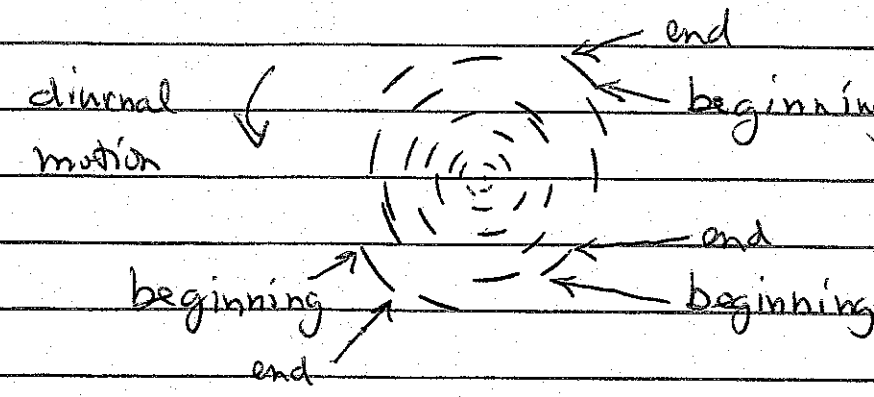
ASTR 1001.2B

Assignment 1.

1. Diseases from Space is an example of science not pseudoscience since the concepts are falsifiable. It is possible to test for the existence of viruses and bacteria in cometary debris by collecting dust samples from the Earth's upper atmosphere and near-space environment and testing them for the presence of biological material, something that has not yet been done. Such experiments are not possible for pseudoscientific concepts.

2. The eastward rotation of the Earth on its axis causes stars to appear to move east-to-west during the course of each day. When viewing towards the north celestial pole, that motion appears as a counterclockwise rotation of stars about the pole. In the images of star trails viewed towards the north celestial pole, the image begins at a specific point where the star was at the start of the exposure, and ends at a point in a counterclockwise direction from that at the end of the exposure. See schematic below:



3. a. At the times of the equinoxes the Sun rises due east and sets due west. Therefore, commuters driving due east or due west at times near sunrise or sunset, respectively, will find the Sun shining directly in their eyes on clear days at such times, making it difficult, or even impossible, to see oncoming traffic. The resulting slowdown of drivers in cars, or even occasional traffic accidents resulting from driver blindness, can account for the increase in traffic jams at such times.

b. Given such circumstances, it would be better to live east of a city to which one commutes to work, since one therefore has the Sun at one's back for both the morning and evening commute.

4. According to Kepler's Third Law, the semi-major axis of a planetary orbit and the orbital period are related to each other. In other words, the semi-major axis of a planetary orbit is especially important since it can be used to calculate the orbital period.

5. According to Newtonian physics, the relationship of Kepler's Third Law includes the sum of the masses of the co-orbiting bodies. In the solar system the Earth orbits the Sun in exactly one year at a mean distance of 1 A.U., and the sum of the masses is approximately the mass of the Sun. For the extrasolar planet to have an identical semi-major axis (1 A.U.) and orbital period (1 year), the star's mass must be identical to that of our Sun ($1\ M_\odot$).

6. If a celestial object is redshifted, it means it is moving away from us. If a celestial object is blueshifted, it means it is moving forward us.

7. The different colours for the two stars in the Albireo system relate to their temperatures. The blue star in the system is hotter than the golden yellow one.

8. The Earth's atmosphere is opaque to gamma rays and X-rays from space, so essentially none of the radiation from stars in these spectral regions penetrates to the Earth's surface. Gamma-ray and X-ray telescopes can only be used to collect radiation from celestial objects if they are placed in orbit above the bulk of Earth's atmosphere, where they are unaffected by atmospheric absorption. Ground-based gamma-ray and X-ray telescopes are unable to "see" through the atmospheric extinction, and are therefore useless.