FOREST LAKE AREA SCHOOLS

Inspire the Learner, Ignite the Potential

Course Title: **Biology at the Extremes**

Course Number:

Grade Level: **10-12**

Credit Hours: **.5**

Course Description:

This course will study the habitability of different environments in the universes. Students will discover the requirements that need to be met in order for an organisms to be considered living. Then the students will explore the physical requirements that an environment needs to provide in order to sustain life. This field of science searches for extreme habits on Earth and planets both within our solar system and elsewhere in the universe that could be habitable environments for life. Students will learn about the search for evidence that life may once have occurred on Mars or elsewhere in our solar system through the Mars rovers and various NASA space missions. Finally, students will study the ways in which living organisms have adapted and will have to adapt to survive the challenges that extreme Earth ecosystems can present and the challenges of surviving in the microgravity of space.

Prerequisite:

None

Articulated Agreements / College Credit(if applicable):

None

Alignment with Minnesota Academic Standards or national/state contest standards:

1. The Nature of Science and Engineering
   - 9.1.1.1.1
   - 9.1.1.1.2
   - 9.1.1.1.6
   - 9.1.1.1.7
   - 9.1.1.2.1
   - 9.1.2.2.2
   - 9.1.3.2.1
2. Physical Science
   - 9.2.3.2.6
3. Eartha and Space Science
   - 9.3.3.2.1
   - 9.3.3.2.3

9.3.3.3.1
9.3.3.3.2

4. Life Science
   9.4.4.1.2
   9.4.4.2.5

Specific Course Learner Outcomes:

Explain the implications of the assumption that the rules of the universe are the same everywhere and these rules can be discovered by careful and systematic investigation.
Understand that scientists conduct investigations for a variety of reasons, including: to discover new aspects of the natural world, to explain observed phenomena, to test the conclusions of prior investigations, or to test the predictions of current theories.
Describe how changes in scientific knowledge generally occur in incremental steps that include and build on earlier knowledge.
Explain how scientific and technological innovations -as well as new evidence- can challenge portions of, or entire accepted theories and models including, but not limited to: cell theory, atomic theory, theory of evolution, plate tectonic theory, germ theory of disease, and the big bang theory.
Formulate a testable hypothesis, design and conduct an experiment to test the hypothesis, analyze the data, consider alternative explanations and draw conclusions supported by evidence from the investigation.
Develop possible solutions to an engineering problem and evaluate them using conceptual, physical and mathematical models to determine the extent to which the solutions meet the design specifications.
Provide examples of how diverse cultures, including natives from all of the Americas, have contributed scientific and mathematical ideas and technological inventions.
Compare fission and fusion in terms of the reactants, the products and the conversion from matter into energy.
Describe how the solar system formed from a nebular cloud of dust and gas 4.6 billion years ago.
Compare and contrast the environmental conditions that make life possible on Earth with conditions found on the other planets and moons of our solar system.
Explain how evidence, including the Doppler shift of light from distant stars and cosmic background radiation, is used to understand the composition, early history and expansion of the universe.
Explain how gravitational clumping leads to nuclear fusion, producing energy and the chemical elements of a star.
Describe the social, economic and ecological risks and benefits of changing a natural ecosystem as a result of human activity.
Recognize that a gene mutation in a cell can result in uncontrolled cell division called cancer, and how exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer.

Course Outline with Pacing:

A. Introduction and stellar evolution (2 weeks)
   1. Basic terms and definitions
   2. Famous astronomers and their contributions
   3. Our sun and its characteristics
   4. Life cycles of low-mass and high-mass stars
B. Our solar system (3 weeks)

1. Earth
    a. What is life?
    b. What are the requirements of living organisms?
    c. Extreme habitats/ecosystems that are able to support life.
    d. What makes the Earth a unique environment that is able to support life?
2. Moon
    a. Its characteristics and effects on life on Earth.
3. The planets and Kuiper Belt bodies
    a. Mars and the search for the possibility of extinct life.
    b. Terra forming.
    c. Comparison of the planets, their unique characteristics, and the possibility of supporting life.
4. Meteoroids, meteors, and meteorites
    a. The possibility of transporting life?
5. Asteroids and the asteroid belt
    a. The possibility of transporting life?
6. Comets and the Oort cloud
    a. The possibility of transporting life?

C. The history of space travel and the factors that have influenced it. (1 week)

D. Space travel and the possibility of life "out there" (2 weeks)
1. Road blocks to long-term space travel
2. Medical issues related to space travel
3. Potential future technologies
4. The International Space Station and microgravity research
5. The search for extrasolar planets and solar systems
6. The Goldilocks Zone

E. Independent astrobiology research project (1 week)

Additional Information: