



NASA's Astro-Venture with Astrobiology

Astrobiology is highly interdisciplinary, relying on expertise in all disciplines of science. The fundamental questions of astrobiologists are some of the most pondered uncertainties known to man. How does life begin and evolve? Does life exist elsewhere in the universe? What is the future of life on Earth and beyond?

These and other embedded questions bring together scientists investigating all corners of the Earth, searching for clues about life's limits. Astrobiology is an excellent context for teaching science. As educators, we can build on the curiosity students have for what may exist beyond Earth to learn about our planet, just as scientists do. Several excellent curricula are available to help achieve this goal. As a participant in this course, you will learn to use them in your classroom.

Astro-Venture is one such curriculum, developed by educators and scientists at NASA AMES, the home of the NASA Astrobiology Institute. Astro-Venture allows students to take on the roles of NASA scientists to search for and design a planet that could support life.

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Course Objectives:

Participants will be able to:

- ✓ Identify and explain the vital characteristics of Earth that make it habitable to humans.
- ✓ Use the process of scientific inquiry to explain the processes scientists might use to find planets that have characteristics necessary for human life.
- ✓ Design a planet that has all of the necessary features to support human survival.
- ✓ Improve content knowledge in Earth Systems and Space Science.
- ✓ Adopt inquiry and technology-based teaching and learning strategies and successfully implement them in the classroom.

Resource Page: <http://stagecourses.net/astroventurelinks.html>

Plagiarism: Anytime you use someone else's language, ideas, or data you must give them credit. When completing assignments for this course and others, be sure to cite your sources appropriately with APA format. No credit will be given for plagiarized papers or segments. For guidance with correct APA formatting consult: <http://owl.english.purdue.edu/owl/resource/560/01/> To read about what constitutes plagiarism consult: <http://owl.english.purdue.edu/owl/resource/589/01/>

Course Requirements:

This course is a blended synchronous/asynchronous class. The live class meeting dates are indicated on the course calendar and on the schedule below. During asynchronous weeks, participants must participate in online discussions with their classmates by responding to questions posed by the instructor. All readings are to be done prior to the discussion or class meeting for the week, and assignments must be handed in before midnight on the date specified. Students will be assessed using rubrics. Major course assignments are outlined in this syllabus, and more detailed information will be provided in class. *Changes may be made to the syllabus to accommodate your learning.*

Course Assignments:

You must complete the required assignments as well as at least one of the content assignments. The other assignments are all optional. Choose the options that will be most beneficial to you and will help you to meet the course objectives. The maximum points you can earn for each assignment are indicated for each.

Part I: Mandatory Assignments

These assignments must be completed by the due date indicated.

1. Class Participation and Preparation– 15 points possible

Due Date: Ongoing

As a participant in this course, you are expected to attend and actively participate in the live sessions. Please arrive to the session prepared and on time.

Participation in online discussions is equally as valuable as the live meetings and will ensure that you take away as much as possible from the course. All readings and discussions are posted on the Lessons page on the online course space.

You are expected to contribute meaningfully to discussions by drawing on readings from the course and outside as well as on your personal experiences as a teacher, learner, and citizen. Please pay careful attention to the rubric that will be used to assess your level of participation. Each discussion post should demonstrate your achievement of the participation criteria outlined in the rubric. In addition, you should also respond to the posts of at least two of your fellow learners for each discussion question—unless the discussion instructions state otherwise. These responses to other learners should also be substantive posts that contribute to the conversation by asking questions, respectfully debating positions, and presenting supporting information relevant to the topic. Also, respond to any follow-up questions the instructor or your colleagues direct to you in the discussion area.

2. Become an Extremophile Expert -10 points possible

Due Date: November 1, 2010

November 8 (provide feedback)

Prepare a 3-5 minute presentation about the current research being done regarding one specific category of extremophiles: Thermophiles, Acidophiles, Alkaliphiles, Halophiles, Barophiles, Psychrophile, Xerophiles. Several articles and links on the resource page will get you started. You may need to narrow your focus to a specific organism within one of the above categories. Address the following in your presentation:

- 1) What types of organisms have been discovered and where?
- 2) What are the specific conditions in which the organisms live?
- 3) How was the discovery made and by whom?

- 4) How have the discoveries contributed to astrobiology and the search for habitable environments beyond Earth?

Please post your presentation to the course space discussion board by creating a 'new post' with your name and topic of your presentation. For example: John Smith - Thermophiles

Following class on November 1st provide feedback and comments to your classmates by creating a thread on their discussion post, no later than **November 8th**.

3. Design A Planet Module – 10 points possible

Due Date: November 29, 2010

Complete the Design A Planet module and document the attempts you make to build your own planet. For each attempt, record your results and discuss why your planet was or was not habitable. If you design a habitable planet on your first attempt, great! However, you must try at least 4 times and discuss the results of each attempt in terms of the parameters listed in the Design A Planet Module: Producers, Liquid Water, Plate Movement, Volcanoes, Planet Mass, Orbit, and Star Type.

4. Lesson Plan – 10 points possible

**Due Date: December 13, 2010 (lesson)
December 27 (provide feedback)**

Choose any of the four units (Astronomy, Atmospheric Science, Geology, or Biology) and go through the Educator's Guide. Choose ONE lesson (not discussed in class already) to present to your classmates. Post your lesson plan to the discussion board as a new post: "First initial Last name, Title of your lesson. For example: *GSmith, Importance of Water*. A rubric for this assignment is posted on the online course space. Please provide substantive feedback for at least one of your classmate's lessons by December 27th.

Part II: Additional Assignments

Final due date for all assignments: May 1, 2011

At least 60 points must be attempted by January 15, 2011.

Please choose the assignments that are most beneficial to your own learning. Note the possible point value of each assignment because you must earn at least 90 points to get an A in the course. **You must choose at least one content assignment.**

A. CONTENT ASSIGNMENT OPTIONS:

Content Option 1: Astrobiology Topic Paper- 20 points possible

Choose a STEM topic related to astrobiology. Read current research articles/abstracts on this area. In a 5-8 page paper, describe the importance of this topic in terms of the fundamental questions of astrobiology and the goals outlined in NASA's 2008 Astrobiology Roadmap.

This is your opportunity to do a more in-depth study of a topic of interest. Please be sure to use reputable sources and to cite them appropriately; no credit will be given for plagiarized papers or segments. Some resources are given on the course resource page.

Possible topics include spectroscopy, microbiology, computer modeling, infrared telescopes, genomic research of microbes, mission engineer, atmospheric chemistry, and a whole lot more. A list of disciplines related to astrobiology are listed here:

http://astroventure.arc.nasa.gov/teachers/fact_sheets.html

Content Option 2: Astrobiology Research Missions Review - 15 points possible

Using the NASA website, research some of the ongoing studies in Astrobiology being conducted at NASA. In a 4-5 page paper, briefly describe at least 3-4 such missions and/or funded research projects. You may not use Kepler for this assignment. Include at least the following for *each* mission:

- Name of Mission and Mission Goals
- Destination
- Major Science/Engineering Research Activities
- Instrumentation
- Relevance to NASA's Astrobiology Goals outlined in the Astrobiology Roadmap 2008.

A great starting point for this assignment is the NASA Astrobiology Institute Missions home page: <http://astrobiology.nasa.gov/missions/> and the course resource page: <http://stagecourses.net/astroventurelinks.html>

Content Option 3: Astrobiology in the News-- 15 points possible

Connections to astrobiology span across disciplines from astronomers to zoologists, engineers philosophers and economists, to name a few. This growing field is much more than the search for little green men. Popular culture and the media shape the majority or citizen's understanding about research and discoveries related to astrobiology.

Collect a series of four articles related to astrobiology from mainstream media (i.e. not overly scientific journals/websites) such as local/national newspapers, news magazines, or websites. For *each* article:

- a. relate the article to the NASA Astrobiology Roadmap.
- b. explain how the article successfully or unsuccessfully presents the research and findings for the general public and discuss the importance of developing a scientifically literate community.
- c. make a connection to one of the other articles you chose. It does not have to be a scientific connection but should demonstrate the multidisciplinary nature of astrobiology.

B. PEDAGOGY ASSIGNMENT OPTIONS:

Pedagogy Option 1: Electronic Portfolio – 45 points possible

Create an electronic portfolio to demonstrate successful program implementation. You may upload your artifacts through the dropbox or use another means, i.e., a webpage or wiki, to display them.

As you implement the program(s), reflect critically on how the program is helping to improve student interest, understanding, and/or achievement.

Follow the following steps to complete your portfolio:

1. Review the course objectives for this course
2. As you implement what you have learned, collect 'artifacts' that illustrate how you have met your course objectives, and passed them on to your students. Artifacts can be in many forms

such as student work samples; digital photographs or videos of students actively engaging in activities; lesson plans showing how you are incorporating the program into your instruction; assessments you have created based on the programs; PowerPoint presentations created by you or your students for use during class; notes from parents indicating changes they have seen in their children; letters from supervisors discussing the program implementation, and other that you choose.

3. Select the three artifacts that most effectively illustrate that you have met each objective. You will have a total of 15 artifacts in your portfolio.
4. Write a short (one paragraph) reflection for each artifact that describes why you selected the artifact and what it shows.
5. Write a 3-5 page reflective essay that briefly describes how you implemented what you have learned in your classroom, and how the portfolio illustrates successful implementation. Explain how the course affected your own planning and instruction, your content knowledge, and also your students' learning and success.
6. Provide an organized table of contents for your portfolio showing where you address each objective with artifacts.

Pedagogy 2: Astrobiology in Your Community – 20 points possible

Astrobiology is getting a lot of attention lately. As an interdisciplinary field, it brings together science concepts traditionally taught as independent subjects. In recent years, universities and high schools have begun offering courses in astrobiology and while there are not currently any astrobiology majors graduating, some universities offer a minor or concentration with a major in a related science discipline.

To complete this assignment, investigate courses in astrobiology within your school district, your local college or university, and/or an informal education setting. Suggestions include but are not limited to:

- 1) Conduct a literature search regarding astrobiology in education.
- 2) Identify the status of astrobiology in your local region. Are there courses offerings in place? At what level? Are there future plans to offer Astrobiology courses? Is there a local education center teaching astrobiology?
- 3) Conduct an informal survey of the educators in your school. This may consist of 5-10 questions about astrobiology. For example: What is astrobiology? Are you interested in life beyond Earth? Rate your knowledge of current research in astrobiology.
- 4) Based on your informal research, assess the potential for an astrobiology course in the local school and argue your position on its value in the school/community in a 4-6 page paper.

Pedagogy Option 3: Astrobiology Lesson Plan- 15 points possible

Choose one or more resources from the course resource page (not from Astro-Venture) and create a formal lesson plan suitable for use in your classroom. You are welcome to adapt an existing plan, however it must include your touch. Do not simply copy and paste an existing plan. Cite the source(s) and re-work it into a format that includes the criteria below and make it appropriate for your class. Another teacher should be able to read your lesson plan and know exactly what to do to successfully implement the lesson. While the lesson plan format may vary, please be sure that your plan includes all of the following:

- ✓ Grade level, Topic of focus, Time Needed
- ✓ Standards Addressed
- ✓ Objectives
- ✓ Detailed Procedures/Methods/Student Worksheets if applicable
- ✓ Assessment (i.e., grading rubric, quiz questions, etc.)

Pedagogy 4: Attend a Conference – 25 points possible

As the field of astrobiology grows, more educational workshops, conferences and meetings are held at the local and national level. These events are great venues for many reasons, including:

- Learning astrobiology content
- Participating in hands-on workshops
- Gaining instructional strategies for incorporating astrobiology
- Networking with other educators interested in astrobiology education

To earn the credit for this assignment, attend at least one day (8 hours) of such an event. Submit ‘proof’, i.e., a receipt, photos, etc., that you attended the conference, as well as a short (~2 page) reflection of your experience at the conference—who you met, what you learned, what you will take away from it.

Some helpful links for finding upcoming conferences/meetings:

NAI: <http://astrobiology.nasa.gov/events/>

Lunar and Planetary Institute: <http://www.lpi.usra.edu/meetings/>

Pedagogy Option 5: Astrobiology Curricula Review - 10 points possible for each curriculum, up to 2x

The course resource page lists several astrobiology curricula:

<http://stagecourses.net/astroventurelinks.html>

Choose a curriculum from the resource page (or suggest another) that was not heavily focused on in the live sessions. Download the available materials and conduct an in-depth evaluation of the resources. Each curriculum description should be 2-3 pages in length. Describe the following for each:

1. What grade level does the program target?
2. Which standards are addressed?
3. Are the lessons inquiry based? Describe your answer.
4. What type of multimedia, student activities, etc. are included?
5. How does the curriculum compliment Astro-Venture? If concepts overlap with Astro-Venture, indicate this and identify which lessons/activities you prefer for your classroom.

This is an opportunity to do look beyond Astro-Venture for additional valuable materials for your classroom. Please be sure to cite the resources and indicate the date you downloaded the materials. Use MLA or APA format; no credit will be given for plagiarized papers or segments.

Grading Scheme

Assignment	Possible Points
Mandatory 1: Class Participation and Preparation	15
Mandatory 2: Become an Extremophile Expert	10
Mandatory 3: Design A Planet Module	10
Mandatory 4: Astro-Venture Lesson Plan	10
Content Option 1: Astrobiology Topic Paper	20
Content Option 2: Astro-Venture Missions Review	15
Content Option 3: Astrobiology in the News	15
Pedagogy Option 1: Electronic Portfolio	45
Pedagogy Option 2: Astrobiology in Your Community	20
Pedagogy Option 3: Astrobiology Lesson Plan	15
Pedagogy Option 4: Attend a Conference	25
Pedagogy Option 5: Astrobiology Curricula Review	10 (up to 2x)

B: 80-89

A-: 90-100

Graduate credit minimum = 80 total points (B-)