Extremophiles (On the team schedule - 30 minutes)

Description: Teams will answer questions on a written assessment on the different types of Earth's extremophiles and how they survive in extreme conditions.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Teams need to bring: Pencils

Safety Requirements: None

The Competition:
Students will take a written test to answer topic questions on extremophiles. The questions will include but are not limited to

- Extreme environments - Acidic, Alkaline, Altered by Humans, Extremely Cold, Extremely Hot, Hypersaline, Radiation, Under Pressure, Without Water, Without Oxygen
- What are extremophiles and the terms used to describe extremophiles
- Adaptations
- Extremophiles found in Yellowstone National Park

Scoring:

- Points will be awarded for each correct response.
- Ties will be broken by the accuracy or quality of answers to select questions chosen by the test writer or Event Supervisor prior to the competition.

Possible Resources:

- Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
- **Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.**

I. NASA Space Place:
   a. Often has articles and activities related to space exploration, which often includes information on extremophiles and their potential for life on other planets.

II. Kids Discover:
   a. May have articles or magazines specifically about extremophiles, presented in a kid-friendly way with engaging visuals.
III. National Geographic Kids:
   a. This website generally has excellent articles and videos on a wide range of science topics, and might include information on extremophiles.
IV. Science News for Students:
   a. Offers science news and articles written for middle and high school students, but some topics might be accessible to younger children with adult guidance.
V. Tips for Finding More:
   a. Use keywords: Search for terms like "extremophiles for kids," "life in extreme environments," "weirdest creatures on Earth" on search engines like Google or DuckDuckGo.
   b. Check educational websites: Look for websites from reputable educational institutions or science museums.
   c. Explore YouTube: Search for "extremophiles for kids" on YouTube to find educational videos.
VI. Microbial Life - Educational Resources
VII. Life in Extreme Heat - Yellowstone National Park (U.S. National Park Service)

Earth's Extremophiles: Study Guide

This study guide focuses on the different types of Earth's extremophiles and how they survive in extreme conditions.

What are Extremophiles?

- Extremophiles are organisms that thrive in environments that would be considered hostile or even deadly for most life on Earth.
- They are incredibly adaptable and have unique adaptations that allow them to survive in extreme conditions.

Types of Extremophiles:

- Thermophiles:
  - Love heat!
  - Live in hot environments like hot springs, deep-sea hydrothermal vents, and volcanic areas.
  - Adaptations:
    - Special enzymes that function at high temperatures.
    - Heat-resistant cell membranes.
- Psychrophiles:
  - Love the cold!
  - Live in icy environments like polar regions, glaciers, and deep-sea waters.
  - Adaptations:
    - Flexible cell membranes that remain fluid in cold temperatures.
    - Enzymes that function efficiently at low temperatures.
    - Antifreeze proteins that prevent ice crystal formation within their cells.
- Halophiles:
  - Love salt!
  - Live in extremely salty environments like salt lakes, salt marshes, and even inside salt crystals.
  - Adaptations:
    - High internal salt concentrations to balance the external environment.
    - Modified proteins that can function in high salt conditions.
- Acidophiles:

    - Love acid!
    - Live in highly acidic environments like acidic hot springs, mines, and the human stomach.
    - Adaptations:
        - Unique cell membranes and proteins that can withstand high acidity.
- Barophiles/Piezophiles:
    - Love pressure!
    - Live in deep-sea environments where the pressure is extremely high.
    - Adaptations:
        - Rigid cell walls that can withstand immense pressure.
        - Unique enzymes that function under high pressure.

Why are Extremophiles Important?

- Help us understand the limits of life on Earth.
- Provide insights into the possibility of life on other planets.
- Have potential applications in biotechnology and medicine.
    - Enzymes from thermophiles are used in industrial processes.
    - Extremophile adaptations can inspire new materials and technologies.

Key Concepts

- Extreme Environments: Understand the different types of extreme environments on Earth (hot, cold, salty, acidic, high pressure).
- Adaptations: Be able to explain how different types of extremophiles have adapted to survive in their extreme environments.
- Importance: Understand why the study of extremophiles is important for science and technology.

Practice Questions:

1. What are extremophiles?
2. What are some examples of extreme environments on Earth?
3. How do thermophiles survive in hot environments?
4. Why are psychrophiles important to study?
5. What are some potential applications of extremophile research?