National Aeronautics and Space Administration

Become a NASA Space Place Explorer!

LEVEL 1 Universe

Want to become a Universe Explorer? Complete at least one page for each year you are old!

What is the universe?

The universe is not just stars and galaxies and planets—it is everything. All of space, matter and energy are part of the universe. The universe even includes time itself and, of course, it includes you.

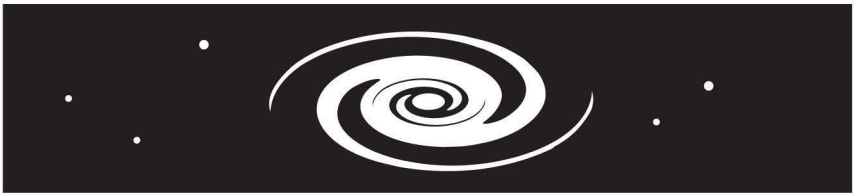
Although the universe might seem like a faraway place, you're in it right now! In the box below, draw three of your favorite things in the universe. People? Pets? Toys? Foods? They're all in the universe!

Where did the universe come from?

The big bang is how astronomers explain the way the universe began. It is the idea that the universe began as just a single point about 13.8 billion years ago. Then, it expanded and stretched. The universe eventually grew as large as it is right now.

In fact, the universe is still stretching today! That doesn't mean that planets and stars are stretching out and getting bigger. It just means that the space between these objects is growing.

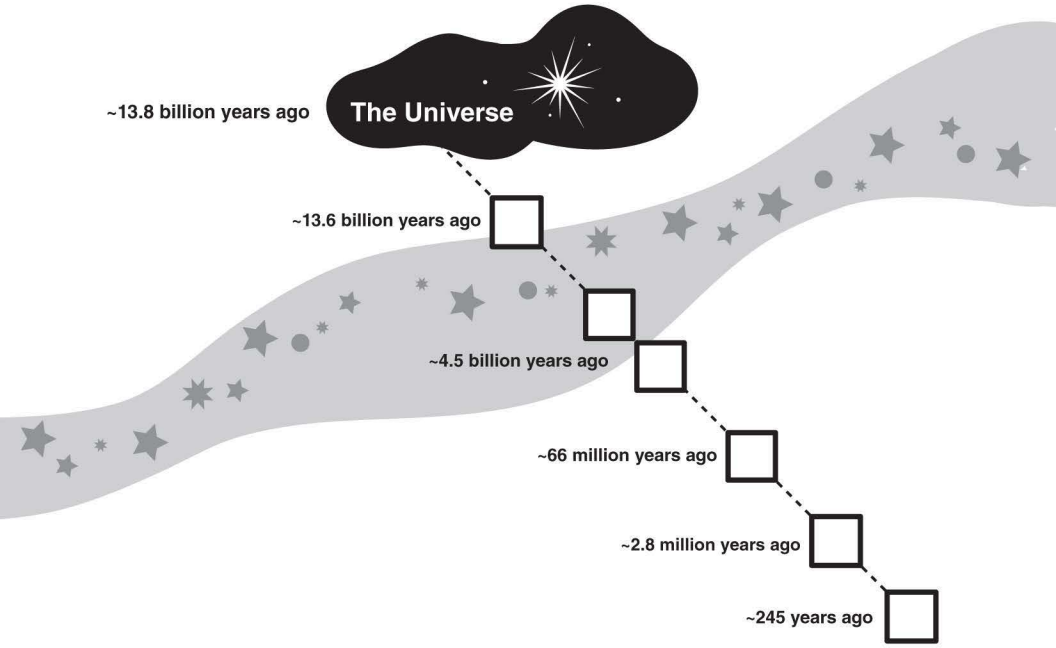
Make your own expanding universe below. Fold accordion-style on the dotted lines below. Once the two galaxies are next to each other, you've reached the early universe! Pull on the bottom of the paper to expand the universe and move the galaxies apart over time.



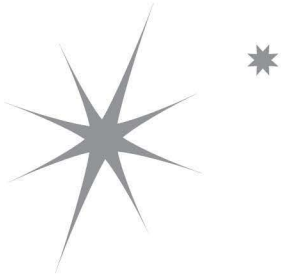
How old is it?

When you think of things that are old, what do you think of? Dinosaurs? The pyramids in Egypt? Our universe is the oldest thing we know of at 13.8 billion years old. That's a lot of birthdays to celebrate!

In the timeline below, enter the letters of each event in order from oldest to most recent. Check your answers at the bottom when you're done!

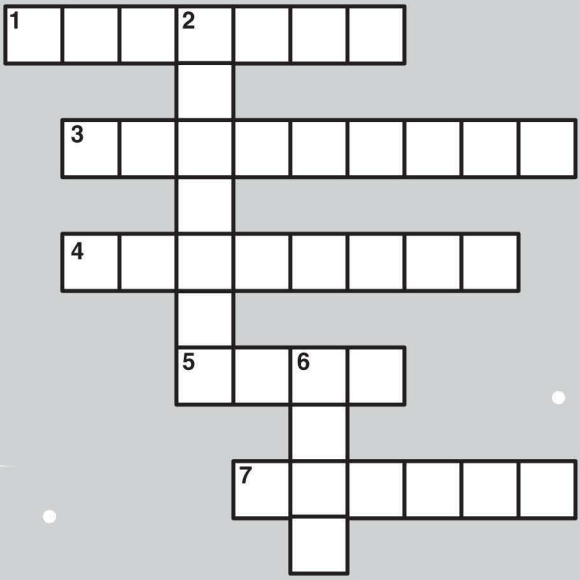


A. Dinosaurs went extinct
B. The Declaration of Independence was signed
C. Earth first formed
D. The last ice age began
E. The Milky Way (our galaxy) first formed
F. The Sun first formed



Answer key: E, F & C, A, D, B

Universe Crossword



Across

1. How astronomers explain the way the universe began as a single point, then expanded.
3. NASA's Hubble Space _____ has been sending back beautiful images and helping scientists to learn about the universe for more than 30 years.
4. Includes everything – space, matter, energy and even time.
5. Agency makes satellites and rockets, and sends humans and robots into space to study the Earth, Moon, Mars, the solar system and the Universe.
7. A huge collection of gas, dust and billions of stars and their solar systems, all held together by gravity.

Down

2. Our universe formed 13.8 _____ years ago.
6. A sphere of gas held together by its own gravity. The closest one to Earth is our Sun.

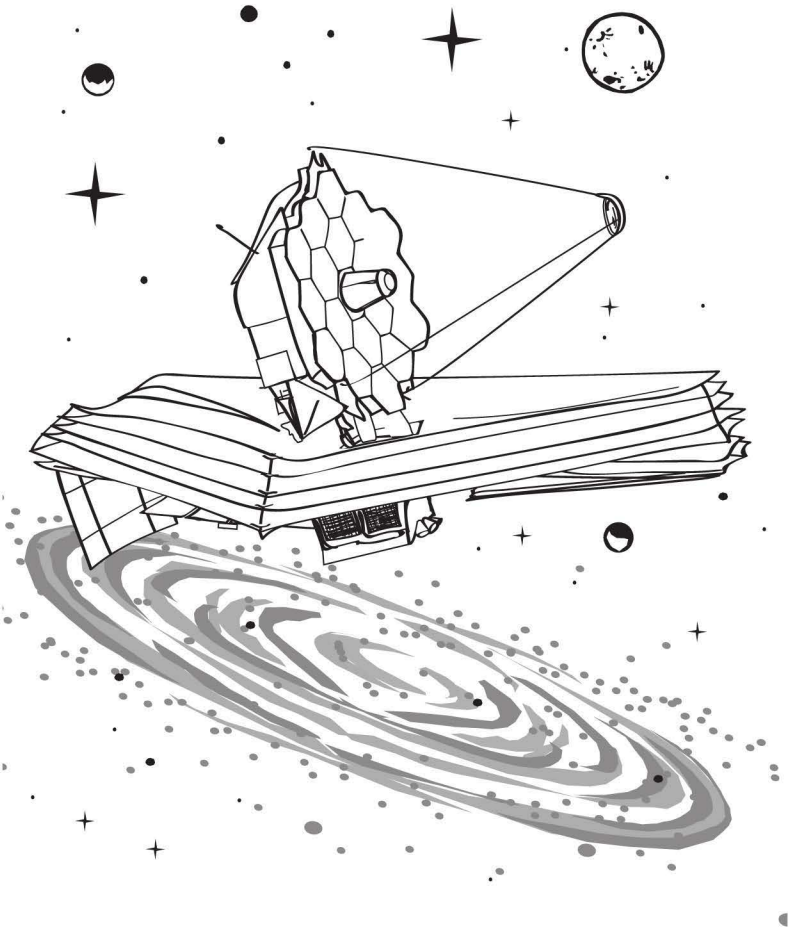
big bang, galaxy, universe, NASA, star, billion

How do we study the universe?

Scientists use telescopes to study the objects in our universe. NASA uses space telescopes to look at some of the oldest parts of the universe – distant galaxies that formed shortly after the big bang.

The Hubble Space Telescope has been producing beautiful images of our universe for more than 30 years. NASA's next big telescope – the James Webb Space Telescope – will be a giant leap forward in our quest to understand the universe and where we came from. It will examine the history of our universe from the Big Bang to the formation of our own solar system.

Color a picture of the Webb telescope below!



Different types of galaxies

A galaxy is a huge collection of gas, dust and stars – as well as the planets that orbit those stars. A galaxy is held together by gravity. We live in a galaxy called the Milky Way, but there are many others. Some scientists think there could be as many as one hundred billion galaxies in the universe.

There are different types of galaxies. Our Milky Way is a spiral galaxy. Spiral galaxies have curved arms that make them look like a pinwheel. Other galaxies are smooth and oval shaped. They're called elliptical galaxies. And there are also galaxies that aren't spirals or ovals. They have irregular shapes and look like blobs.

Sort through this galaxy of letters to find the words below!

K M E C B M V E V Q F R G J T
K V H O S I W N H W F A A M L
S D K L H L W F K U L L M F U
Q G Z Z M K I T O A R U N A Z
Y J M U P Y K L X M O G H I X
W Q X C L W D Y G T R E D B I
F A O L O A D Q U O M R P C Y
V I R S S Y C O L U U R V X H
P S Z R Z T Y I Y U S I C H V
N K H V Q T A U T P W Z C E P
N D X D I L A R I P S P G G B
U I Z V H H G Z S I I W F F C
R H A D U S T M R I E L R U P
T R N S D U D Z A C B M L S V
G F X X N F Z R X J B R J E M

dust elliptical galaxy gravity irregular
Milky Way spiral stars

What is a black hole?

A black hole is a region of such immense gravity that nothing – not even light – can escape from it. NASA missions such as Chandra, NuSTAR and Swift help to capture information that is useful for understanding black holes.

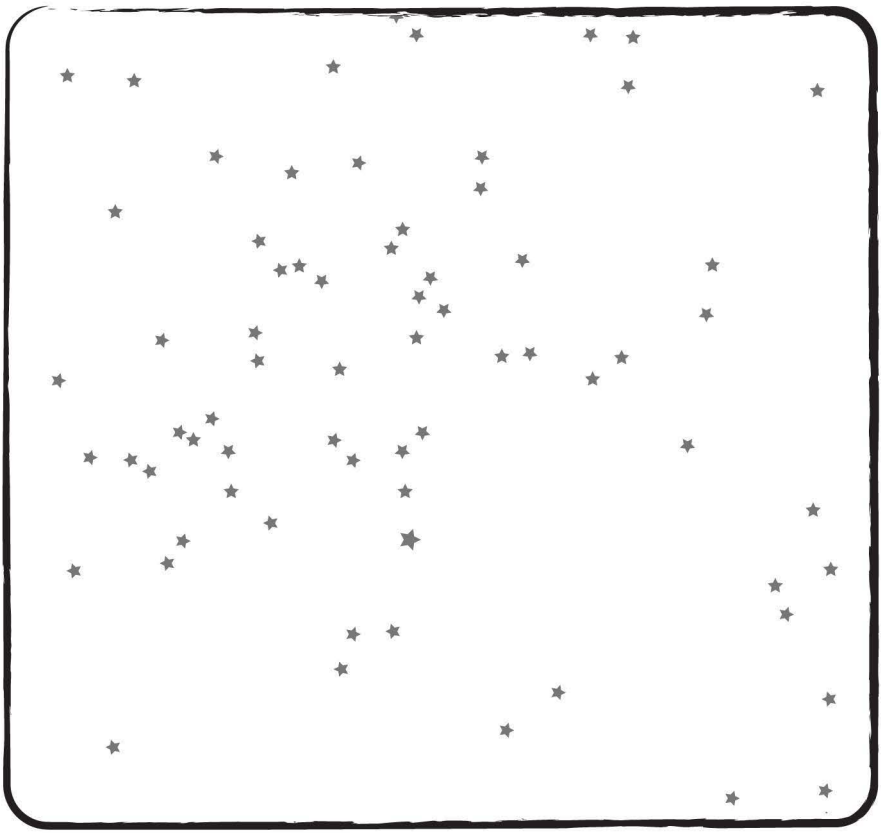
There is a black hole at the center of most galaxies, including our home galaxy, the Milky Way. Draw a line from dot to dot in number order to make an image of a spiral galaxy and its black hole.

What is a constellation?

A **constellation** is a group of stars that looks like a particular shape in the sky and has been given a name. These stars are far away from Earth. They are not connected to each other at all. But, if you were to draw lines in the sky between the stars – and use lots of imagination – the picture would look like an object, animal or person. Usually the names and shapes of constellations relate to stories and myths from different cultures.

Stars and constellations appear to stay in approximately the same spot for many, many years. Because the constellations appear to be in a fixed location, they are often used as landmarks in the sky. So, NASA's robotic spacecraft use maps of the stars to find their way. They carry a star map in their onboard computers and compare these star maps to patterns of stars in images they take.

Make and name your own constellations in the field of stars below!

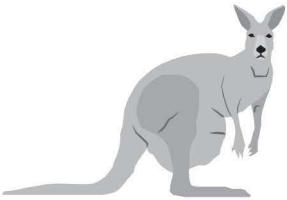


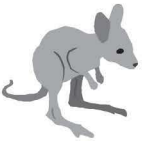
What is a nebula?

A nebula is a giant cloud of dust and gas in space. In fact, nebula is the ancient Greek word for “cloud.” Some nebulae (more than one nebula) come from the gas and dust thrown out by the explosion of a dying star, such as a supernova. Other nebulae are regions where new stars are beginning to form.

Astronomers use very powerful telescopes such as NASA's Hubble Space Telescope to capture images of faraway nebulae.

A nebula is where newborn stars call home. What environment do these baby animals call home? Match the animal baby to its home below





Are there other planets outside of our solar system?

Yes! All of the planets in our solar system orbit around the Sun. Planets that orbit around other stars are called exoplanets. There are even some exoplanets that don't orbit a star at all. NASA scientists have discovered thousands of exoplanets in our universe – and they're finding new ones all the time.

Exoplanets are too far away from Earth to visit. But we can learn a bit about what they are like by using powerful telescopes, such as the Transiting Exoplanet Survey Satellite.

Pretend that you've just discovered an exoplanet and you need to log your discovery in your notebook. What does your planet look like? What is it like there? Tell the other scientists all about your planet in the space below!

Discovery Alert!

Draw what this planet looks like below

Planet name: _____

Discovered by: _____
(your name here)

How does this planet compare to Earth? (circle one)

Size: Smaller Larger Same size

Temperature: Colder Warmer About the same

The ground on this planet is made of: _____

The sky on this planet is: _____
(color)

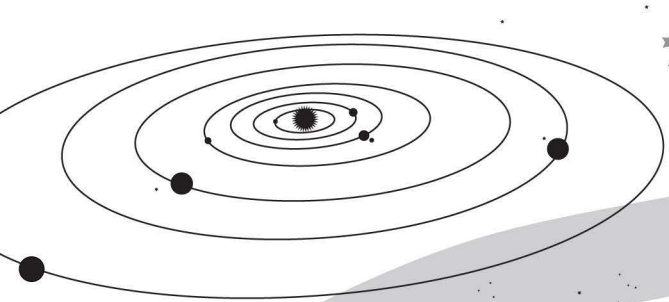
This new planet smells like: _____

Is there water on this planet? (circle one)

Yes No Not sure

Do you think something could live here? (circle one)

Yes No



Is there life on other planets?

Scientists haven't found life beyond Earth yet. But they have found a few places where it might be possible! Planets that can support life are in what's called the **habitable zone**.

A habitable zone planet is exactly the right distance from its star. At this distance, the planet is warm enough to have liquid water on its surface, which is essential for life as we know it. In our solar system, Earth sits comfortably inside the Sun's habitable zone.

Find words that are important to the search for life in the puzzle below!

L E L K D S C J S Q N A A D Z
U I X O F I P P O E I I O E G
Y L F O S G U L S P E C I C O
L Q O E P D R Q X R N C M F U
P U P F G L R D I F E O V M G
P C L L X H A R U L R W G B F
B V O D L E B N Q U G Y S J H
A Z V X X A Q T E W Y K L A Q
B P D Y V W W Z H T W B B A G
Q I K M K C J I A E S I W G Z
W H P B H X P R C O T Z M U P
A T F Y V N A R I A M O O N S
T R X L Q T D C B X N U M G E
E A E B S B K L D F W G Z S Z
R E C E E R E H P S O M T A P

atmosphere Earth exoplanets energy habitable,
liquid water life moons star

What is space made of?

Believe it or not, planets, stars, galaxies, comets and black holes are only a small part of the universe. The rest of the universe is made up of other stuff that we don't really understand. Scientists call it dark matter and dark energy.

Dark matter is stuff in space that has gravity, but it is unlike anything scientists have ever seen before. Dark energy is the force we can't really see that is making the universe expand.

Lots of scientists are using observations and math to figure out what dark matter and dark energy are. Can you use math to solve this puzzle? Complete the four puzzle boxes below. Every row, column and block must contain the numbers 1 through 4 once.

3		4	
	1		2
	4		3
2		1	

	4		1
3		2	
1		4	
	2		3

	4		2
3		1	
2		4	
	3		1

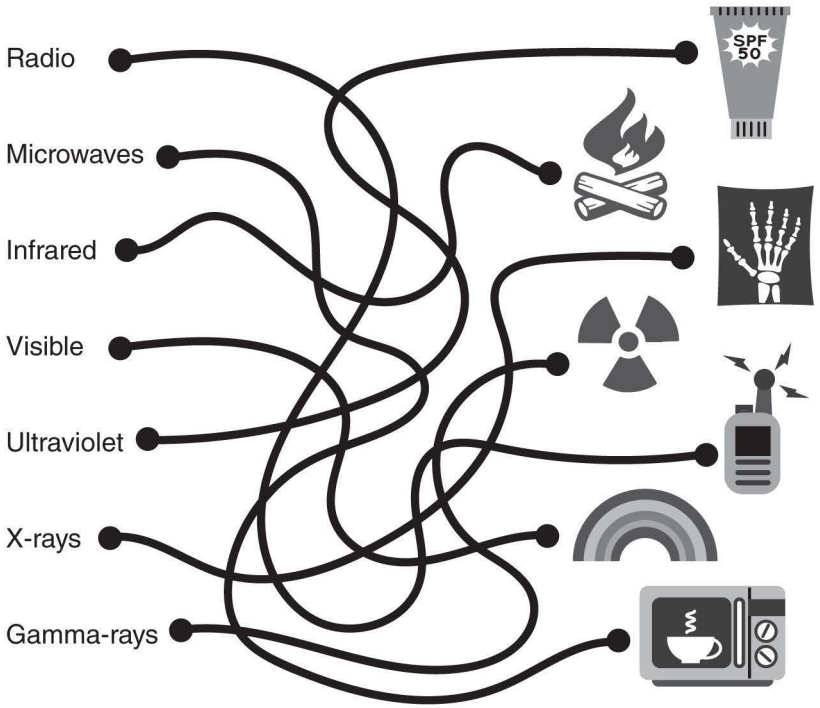
4	2		
		4	2
		3	1
1	3		

All about light

Space is a dark place! What brings the light? Stars, of course! Our own star, the Sun, is what lights up the daytime on Earth. When you look at the sky on a dark night, you can see the light from other stars, too.

But light that we can see – called visible light – is only one kind of energy released by stars. There are other kinds of light energy, too. They are called radio waves, microwaves, infrared, visible light, ultraviolet light, X-rays and Gamma-rays. Together, these energy types make up what is called the electromagnetic spectrum.

NASA scientists use different types of telescopes to detect different types of light. This helps us learn more about the stars and galaxies in our universe. We use these different kinds of light energy on Earth, too. Follow the paths below to match each energy type to its use on Earth.

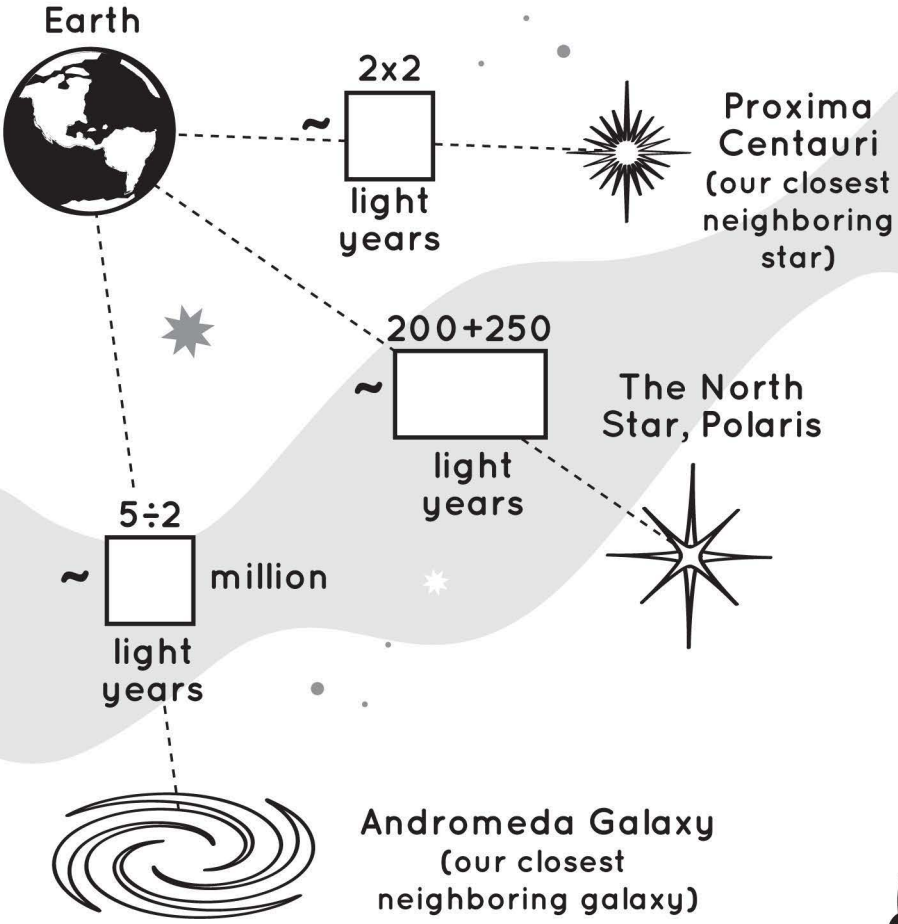


How far away?

Stars – like our Sun – produce light and energy. NASA's space telescopes look at the light from these stars to learn about how old the stars are and what they are made of. We also use light to measure how far away the stars are.

Have you ever heard the term "light-year"? A light-year is used to measure very long distances. One light-year is equal to the distance that light can travel in one year – 5.8 trillion miles (9.4 trillion kilometers).

Imagine you're a light wave. How long would it take you to travel around the universe? Do the math problems below to see how far away these things are!



Checklist

- ☐ Page 1 - What is the universe?
- ☐ Page 2 - Where did the universe come from?
- ☐ Page 3 - How old is it?
- ☐ Page 4 - Universe crossword
- ☐ Page 5 - How do we study the universe?
- ☐ Page 6 - Different types of galaxies
- ☐ Page 7 - What is a black hole?
- ☐ Page 8 - What is a constellation?
- ☐ Page 9 - What is a nebula?
- ☐ Page 10 - Are there other planets outside of our solar system?
- ☐ Page 11 - Is there life on other planets?
- ☐ Page 12 - What is space made of?
- ☐ Page 13 - All about light
- ☐ Page 14 - How far away?

1. How many activities did you do? ☐

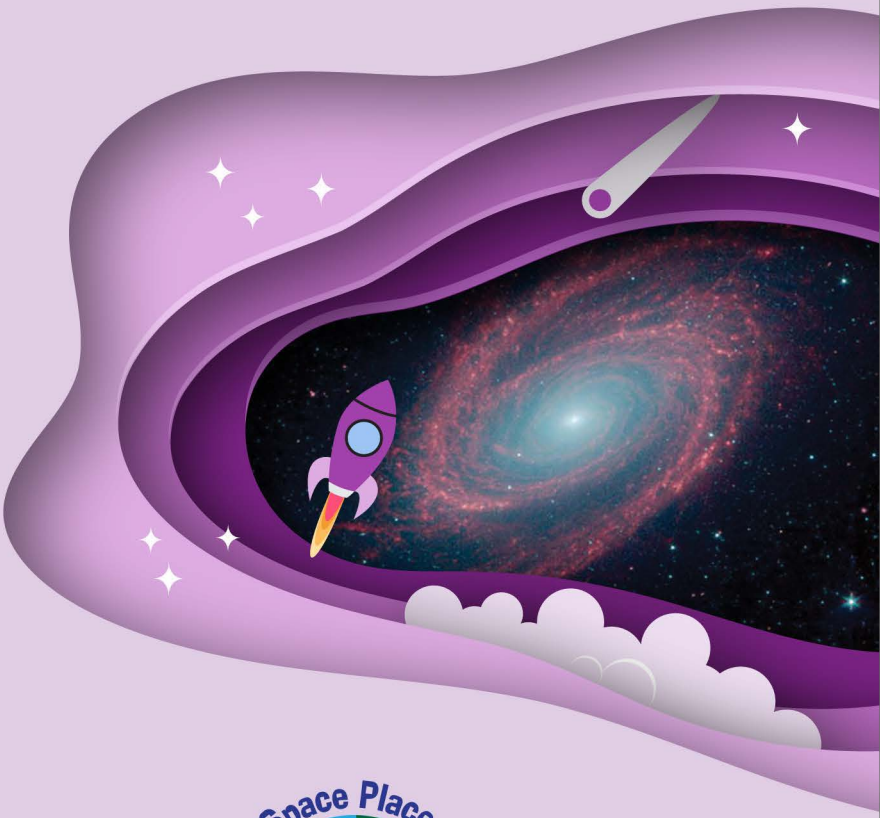
2. How old are you? ☐

When answer 1 is greater than or equal to answer 2, you're a Universe Explorer!

Ready for more? Head over to our spaceplace.nasa.gov to play games, do activities and learn more about our planet, our solar system, our galaxy and our universe!

Front cover: Spitzer reveals the Carina Nebula, which contains Eta Carinae, a star that's 100 times as massive and a million times as bright as our sun. Photo: NASA/JPL-Caltech/M. Povich, Penn State Univ.

Back cover: The magnificent spiral arms of the nearby galaxy Messier 81 are highlighted in this NASA Spitzer Space Telescope image. Photo: NASA/JPL-Caltech



For more information, visit the NASA Space Place website at:
https://spaceplace.nasa.gov/.

NASA Space Place Facebook: www.facebook.com/nasaspaceplace

NASA Space Place Twitter: www.twitter.com/nasaspaceplace

NASA Space Place YouTube: www.YouTube.com/NASASpacePlace/videos