

Below, you'll find hundreds of astrobiology questions and their relationship to the Arizona State Standards. (For those out of state, the Arizona State Standards are closely aligned with the NGSS Standards, but not exactly the same. For instance, NGSS combines all middle school science standards.)

If you'd like to add to the list, or if you're interested in collaborating to make a lesson plan about any of these topics, please email Lauren James at laurenjames@arizona.edu. Thank you!

Origin of Life Questions

High School: E = Earth Science, L = Life Science, P = Physical Science

Question	K	1	2	3	4	5	6	7	8	E	L	P
What is life? How do we know if something is "alive?"	X	X	X	X	X	X	X	X	X	X	X	
How did the formation of the Solar System create the conditions for life to develop on Earth?	X	X	X			X	X			X		X
What does the timeline/chronology of the formation of the Earth look like? What portion of this timeline includes life? What portion of this timeline includes human life?		X	X	X	X			X	X	X		
What conditions were needed for early Earth life to grow and develop?		X	X		X			X		X	X	
What characteristics does our Sun have that are conducive to life forming on Earth? How does our Sun compare to other stars in this way?			X	X	X		X	X		X		
Why do we look for places with water when we search for life beyond Earth? (Basic concept that all living things on Earth need water)	X	X	X									
Why is liquid water essential to the formation of life? What makes water special? (Are there alternatives?)			X		X		X	X	X	X	X	X
Why might the "right" atmosphere be essential to the formation of life? (Protection from radiation, temperature regulation, etc.)					X		X	X		X		X

What are the basic “building blocks” for life as we know it? Why are they special? (Are there alternatives?)							X	X	X		X	X
What life processes might originate at the atomic level? (Quantum consciousness, the “Quantum Robin”)						X	X		X		X	X
What was the Miller-Urey experiment, and how did it influence our understanding of the origin of life?								X		X	X	X
How did cells (or cell-like structures) first develop on Earth?								X			X	
Why do scientists think that the cell replication process developed fairly early in the history of life on Earth?								X			X	
Why is homeostasis/internal stability often included as an essential characteristic of life?								X			X	
How does the vacuum of space present a challenge to homeostasis?								X			X	
What do scientists know about the genetics of the Last Universal Common Ancestor (LUCA)?									X		X	
Could alien life have alternative genetic systems?									X		X	
Might we share common genetics with aliens (Panspermia Hypothesis)?									X	X	X	
How do stars (and their life cycles) create the building blocks for planets and life?										X		X
How might cosmic rays have influenced the “handedness” of life?										X	X	X
The mysterious origin of nucleic acids, RNA, DNA - how did they originate? How did they stay stable? How did they replicate?											X	
What is consciousness? Does it have biological origins? Does it have quantum origins?							X		X	X	X	X

What organisms on Earth are affected by the movement of the Moon (i.e. tidal ecosystems)? How might life be different on a planet with no moons, or many moons?	X		X			X	X			X	X	X
What organisms on Earth utilize the movement of the stars for navigation? (Sea turtles, migratory birds, dung beetles, etc.) How does light pollution affect this?	X						X				X	
What different body parts or adaptations might an alien animal/plant have in order to survive on another world?	X	X	X	X	X	X	X	X	X		X	
Why do some living things move? What different types of locomotion have evolved? Could we expect these to evolve on other worlds?	X	X		X	X		X		X		X	
How would the amount of friction or gravity on a planet affect what types of locomotion might survive and evolve?		X			X	X			X		X	X
Why do some living things glow in the dark? Could this happen on another planet?				X	X	X	X					
Why did so many animals evolve to use sound to communicate (as compared to light, touch, behavior)? Could we expect the same on other worlds?		X		X	X				X		X	X
How have past extinction events affected the course of life on Earth?		X			X	X			X	X		
What are some “alternative” ways that life has evolved to obtain energy (chemosynthesis, lithotrophy, etc.)? What does the flow of energy/matter in these ecosystems look like?		X	X	X	X		X				X	
Could organisms evolve to survive on a world with little/no energy from the Sun (such as energy from tidal forces)?			X	X	X	X	X	X		X	X	X
What might food chains/food webs look like on an alien world?			X	X			X				X	
What are hydrothermal vents, how do they form, and why are they of interest to astrobiologists?					X			X		X		

[illegible]

Distribution of Life Questions

High School: E = Earth Science, L = Life Science, P = Physical Science

Question	K	1	2	3	4	5	6	7	8	E	L	P
What tools do we use to help us search for life beyond Earth? (Telescopes, spacecraft, rovers, etc.) How do they work? What can they tell us?	X						X	X	X	X		X
How would human needs, wants, and the availability of resources affect the population of a space habitat, or habitat on another world?	X	X	X						X	X	X	
Why do astronauts wear spacesuits? What would happen if they didn't?	X	X	X									
What is the weather like on other planets/moons? How does this affect the possibility of life and the type of life that might exist there?	X		X		X		X	X		X		
Which conditions make a planet or moon potentially habitable?	X	X	X	X	X		X			X		
How does spectroscopy utilize our knowledge of light and atoms to assess the habitability of other worlds?		X		X			X	X	X	X		X
What are "biosignatures"? Why do astrobiologists look for them? How are they related to Earth organisms and ecosystems?							X	X	X	X	X	X
What are "technosignatures"? How are they related to human activity and human impact on Earth's environment?							X		X	X		X
Could plants/animals survive on _____ (planet/moon)? Why/why not? (Why is Earth so special for life as we know it?)		X	X	X			X			X	X	
What conditions cause extinction events on Earth?		X			X	X	X		X	X		
What extreme environments can organisms survive in on Earth? What can this tell us about the distribution of life beyond Earth?	X	X	X	X	X	X	X	X	X		X	
What extreme environments or natural hazards exist on other	X	X	X	X	X	X	X		X	X		

How might this affect where we look for life?												
What types of signals is SETI looking for and why?												X
Is a planetary magnetic field necessary for life? (How does our magnetic field provide protection from radiation?)					X	X		X				X

Future of Life Questions

High School: E = Earth Science, L = Life Science, P = Physical Science

Question	K	1	2	3	4	5	6	7	8	E	L	P
How do people with a variety of careers/backgrounds work together to create new space missions? What skills would be needed in a colony on another world?	X	X	X	X	X	X	X	X	X	X		
How does climate change affect the future of life on Earth?	X	X	X		X	X	X	X	X	X	X	X
What natural resources are we “running out of” on Earth that we might seek out elsewhere (such as asteroid mining)? How practical is this?		X	X				X			X		
What “signs of life” would be left behind after humans go extinct?		X			X					X		X
How might organisms evolve and adapt to future Earth conditions?		X		X	X	X	X		X		X	
What would it be like to live on Mars? How would the environment affect the people who live there? Are there any similar environments on Earth?			X				X			X		
What would farming look like on Mars? Could we grow food crops and trees there?	X	X	X		X		X			X	X	
If you lived on the Moon, Mars, or a spaceship, how would the different						X		X			X	

gravity affect your growth?												
How will the evolution of the Sun impact Earth life in the future?			X	X	X	X	X	X	X	X	X	
What is terraforming? What are the ethical, cultural, and practical considerations when terraforming or occupying another world?										X	X	
What genetic variation/composition concerns might arise in an isolated colony on another world?											X	
Why is it hard to live in space?		X	X									
What health conditions are a challenge in long-term space travel? (Exposure to radiation, microbial ecology, bone density loss, etc.)											X	
Is cryogenics for long term space travel scientifically plausible?											X	
Could we (and should we) genetically modify humans to adapt to live on another world, such as Mars?											X	
What attempts have we made to preserve genetic diversity for the future? (Seed banks, frozen zoos)											X	
How are Newton's laws relevant to space travel? (Thrust, gravity, inertia)								X				X