

**ASTR 305:** term paper scoring      **Student Name:** \_\_\_\_\_

Developing critical thinking skills is an essential component to a liberal arts and sciences education. The all-important starting place is to be able to ask the right questions. To succeed in the 21<sup>st</sup> Century workplace, our citizens must make the transition from just memorizing facts to correlating the material into a cohesive context. With these goals in mind, your work in this class will be evaluated according to the Foundation for Critical Thinking's *Elements of Thought* ([www.criticalthinking.org/CTmodel/CTModel1.cfm](http://www.criticalthinking.org/CTmodel/CTModel1.cfm)). The *Elements of Thought* capture the notion that whenever we think, we think for a purpose within a point of view based on assumptions leading to implications and consequences. We use concepts, ideas and theories to interpret data, facts, and experiences in order to answer questions, solve problems, and resolve issues. These *Elements* must be incorporated into your writing. Specifically, your essay will be directly graded upon the Foundation for Critical Thinking's *Intellectual Standards* ([www.criticalthinking.org/articles/universal-intellectual-standards.cfm](http://www.criticalthinking.org/articles/universal-intellectual-standards.cfm)): Clarity, Accuracy, Precision, Relevance, Depth, and Breadth. In addition, points are awarded for following instructions for the submission format, the significance of the chosen topic, use of properly cited references, a clear indication that you have reviewed the material, and overall good writing techniques.

The grade for your term paper is based on several elements, each weighted separately (on a scale of 0 [low] to 5 [high] leading to a total possible score of 60 points.

- \_\_\_\_\_ (max 5 pts) **Format:** electronically submitted word-processed document (Microsoft Word, WordPerfect, StarOffice, LaTeX, etc.), single space, 12-pt font, 1-inch margins, minimum 2000 words (4 full page) and maximum 3000 words (7 pages)
- \_\_\_\_\_ (max 5 pts) **Appropriate Topic:** matches course goals
- \_\_\_\_\_ (max 5 pts) **Adequate References and Proper Citations**
- \_\_\_\_\_ (max 5 pts) **Clarity:** ample elaboration and illustration of points raised
- \_\_\_\_\_ (max 5 pts) **Accuracy:** sufficient verification of issues and commentary
- \_\_\_\_\_ (max 5 pts) **Precision:** detailed, specific and exacting presentation
- \_\_\_\_\_ (max 5 pts) **Relevance:** lucid connections to overall goal(s)
- \_\_\_\_\_ (max 5 pts) **Depth:** fully addresses complexities surrounding the question
- \_\_\_\_\_ (max 5 pts) **Breadth:** fully considers alternative perspectives
- \_\_\_\_\_ (max 5 pts) **Logic:** clear bottom-line conclusions based on paper's content
- \_\_\_\_\_ (max 5 pts) **Significance:** clear statement of basic issues and arguments
- \_\_\_\_\_ (max 5 pts) **Fairness:** thoughtful presentation of different sides of issues
- \_\_\_\_\_ (max total 60 pts)

The first paper (due February 19) must deal with one of the following topics from the first portion of the course material: the nature of life; artificial life; self assembly of complex, replicating molecules; natural selection and evolution; metabolic processes; or extremophile organisms. The paper is worth 60 pts, peer review is worth 15 pts.

The second paper (due March 19) must deal with one of the following topics from the second portion of the course material: habitable environments in our Solar System or around other stars. The paper is worth 60 pts, peer review is worth 15 pts.

The final paper (due April 30) is to be written on a topic developed by the individual students and approved by the instructor. The paper is worth 60 pts, peer review 15 pts, and oral presentation 25 pts.

Examples of opening statements for a promising ASTR 305 term paper are provided below.

The British scientist James Lovelock proposed that Earth's living organisms, in conjunction with its physical components (atmosphere, oceans, etc.), can be considered together as the equivalent of a single superorganism dubbed "Gaia". In this paper I justify the conclusion that such an entity satisfies all of the definitions of life that we have discussed in this class.

The process of science is typically taught in terms of a sequence of steps labeled the "Scientific Method." A brief summary of the steps might be: (1) choose a problem or question to investigate, (2) formulate a hypothesis, (3) make a prediction based on the hypothesis, (4) design and conduct an experiment to test the prediction, (5) evaluate and, if necessary, revise the hypothesis in light of experimental results. In this paper I discuss the extent to which the actual scientific activity that led to Darwin's "The Origin of Species" matches the steps of the Scientific Method.

A scientist reporting the measurement of some quantity is expected to provide an estimate of the uncertainty in that measurement, which other scientists can use to assess the reliability of the result. Considering our previous readings and discussions in this class, identify a measurement or calculation whose uncertainty limits our ability to reach a conclusion on some question in astrobiology, and explain why this is the case.

The current budgetary situation in the USA will mean that in the next ten years NASA will be able to fund no more than one exploratory robotic mission to search for evidence of life in our solar system. In this paper I justify why such a mission should investigate Jupiter's icy moon, Europa; versus other possible candidates such as Mars or Titan.

The Arecibo Message, the Pioneer Plaques, and Voyager Golden Recordings are three examples of *deliberate* efforts to communicate with extraterrestrial civilizations. In this paper I assess the effectiveness of these communications and describe what information humanity's next such message to the cosmos should contain.