**Astrobiology**

**Name: Loz**

**Directions**

1. Answer the questions below after discussion with your group. Your answers should be written in your own words (this applies to the entire activity) (3 points each)

**Think, discuss, write:**

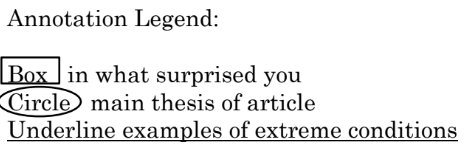
What is Astrobiology? **Astrobiology is the scientific study of life and space.**

**New Answer: Astrobiology is the scientific study of the origin of life, evolution, distribution and the future of life in the universe.**

What is the purpose of Astrobiology? **The purpose of astrobiology is** **to find the purpose and history of the universe.**

**New Answer: The purpose of Astrobiology is to find out what life is? How did we get here? Are we alone in the universe? How can we tell if we are? The future of our universe. It is a collaborative effort to transcend the boundaries of scientific disciplines. To explore extreme forms of life and to relate conditions necessary for early life on Earth to exterrestrial life.**

1. Read the Astrobiology reference and refine your answers to the questions above
2. Read the information in the reference about extremophiles
3. As you read, annotate the text (5 points)



1. Read the purpose and create a hypothesis

**Purpose**

To explore extreme forms of life and to relate conditions necessary for early life on Earth to extraterrestrial life.

**Hypothesis**

What makes Earth special? Why can life exist on Earth (four reasons)? **Earth is a place where life and new possibilities can be achieved through science and technology. Life can exist because of carbon dioxide, oxygen, atmosphere and conditions.**

*(5 points-see CER rubric at end)*

**Materials and References**

Astrobiology Reference (doc)

Planet Profile Cards (paper and slide show)

Extremophile Profile Cards (paper and slide show)

1. Read and discuss the Extremophiles Profiles with your team
2. In your own words, describe the extreme conditions the organism is able to tolerate, record notes in Table 1.
3. Choose a planet or moon from the Planet Profiles
4. Decide which organisms have potential to survive well, which would potentially survive less well, and which would potentially not survive at all. Use the rating scale to indicate survival chances.
5. Add a brief note about your choice in the reasons row (why did you choose the answer)
6. Repeat process with each organism and for each of the planets and moons

**Table 1. Organisms Notes- What Extreme Conditions is this organism adapted to surviving? Or what does it need to survive? (24 points)**

| **Organism** | **Extreme Conditions it is Adapted to Surviving** | **Needs** |
| --- | --- | --- |
| Tube Worms | They live around hydrothermal vents on the ocean floor, high pressure and in near boiling temperatures. In addition hydrothermal vents release a poisonous gas to protect itself called hydrogen sulfide which would kill most organisms. | Energy source, protection from predators. |
| Brine Shrimp | Brine shrimp are a micro crustacean which means they are super small and their system removes extra salt from the body. Live in saltwater ponds and marshes with high amounts of salt. | Salt water habitat, can’t survive in freshwater, sensitive to radiation. |
| Deinococcus Radioduran Bacteria | It is found in many unusual places like meat, sewage, filtered air, soil and stone in Antarctica. | It does really well in 86 degrees fahrenheit. |
| Antarctic Midge | The Antarctic Midge can survive freezing temperatures and no predators and relies on Dehydration for survival. In addition to being frozen, losing 70% of water and radiation. | It needs water, bacteria, penguin waste and algae for energy. |

**Rating Scale:**

1- Would Not Survive (missing key habitat features)

2- Would Survive Less Well (missing 1-2 key habitat features)

3-Survive Well

(15 points per creature)

| **Planet/Moon** | **Mars** | **Europa** | **Venus** | **Enceladus** |
| --- | --- | --- | --- | --- |
| Tube Worms  (rating) | 1 | 2 | 2 | 3 |
| **Reasons** | It has no conditions that would be suitable for the Tube worm. | It has a high level of radiation but no water environment that the worms could use to survive. | Its terrain is very dry and rocky which would leave no water for the worms and the temperature of 847 degrees would evaporate and kill the worms immediately. The acid clouds would toxicate the area but the tube worms would love the heat. | Enceladus is an environment that is very cold. Through the hydrothermal vents it could adapt and would suit its needs. |
| Brine Shrimp  (rating) | 3. | 2. | 2. | 1. |
| **Reasons** | The environment is very rocky and has no water so it would die. | Europa has high levels of radiation but has water similar to Earth’s ocean along with oxygen. | The Brine Shrimp is very hot, rocky but does have some water. Its vapor and other conditions would be suitable conditions for it. | The Brine shrimp has a chance with it having lots of water and its similar to the earth's coils which give it a chance but challenge to overcome. It would be a challenge to overcome - 330 degrees fahrenheit. |
| Deinococcus Radioduran Bacteria  (rating) | 2 | 2 | 1 | 1. |
| **Reasons** | It has a very little chance of surviving and Mars also has some oxygen which would give it a challenge. Its radiation levels are very high so that does provide a suitable environment for it. | Too cold of an environment for it and it needs rocks and sewage and that is not happening. But it does love radiation so maybe. | The Bacteria loves radiation but its 847% degrees fahrenheit on Venus. The Bacteria can only handle 86% fahrenheit. | Encleladus is too cold for the bacteria and it would die off instantly to the extreme conditions. |
| Antarctic Midge  (rating) | 3. | 2. | 1. | 1. |
| **Reasons** | The Antarctic Midge loves the cold so it would adapt to mars pretty quickly. | The Antarctic midge on Europa may have a chance but it is colder than the temperatures it normally lives in. | The Midge needs cold temperatures and this planet is 847% degrees Fahrenheit so it could not survive here. | Antarctic Midge would die instantly because it is way colder than earth conditions. Adding another -250 degrees on top of - 80 degrees it would die. |

**Paragraph Analysis- see next page**

Enceladus is a planet with -330 degrees fahrenheit and has clean ice with all the sun bouncing off it leading 80% to hit the planet. I think that a creature like the Antarctic Midge could survive this extreme exoplanet due to it surviving in freezing temperatures and relying on dehydration for survival which Enceladus could provide all of that for the extremophile. The planet Enceladus has carbon, hydrogen, nitrogen, sulfur and oxygen. As well as a giant ocean of water which could give some creatures that love the cold so much a chance for survival like bacteria or other small organisms. As the creature loves coldness theoretically it should adapt with the conditions similar to the Antarctic ocean with all the conditions just a little different and more cold. The planet has the essential 5 elements for life but still could have dangerous effects. Our knowledge only goes so much on the planet and we haven't visited it yet so we have no clue what's there. But if we were to arrive I would immediately look for any signs of life and the essential elements for life.

**Analysis**

1. **Choose a location from the ones studied or research another possible location:**
   1. Exoplanets <https://exoplanets.nasa.gov/>
   2. Titan [https://solarsystem.nasa.gov/mo](https://solarsystem.nasa.gov/moons/saturn-moons/titan/in-depth/)[Exoplanet Exploration](https://exoplanets.nasa.gov/)[ons/saturn-moons/titan/in-depth/](https://solarsystem.nasa.gov/moons/saturn-moons/titan/in-depth/)
2. **In a paragraph, summarize the following:**
   1. The location chosen and what interested you about the location
   2. What conditions exist at this location that could support life? Why do scientists view the location as capable of having life?
   3. Which organisms studied could survive at this location and why?
   4. What hypothesis of early life on earth would best support life in this location?
   5. What limits our understanding of the location? Why don't we know if there is or was life there?
   6. What would you look for at this location?

**Rubric (CER)**

| **Element** | **Sophisticated (3 pts)** | **Emerging (2 pts)** | **Early (1 pt)** | **Missing (0)** |
| --- | --- | --- | --- | --- |
| **Claim**  statement | Makes an accurate and complete claim (statement) in response to the question. | Accurate but incomplete claim | Responds to question with inaccurate claim. | No claim made that responds to question. |
| **Evidence**  (data) | The evidence contains all appropriate data from an observation | Evidence contains most of the appropriate data | Evidence contains some of the appropriate data | No evidence from observations are included |
| Interprets all of the data accurately. | Interprets most of the data accurately | Interprets some of the data accurately | Does not interpret any evidence. |
| **Reasoning**  (the how and the why) | Answers how or why the evidence supports the claim with sufficient (enough) relevant scientific information | Answers why or how the evidence supports the claim with insufficient relevant  scientific information | Answers why or how the evidence supports the claim with no relevant scientific information | Does not provide any reasoning |
| Uses all pieces of evidence and relevant scientific vocabulary to explain the relationship between the claim and evidence (how & why) | Uses most pieces of evidence and relevant scientific vocabulary to explain the relationship between the claim and evidence (how & why | Uses some pieces of evidence and relevant scientific vocabulary to explain the relationship between the claim and evidence (how & why | Uses no evidence and relevant scientific vocabulary to explain the relationship between the claim and evidence (how & why |

**Example Paragraph Starter**

Titan is an interesting location to look for life. Titan is intriguing because it has both ice and an atmosphere.