Writing Assignment no. 1, "Science: Past and Present":

Below you can see the prompt for Writing Assignment no. 1, "Science: Past and Present". Before you watch the videos, please read the prompt and questions carefully.

Astronomy is the oldest science and some important insights about the universe were gained even before the invention of the telescope. In no more than 750 words, address the following two questions:

Project Title: Informing Astronomical Science through Evidence and Reasoning

## In terms of the scientific method, how does astronomy differ from a lab science like chemistry or biology? How can astronomers be confident of their understanding of objects that are remote from the Earth?

The scientific method is a procedure to understand natural science consisting of systemic observation, measurement, and experimentation with the aim of formulating and testing hypotheses. In terms of the scientific method, astronomy is largely no different than lab sciences like chemistry or biology. In all disciplines, the scientist conducts activities to make observations and collect measurements that may be used to identify patterns and eventually prove or disprove hypotheses. Similarly, scientists from all disciplines follow the data to make discoveries and then seek verification by independent researchers and scientists.

While some may question how astronomers can be as confident as in their understanding of remote objects, one may similarly ask how chemists can understand atomic interactions they cannot see with the naked eye. In most cases, one may assert that the confidence in any scientist’s understanding of a phenomena traces back to the confidence he or she has in the supporting. To this end, the uncertainty or variances in measurement may affect the level of confidence. This again is not a unique problem to astronomers though. The ability to locate an astronomical object to a right ascension and declination within some angular error is analogous to a chemist measuring the pH of a solution within some margin of error or level of precision. Sources of error in measurement are something all scientists must take into consideration. With enough data however, the margins of error may be bounded. With error sources and margins well understood, scientists of all disciplines may use evidence-based reasoning to increase confidence in their understanding.

(258 words)

## Ancient cultures built some impressive structures that incorporated astronomical functions and information (Stonehenge, Chichen Itza, the Great Pyramid). A friend or acquaintance of yours tries to argue that some of these structures and artifacts are evidence of "ancient astronauts" or visits by intelligent aliens. How would you rebut or argue against this idea?

I think the largest body of evidence available to refute the notion that ancient astronauts or aliens visited this planet and constructed these impressive structures and artifacts with astronomical functions such as Stonehenge, Chichen Itza, and the Great Pyramid is the variation between them. In most cases, these structures and artifacts have attributes that are location or region specific. For example, the astronomical functions of findings of artifacts discovered in Africa depict two seasons (rainy and dry seasons) while artifacts found in northern climates depict the four traditional seasons most of us are familiar with. To me, these variations lend evidence to the artifacts being created by the humans that lived in the regions where the artifacts were discovered. It makes sense that they made attempts to map patterns in the sky to the cycle of nature they experienced in their daily lives. If aliens or ancient astronauts had visited Earth to impart astronomical knowledge, I believe the commonality or level of similarity of artifacts between ancient civilizations that otherwise had no means of communicating would have been a lot greater. Additionally, if the artifacts or knowledge was gifted by some entity foreign to Earth, it stands to reason that the astronomical features tracked may also have been more globally applicable than regionally applicable.

(214 words)