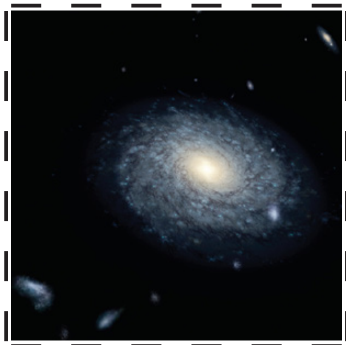
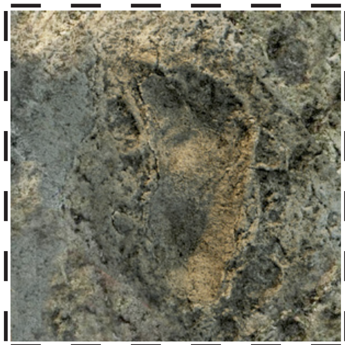
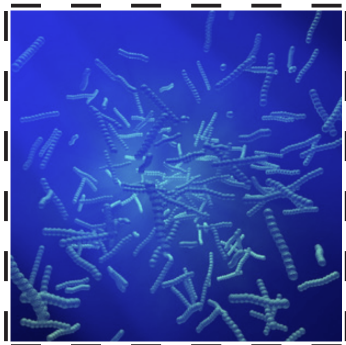
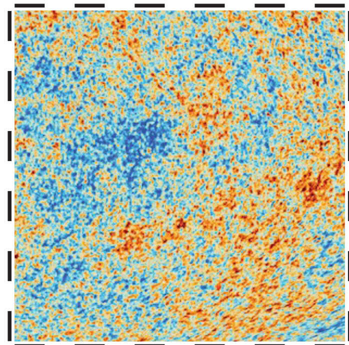
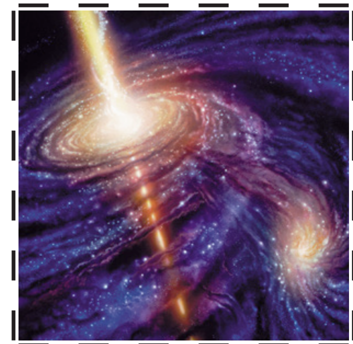
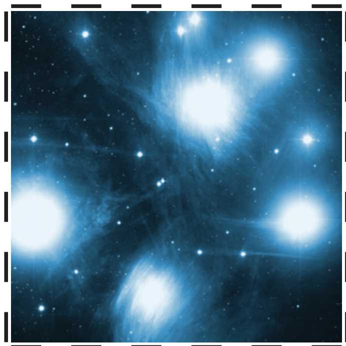
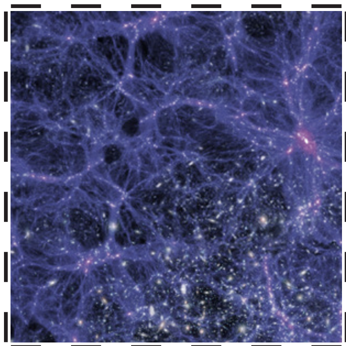
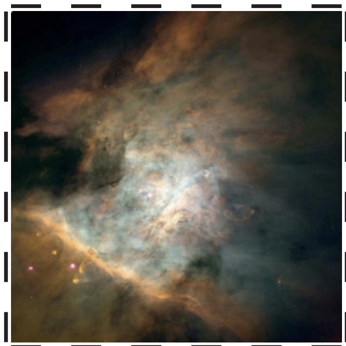
UNIVERSE

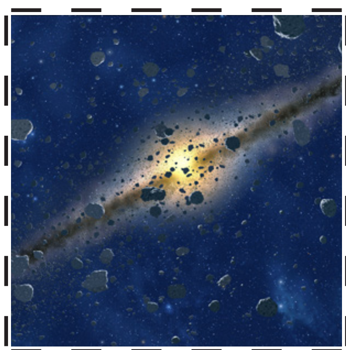
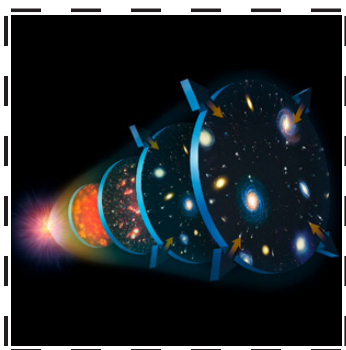
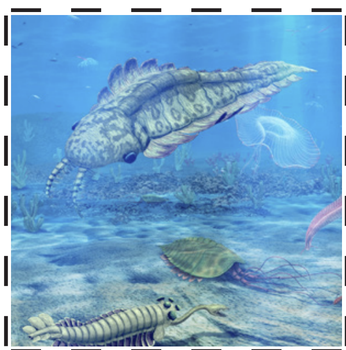
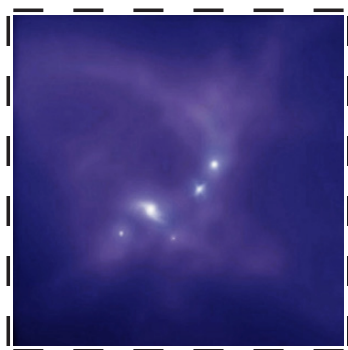
CONGRATULATIONS!

You became the first person to receive, and fully understand, a postcard from an extraterrestrial life form.

Making Cosmic Connections

It took a long time for the universe to become what it is today, and it took many bright stars for us to exist. It also took many bright minds to figure out how the universe developed. Cut out the images on this page. Then match each image to its corresponding timeline event on the following pages. Read the "hints" to get clues about which images match which events, and learn about some extraordinary scientists, too!


BILLIONS OF YEARS

0

The Beginning of Time

Hint: If the universe is expanding, Belgian astronomer Georges Lemaître theorized in 1931, then it must have begun in a small, compact state. We now know this model as the big bang theory.

The Curtain of Light

400,000 years after the big bang

Hint: In 1965, two American physicists, Arno Penzias and Robert Wilson, were trying to map radio signals from the Milky Way galaxy and kept detecting an extra signal everywhere they pointed their antenna. They first thought the "noise" was pigeon poop interfering with the antenna, but it was actually radiation left over from the big bang!

The First Candles in the Darkness

400 million years after the big bang

Hint: In 1944, German astronomer Walter Baade used the world's largest telescope at the time (the 100-inch telescope at Mt. Wilson Observatory in Los Angeles County) to discover that stars belong to different generations. He named younger stars *Population I* stars and older stars *Population II* stars. Later, in 1965, American astronomer Neville J. Woolf introduced *Population III* stars: Stars almost as old as the big bang. They existed and died so long ago none are now observable.

A Fully-Formed Milky Way Galaxy

1 billion years after the big bang

Hint: In 1924, American astronomer Edwin Hubble, at Mt. Wilson Observatory in Los Angeles County, discovered that our Milky Way galaxy is one of many galaxies! He used Cepheid variable stars, which were discovered to be cosmic measuring sticks by American astronomer Henrietta Swan Leavitt, to show that the neighboring "great spiral nebula" is a galaxy like the Milky Way.

1

Threads and Ribbons

1.2 billion years after the big bang

Hint: Dark matter shapes our universe into web-like structures, with clusters of galaxies at each intersection of the web. In the 1970s, American astronomers Vera Rubin and Kent Ford studied the rotation of spiral galaxies. They discovered that the stars at the edges are moving just as fast as the stars near the center. They determined there must be some unseen mass acting as a gravitational glue to hold galaxies together. Their work provided evidence for the existence of dark matter.

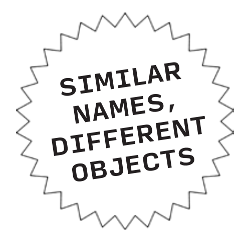
Vera Rubin and Kent Ford

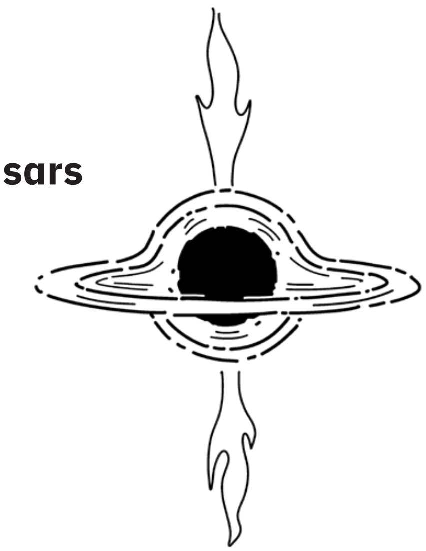
Lights Full On

1.4 billion years after the big bang

Hint: Some galaxies have extremely explosive, active centers. These “active galactic nuclei” are so bright and far away that many look like stars, but close observation reveals they aren’t stars at all. The most powerful are called “quasars,” first identified by Maarten Schmidt, Dutch-American astronomer, at Palomar Observatory.

Pulsars vs. Quasars





Pulsars, discovered by British astronomer Jocelyn Bell Burnell in 1967, are stars that spin very fast and cannot be seen, but they produce regular pulses of radiation, similar to the way lighthouses shine rotating pulses of light.

Quasars also emit light, but are much bigger and more powerful than pulsars, and they have jets of particles that can be trillions of miles long!

3 4 5 6 7 8 9

FACT: For the next many billions of years, the universe continued to expand and cool. Generations of stars came and went. Galaxies evolved and often collided, and the cosmic web of galaxies grew more and more complex.

Making a Neighborhood

9.1 billion years after the big bang

Hint: Our solar system is born. A "nebula," a vast cloud of gas and dust in outer space, begins to rotate around a star. Eventually, clumps of matter form planets orbiting the star. This explanation for solar system formation was developed in the 1700s by Swedish scientist Emanuel Swedenborg, German philosopher Immanuel Kant, and French scholar Pierre Laplace.

Icy objects in an outer region called the Kuiper Belt, discovered by astronomers Jane Luu and David Jewitt, are thought to be remnants from the formation of the solar system.

David Jewitt and Jane Luu

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Impacts Call It an Era

9.9 billion years after the big bang

Hint: In 1609, Italian astronomer Galileo Galilei used his telescope to make observations of the Moon. He discovered that its surface was covered in mountains, valleys, and craters.

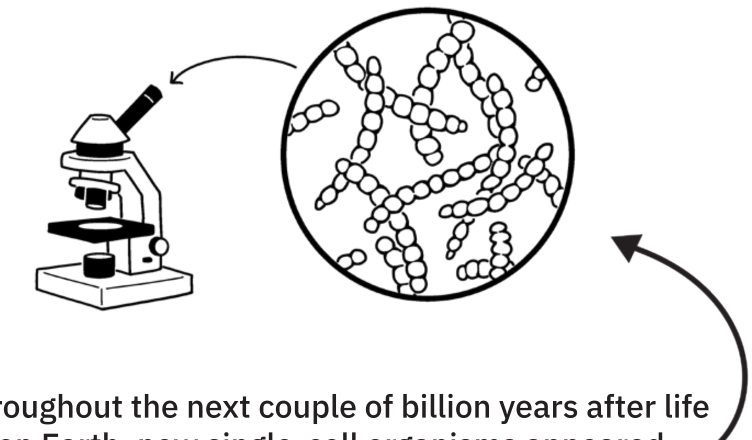
Impacts from objects orbiting the Sun helped build worlds in the early solar system. The scars visible on the Moon are from the last major collisions in the era of planet formation.

A microfossil over three billion years old discovered by J. William Schopf in 1992

Getting a Life

10.2 billion years after the big bang

Hint: American scientist J. William Schopf found fossils in Western Australia of the oldest life. They are almost as old as Earth. These early traces of life provide a model in our search for life in the universe. Astrobiology is the study of potential life beyond Earth, and it is a popular topic in science as space exploration continues to inspire curiosity.



FACT: Throughout the next couple of billion years after life emerged on Earth, new single-cell organisms appeared. They are called **cyanobacteria**, and they produced so much oxygen, they changed Earth and the life on it. Cyanobacteria paved the way for a new kind of life that breathes oxygen–like us–to develop.

Emmett Chappelle

In 1958, African-American scientist Emmett Chappelle discovered that certain single-cell organisms are able to photosynthesize, like plants. This means they convert carbon dioxide to sugar and water into oxygen. His research and others' contributed to our understanding of cyanobacteria.

11

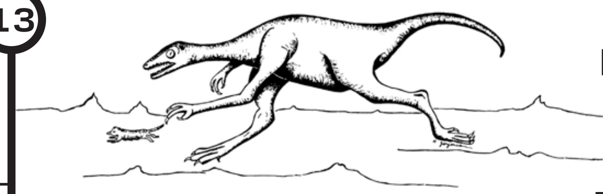
12

13

Hard Bodies

13.1 billion years after the big bang

Hint: At this time, all animals still lived in the sea. A rich and diverse population of arthropods, or hard-shelled organisms with exoskeletons, spread through the oceans. In the early twentieth century, American paleontologist Charles Doolittle Walcott was one of the first scientists to study arthropods and examined over 65,000 fossil samples during his career.



High Plains Drifters

13.35 billion years after the big bang

Hint: Life on Earth expands its habitat from the ocean to the land. Some amphibians join insects and plants and adapt to life outside of water. They set the stage for new forms of life to evolve. Between 1913 and 1963, Alice Wilson, Canada's first female geologist, mapped and conducted scientific studies of rocks and fossils in a 14,000-square-kilometer area of the Ottawa region—all alone! She focused on fossils of the Ordovician period, which is when life first took hold on land.

Bright Young Stars

13.63 billion years after the big bang

Hint: Star formation continues in our galaxy as new stars are born in clouds of gas and dust. The Pleiades, a group of hot young stars, first began to shine just before the dinosaurs died out on Earth. The earliest mammals were better suited to adapt to climate change. We try to understand our constantly-changing world with help from scientists like Dr. Kathleen R. Johnson of the Grand Traverse Band of Ottawa and Chippewa Indians. She focuses her research on the changing climate and weather patterns of millions of years ago.

Rocking the Cradle

13.69 billion years after the big bang

Hint: New stars form constantly in giant space clouds called nebulae. In 1902, English astronomer Sir James Jeans suggested that gravity causes the gas molecules in nebulae to clump together and create hot, dense globules. The cores in these globules become "protostars," as suggested by Japanese astrophysicist Chushiro Hayashi in 1966. They eventually get so large and hot that they burn hydrogen through a process called fusion, and a star is finally born!

14

Our Cosmic Connection

13.7 billion years after the big bang

Hint: People first walked on the surface of another celestial object in 1969, when Neil Armstrong stepped down from the lunar lander onto the Moon’s surface and famously said, “One small step for a man, one giant leap for mankind.” These footsteps and those of astronauts to follow have left a significant mark on our understanding of our place in the universe.

Hint: In 1976, paleoanthropologist Mary Leakey led an archaeological dig in Laetoli, Tanzania, Africa. Team members engaged in an elephant dung fight for a moment of fun. Andrew Hill, a member of the team, was dodging poop, and he tripped and fell face-first onto fossilized rock. As Leakey later confirmed, the fossils were footprints of our early human ancestors. The “Laetoli footprints,” as they’re called, are about 3.6 million years old.

Distant Ancestors

13.696 billion years after the big bang

Illustrations by Ian Crovella

Exploring Environment Evolution

A SHORT–ANSWER HANDOUT

Our environment is affected by our actions. Looking at how we affect our environment locally helps us understand how we affect our environment on a long-term and global scale. This handout inspires thought about how we change environments to meet our needs.

PART ONE: BEFORE AND AFTER

Two important sites will be built in this mountain range in the 1920s and 1930s. Can you guess what they are?

This is an image of Los Angeles from 1896. What changes can you imagine that people made since then to make living easier? How many people do you think could live here comfortably? What resources do they need to survive?

If you want thousands of people to be able to live sustainably in this area less than 100 years later, what do you need to prepare for them?

The Hollywood Sign (originally "Hollywoodland") was installed in 1923, and Griffith Observatory opened its doors in 1935.

This is a picture taken from the same location but in 2024. What changes have people made since 1896? Can you list a few things in the foreground and middleground that are different?

____

____

____

____

How many people do you think can comfortably live in this place now? What changes would you make if you wanted even more people to live sustainably in this area in another 100 years?

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Griffith Observatory now stands prominently on the slope of a mountain that overlooks Los Angeles. What do you think people needed to do to create an observatory at that location?

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Griffith Observatory under construction in 1934

PART TWO: MOVING TO MARS?

Think about what we would need to make the Martian environment livable.

Surface of Mars

Los Angeles

Mars is very cold. NASA's *Curiosity* rover has a **MARS DAILY WEATHER REPORT** that you may check anytime. The low temperature is typically -100°F, and the high temperature is around 10°F. There is 100 times less atmosphere than on Earth, and it is made almost entirely of carbon dioxide. That's what we breathe out, not in. There is hardly any useful air for people on Mars. There is no liquid water on the surface of Mars, either. There is frozen water buried under the ground at some locations and at the polar ice caps. Mars is a harsh place.

List three things that people would need in order to live on Mars. Think about basic human needs first.

___

___

Where can we get these things we need to survive? Do we need to bring them from Earth, or do you think there is a way to get what we need from Mars?

___

___

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Living on Mars will be hard. List three things that Earth already has that Mars needs for people to be able to live there **sustainably** (This word is defined in the Module 5 glossary.).

___

___

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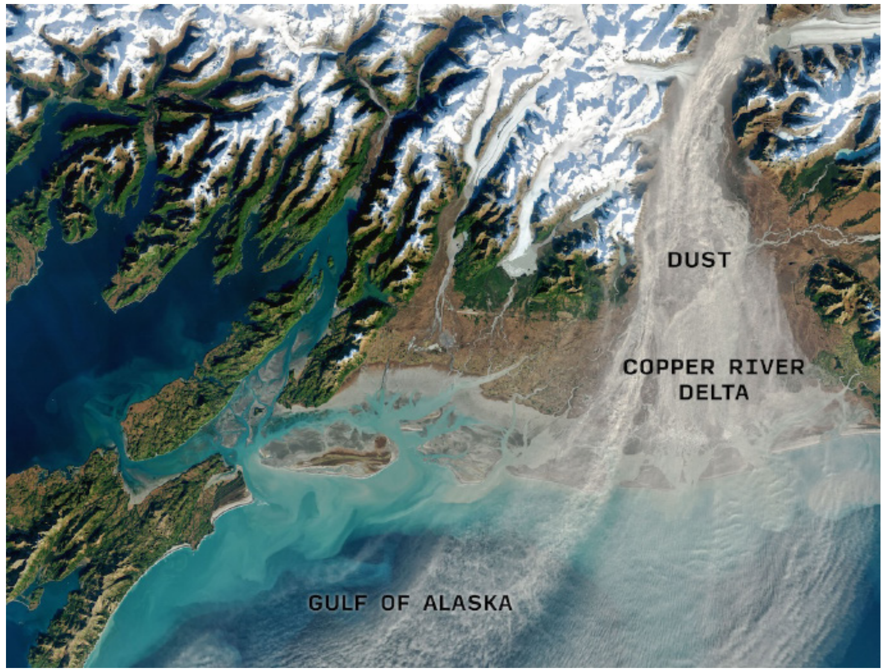
PART THREE: OBSERVING CHANGES ON EARTH

NASA has satellites that observe Earth and resources that let you see what is happening. Earth Observatory Kids (linked below) is published with support from NASA's Landsat, Terra, and Aqua missions and is written for audiences aged 9 to 14.

Explore the **EARTH OBSERVATORY KIDS WEBSITE**.

Find and describe one way that people are using space to observe changes on Earth. Then, explain how space helps us understand Earth better. For example, satellites can track dust from space. That's demonstrated in this image of the Copper River valley in Alaska. This true color image was taken by the *Landsat 8* satellite on October 22, 2020. The view lets us see how the dust is blown out past the land and how it interacts with the sea.



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WRAP UP: Now you can see how we change the environment in which we live and how that can translate to changing environments on other worlds as well. Understanding that we have all the resources we need right now to maintain balance at home is important. Earth is the only planet that now has everything we need. Living sustainably is possible when we observe and plan for the changes that are certain to come.

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The Roll of a Lifetime

AN EXPERIMENT TO DO WITH AN ADULT

IT'S THE YEAST YOU CAN DO!

ACTIVITY OBJECTIVE

In this hands-on activity with a delicious result, participants witness an organism changing its environment and the environment changing the organism, too.

FIFTH-GRADE NGSS STANDARDS ADDRESSED

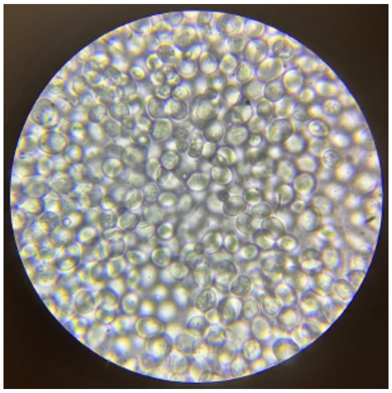
5-PS1-4: Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

5.LS2.B (5-LS2-1): Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases and water from the environment and release waste matter (gas, liquid, or solid) back into the environment.

UNDERSTANDING BREAD AS AN ENVIRONMENT

Ever since life began on Earth over 3.5 billion years ago, living things have affected Earth. Life and Earth are intertwined, and neither can change without affecting the other. This is true even for the organisms in bread.

Yeast is a simple organism that people use when making bread. It can change its environment if the conditions are right. All living things need the right chemical ingredients, water, energy, and a stable environment. We can see this in action and end up with delicious dinner rolls.



BAKING YEAST CELLS - 40X

The yeast in bread uses the flour for chemicals, sugars as energy, and water. The stable environment is usually a bowl on the kitchen counter. Yeast makes the dough rise and gets it ready for baking by turning sugars into gas. That adds bubbles, and those make bread fluffy and delicious. Yeast alters its environment in a short time, and luckily for us, it's one way to make bread extra tasty.

Follow this simple recipe with an adult to see the yeast in action and end up with rolls!

MATERIALS NEEDED

- two large bowls
- a whisk or fork
- a spatula or wooden spoon
- measuring cups and spoons
- a clean dish towel or plastic wrap
- a large, clean, flat surface
- an oven
- an 8- or 9-inch square or round baking dish
- 2 ½ cups all-purpose flour or bread flour (Spoon and level your flour. Do not scoop it out of the package. This ensures that your dough doesn't get too tough.)
- 2 ¼ teaspoons active dry yeast (one packet)
- 1 ½ teaspoons salt
- 2 tablespoons granulated sugar
- 3 tablespoons vegetable or olive oil
- 1 cup warm water (about 110°F)
- 3 tablespoons of melted butter or plant-based alternative spread
- (optional) fruit preserves, honey, gravy, *etc.*

INSTRUCTIONS

1. Add the flour (chemicals), sugar (energy), salt, and yeast (organism) to a large bowl (stable environment).
2. Mix them together well using a whisk or fork.
3. Add the oil and warm water. The yeast will activate now that it has everything it needs to eat and produce waste (We promise this is a good thing and not gross!).
4. Mix the ingredients with your silicone spatula or wooden spoon until they come together and form a dough.

5. Once the ingredients are combined, it is time to knead the dough. Put a little flour on a flat surface. Wash and dry your hands, then put some flour on them. Transfer the dough to your floured surface.
6. Knead the dough by hand for five full minutes by smooshing it out into a flat shape about ½ inch thick, then folding it in half, rotating it 90°, and folding it again. Repeat.
7. If the dough is too wet to knead, add a tablespoon of flour. If it is too dry, add a bit of water. Knead until the dough is smooth and stretchy.

Kneading develops chewy **gluten**, a sticky protein that helps trap the carbon dioxide bubbles released by yeast. This helps your bread develop a light and fluffy texture.

INSTRUCTIONS CONTINUED...

8. Place the dough in a greased bowl and turn it to coat all sides in the oil, and cover with plastic wrap or a dish towel. Place it in a stable environment of about 70 to 75°F.
   - Tip: If it's too cold or too hot outside, place a baking dish on the bottom rack of your unheated oven and have an adult fill it with boiling water. Place your dough on the middle or top rack and shut the door.
9. The dough should double in size in about an hour.

If your dough grew, that's a sign that the yeast has changed its environment! When you added the warm water, the yeast activated and fed on the sugar and starches in the flour. Then, a chemical reaction occurred, and the yeast released a new substance, carbon dioxide gas. Do you see signs of bubbles? Those are the carbon-dioxide gas pockets. The air pockets made your dough grow.

10. Divide the dough ball into nine equal-sized portions. Shape them into smooth topped balls and place into a greased 8- or 9-inch square or round baking dish.
11. Cover again and let these rise until doubled in size. This will take about another hour.
12. Have your adult preheat the oven to 400°F and bake your dinner rolls for 15 minutes or until the tops are a light golden brown.

When you put bread in the oven, the yeast responds to its warming environment by making even more carbon-dioxide bubbles. This continues until the environment gets too hot for the yeast (around 122°F) and they start to die off. Yeast cells don't have brains or nervous systems, but they did complete an important function. You can thank them for the energy they will give you.

13. After removing the rolls from the oven, immediately brush them with butter or olive oil to make them shine.
14. Enjoy with your favorite spreads or sandwich fixings. Try different combinations with the rolls that you, with the help of the yeast, made from scratch.





PICTURES BY DR. DAVID REITZEL

Modern and Pleistocene Los Angeles
Name: ______________________

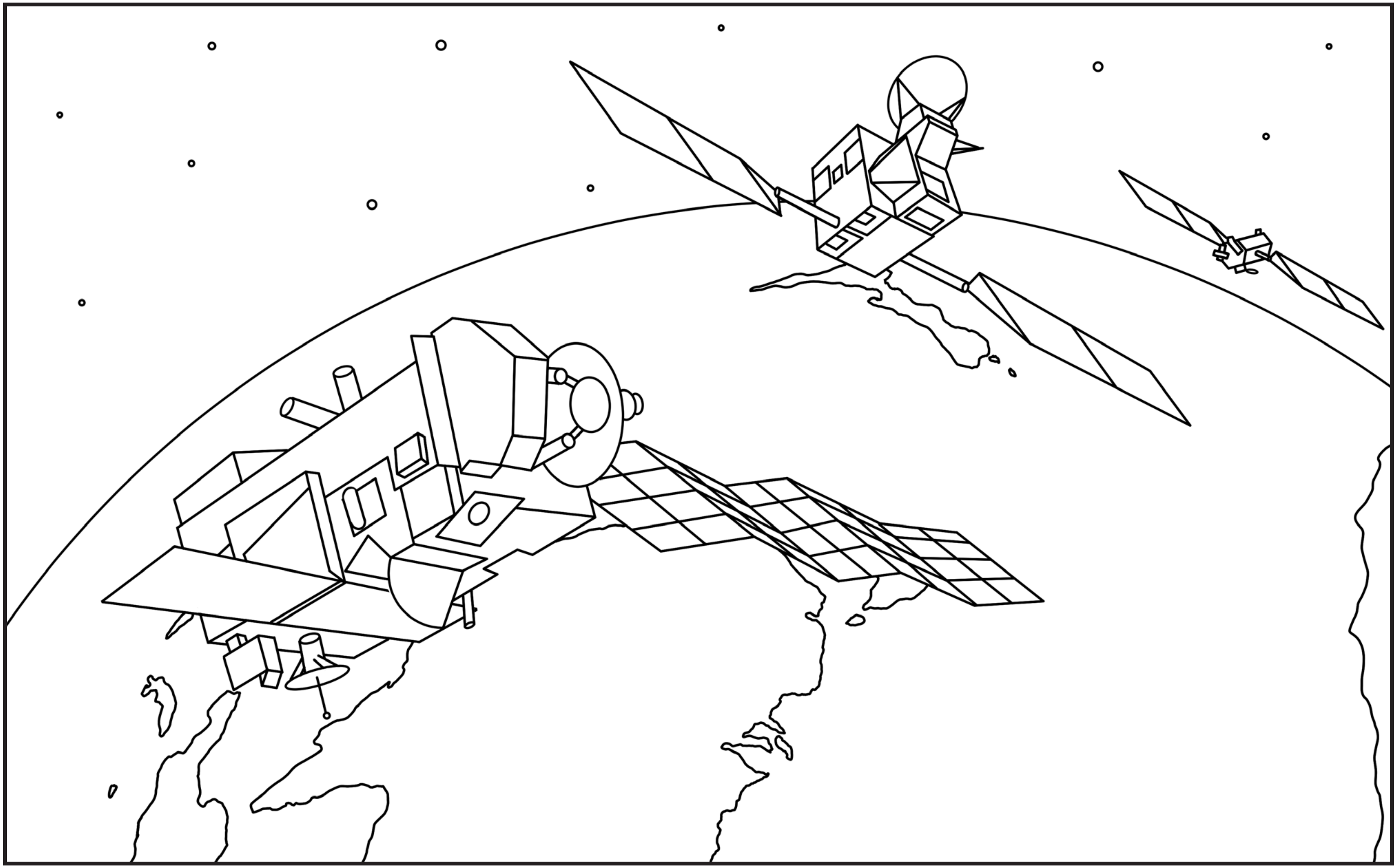
Los Angeles is home to one of the most famous Pleistocene fossil deposits in the world (La Brea Tar Pits). It contains a rich record of life in southern California from 11,000 to 50,000 years ago.

By Ian Crovella

Earth Observation Satellites

Name: ______________________

Observing the full picture about our changing climate takes a fleet of satellites. NASA's network of satellites provides climate scientists with the information they need to predict accurately how Earth's climate will respond to changes we make. The satellites pictured are: **Aura** (left; studies Earth's atmosphere), **GCOM-W1** (middle; observes water-cycle changes), and **OCO-2** (right; studies CO_2 levels).



By Ashley Ferrum

A-Z Responsible Disposal

Do you reduce, reuse, recycle, or repurpose any of your belongings? Most household items have more than one option for disposal. Choosing how you dispose of these common household items is an opportunity to be responsible and help our planet stay healthy.

The symbol(s) next to each item cooresponds to instructions for responsible disposal below.

A aerosol cans

B batteries

C cardboard

D drink cans

E electronic waste

F food cans

G glass bottles

H household containers

I ice cream cartons

J jars (lids removed)

K kitchen utensils (plastic)

L leftover food

M magazines

N newspapers

O old clothes

P plastic bags/wrappers

Q quilts/blankets/towels

R rubber bands

S soiled pizza boxes/napkins

T toilet paper tubes

U used toys

V video games/consoles

W water/soda bottles

X Xerox paper (regular paper)

Y yogurt cups (lids removed)

Z Ziploc bags

Recycle: *All* items with this symbol must be empty, clean, and dry to avoid contaminating other recyclables. Item must not be shredded. In Los Angeles, you don't need to bag your blue bin recyclables. Check your local recyclable collecting service for the most accurate guidance.

Reduce: Items with this symbol usually may not be recycled curbside. Purchase and use this item mindfully. Check with your local recyclable collecting service guidelines for how to responsibly dispose or recycle this item. Or, there might be a more reusable alternative!

Reuse: Items with this symbol may be reused or donated. Donation helps others and reduces waste. Research whether a local shelter or donation center accepts your item.

Repurpose: Crafts, gifts, and other useful items could be made with this item.

Compost: All Los Angeles Sanitation and Environment (LASAN) customers should use the green bin to dispose of all food scraps and food-soiled paper, along with their existing yard waste.

These guidelines are based on 2024 CalRecycle guidelines and are not the same for every community. Always check your ***local recyclable collecting service*** *for up-to-date guidelines.*

Imagining Jobs in Space

A SHORT-ANSWER HANDOUT

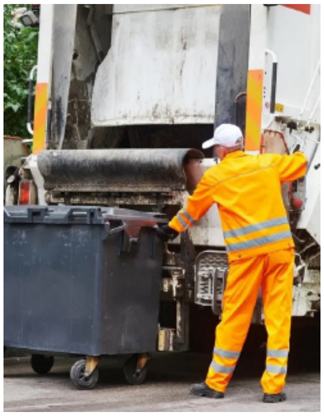
There are many choices for careers and jobs here on Earth. Some are new versions of jobs we have done for a long time. For example, sanitation workers handle garbage collection, which is vital for keeping resources like water clean and our communities healthy. Most of these jobs evolved out of our need to use the resources around us to make our environment more livable.

PART ONE: ECO-FRIENDLY JOBS

Pick one of the jobs below and research to find out what people do in that job. Write your description of the job below.

Recycling Technician

Forestry Worker



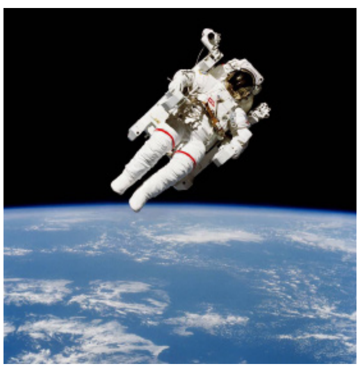
Sanitation Worker

Agricultural Specialist

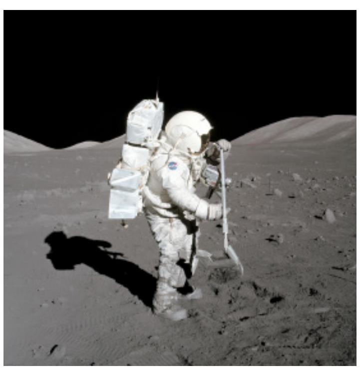
Exercise: Think of places in your community where these jobs have an impact. Describe how at least one of these jobs makes an impact below.

PART TWO: JOBS IN SPACE

Imagine a future version of a job people do on Earth but is a job done in space, or on the surface of a moon or a planet other than Earth. Here are two examples.



Pilot-astronaut Bruce McCandless tests a device to allow him to move around Space Shuttle *Challenger* without a tether for the first time ever. On Earth, he is a pilot. In space, what would you call this new job he is doing—testing equipment outside of a spacecraft? There are no wrong answers.



Scientist-astronaut Harrison H. Schmitt uses a special rake to collect lunar samples on the *Apollo 17* mission. These will be studied later. On Earth, he was a geologist (prefix *geo* means "earth" or "ground"). What would you call the job he is doing on the Moon? There are no wrong answers.

Think of a job on Earth that would be needed in space. What do you call this new job? For example, a delivery driver would be needed in space because people need supplies delivered. In outer space you might need a shuttle pilot to bring supplies. We don't drive in orbit. Use your imagination!

How do you think, based on what you know about the job on Earth, the job might work in outer space or on another planet? Would you need special equipment to protect the worker or to get the job done? Would the job be easier or harder in this unique location?

PART THREE: VISUALIZING THE JOB

Using your idea and your description written for Part Two, draw a person working in space or on another planet or moon and doing that job. Be imaginative—it can either be based in reality or complete fantasy. Include any robots or other machinery and equipment, like space suits, that are needed for the job.

Don’t worry if your drawing is not as good as someone else’s. You will get better each time you draw something.

PART FOUR: REALITY

Remember the eco-friendly Earth job examples from Part One? Here we have described the *actual* space-based versions of these jobs.

Sanitation and Recycling in Space: Astronauts can process small pieces of trash in a high-temperature reactor, which breaks the waste down into water, oxygen, and other gases which the crew can use or vent as needed. Besides the gases, the leftovers of the waste are greatly reduced in size and sterilized. Since it costs so much to get things into orbit, astronauts work hard to get as much use from those items as possible. What can we learn from what we do on Earth to best prepare us to live in space? Is there anything you can try at home?

Forestry in Space: Seeds were taken into space for the *Apollo 14* mission and when returned to earth, they did grow. There are, however, currently no jobs that involve forests in space. Someday, if we plant forests in space, these jobs might be needed. Planning will begin here on Earth. What would you need to bring to the Moon if you wanted to plant a forest?

Agricultural Specialists in Space: The Vegetable Production System (Veggie) has been used aboard the *International Space Station (ISS)*. Plants tested in Veggie so far include lettuce, leafy greens, flowers, and even radishes. Growing food is an important part of our research for living in space. Plant-growth experiments in space need to be compared to how plants grow on Earth. Can you think of ways to prepare to do agricultural experiments in space? Are there experiments you can do at home now to prepare?

In 2022, NASA astronauts Jessica Watkins and Bob Hines used instruments in the *International Space Station's* Veggie facility to test soilless methods of growing plants.

WRAP UP: Discuss why these jobs on Earth work best when they're in balance with our environment. How can we translate maintaining a healthy environmental balance into working in space?

Citizen Science

HELP POWER REAL RESEARCH

No matter your age or level of experience, you can help scientists change the world, and have fun doing it, too! Citizen Science projects are direct ways to help real researchers online. Citizen Science makes research possible that would not be possible otherwise. These projects result in new discoveries, create new data with many uses, and expand our understanding of Earth, life, and outer space.

Here are two sites that contain Citizen Science projects.

NASA CITIZEN SCIENCE

You can help make actual scientific discoveries with data from NASA! Through collaborations with NASA scientists, search for undiscovered worlds, protect and improve life on Earth and in space, and decode the secrets of the universe.

https://science.nasa.gov/citizen-science/

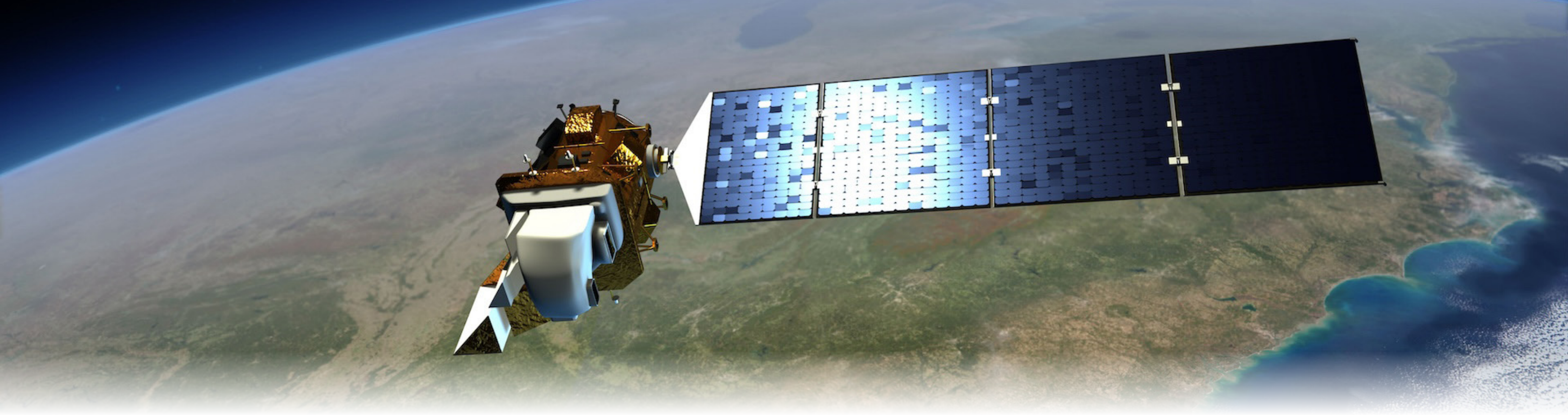
ZOONIVERSE

The Zooniverse is a big portal for people-powered research. You can classify data from many research fields, including climate, biology, space, medicine, history, and more! In the Zooniverse, there's a place for everyone to contribute to science.

https://www.zooniverse.org/

HELP

- Worried that your classifications may be incorrect? That's OK—many people will see the data, and everyone's classifications will be combined to produce a result. The combined knowledge of many people tends to give the right answer.
- If a project in which you're interested is on pause, check back later; projects are typically updated with new data regularly.



Surf the Earth-observing Web

Check out these trusted online educational resources from NASA and continue your Earth-observing journey. You can make a positive impact on our planet's health simply by staying informed about climate science.

NASA CLIMATE KIDS

This K-8 portal from NASA's Jet Propulsion Laboratory has games, activities, crafts, videos, and articles about climate science. There is much to learn from NASA's missions that study Earth! This site for students tells the story of our changing planet through the eyes of the NASA missions studying Earth.

https://climatekids.nasa.gov/

EYES ON THE EARTH

Keep an eye on Earth's health with this beautiful 3D visualization. You can discover what Earth-observing satellites are up there, where they are, and what they're doing right now. You can even view near real-time data and images of recent Earth events.

https://eyes.nasa.gov/apps/earth/#/

EO KIDS

This resource created for students ages 9-14 features articles and hands-on activities about Earth science published with support from NASA's *Landsat*, *Terra*, and *Aqua* satellite missions.

https://earthobservatory.nasa.gov/blogs/eokids/

SPOT THE STATION

Watch the *International Space Station* pass overhead! It is the third brightest object in the sky and easy to spot if you know when to look up. This mobile app and website makes it easy to find.

https://nasa.gov/spot-the-station/

NASA CLIMATE CHANGE

This is NASA's central hub for climate science. Get connected to the latest articles, videos, interactive data, resources, and more.

https://science.nasa.gov/climate-change/

Internet Resources

Not all websites are equally accurate. The world wide web, while convenient, can frequently provide incorrect and incomplete information. Below is a list of some of the best space science websites recommended by Griffith Observatory educators.

GRIFFITH OBSERVATORY

The most-visited public observatory in the world.

https://griffithobservatory.org

ASTRONOMY CLUBS

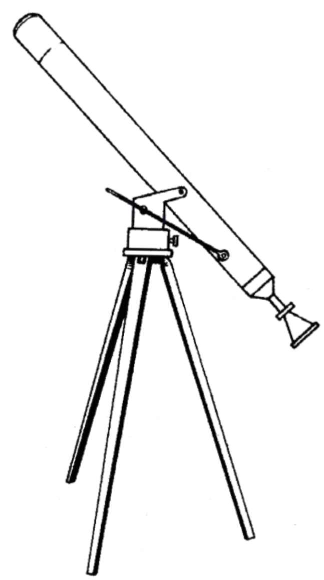
Find an astronomy club near you! Amateur (and some professional) astronomers are happy to share their telescopes, their enthusiasm, and their knowledge. A list of local clubs and more information may be found on our website:

https://obs.la/astronomyresources

CITIZEN SCIENCE PROJECTS

You may make a real contribution to astronomy by participating in these scientific projects.

Help scientists with their research into stars, Mars, Earth, galaxies, astronautics, the Sun, and black holes! Multiple projects are listed at this website:
https://science.nasa.gov/citizen-science



Another useful site that lists multiple Citizen Science projects:
https://zooniverse.org

NASA WEBSITES FOR SPACE FANS

Check out games and projects for budding space scientists:
https://spaceplace.nasa.gov/menu/play

Explore space with NASA's remarkable app, "NASA's Eyes:"
https://science.nasa.gov/eyes

Visit websites dedicated to learning for grades 5 through 8:
https://nasa.gov/learning-resources/for-students-grades-5-8

Watch NASA's live and original programming for free:
https://plus.nasa.gov

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INTERNET RESOURCES CONTINUED...

RESOURCES FOR TEACHERS

Free lesson plans and activities for K-12 from Jet Propulsion Laboratory:
https://jpl.nasa.gov/edu/

Find Next Gen STEM learning opportunities for students in multiple settings:
https://nasa.gov/learning-resources/for-educators

Search NASA's educational activities and resources by subject, type, and grade level:
https://science.nasa.gov/learn/catalog

YOUTUBE CHANNELS

Griffith Observatory

European Space Agency

PBS Space Time

MORE WEB LINKS

California Science Center: Astronomy education programs, workshops, lesson plans, and resources. https://californiasciencecenter.org

The Lunar and Planetary Institute: Astronomy education programs, workshops, and resources. https://lpi.usra.edu/education

StarDate: The public education and outreach arm of the McDonald Observatory, Texas.
https://stardate.org

WorldWide Telescope: This website turns your computer into a telescope and brings together data and imagery from telescopes around the world.
https://worldwidetelescope.org

Astronomical Society of the Pacific: Organization of professional and amateur astronomers with astronomy education conferences, education programs, and resources, including professional development opportunities for teachers. https://astrosociety.org

Planetary Society: Open membership organization that sponsors planetary events and programs. Its "Space for Kids" page lists many at-home activities.
https://planetary.org/kids

Exploratorium: A resource for at-home experimentation and projects.
https://exploratorium.edu/explore

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