JAF03 Lesson 9 The Universe

I. Discuss:

1. Why might an astronomer feel offended upon being introduced as an astrologer?
2. Why do you think so many cultures, down through history, have worshipped the Sun?
3. What do people commonly associate with the Moon?
4. What causes the seasons on our planet?

II. Which planets are described below? (www.astronomy.com)

_______ is the largest planet in our solar system, with a diameter of 89,000 miles.
_______ is the closest planet to the Sun, takes only 88 days to orbit the Sun.
_______ has a ring system made up of ice and rock particles, some as big as a minivan.
_______ has rust in the soil, which creates its signature colour.
_______ is the third-largest planet in the solar system, has an average temperature of –350° F and does not have a solid surface.
_______ was reclassified as a dwarf planet in 2006.
_______ has 13 moons; the two largest are Triton and Nereid.
_______ takes 23 hours, 56 minutes to spin on its axis one time.
_______ is the brightest object in the sky after the Sun and Moon.

III. In pairs define as many concepts given below as possible, following the example:

1. *<u>Solar eclipse</u>: an eclipse in which the Moon passes between the Sun and the Earth and so it prevents all or part of the Sun´s light from reaching the Earth´s surface.*
2. *Light year*
3. *Black hole*
4. *Galaxy*
5. *Outer planet*
6. *Milky way*
7. *Red giant*
8. *White dwarf*
9. *Space probe*
10. *Summer solstice*
11. *Winter solstice*
12. *Hubble constant*
13. *Hubble telescope*
14. *Universe*

IV. Reading - The Big Bang

(adapted from Shipman, Wilson, Todd: *An Introduction to Physical Science.* Houghton Mifflin, 2006)

1. Complete the text with suitable words:

If galaxies are ________ away from each other, then galaxies must have been closer to one another in the past. That is, the universe must have been more __________. Carrying this idea to its logical conclusion, most astronomers _________that the universe began in a small, hot, dense state, the rapid expansion of which is called the Big Bang.

The hypothesis that came to be called the Big Bang was first ___________ in 1927 by Georges Lemaitre, a Belgian Catholic priest and cosmologist. Since 1927, scientists have _________ great efforts on investigating the Big Bang model. The standard Big Bang model has received broad acceptance because experimental evidence ______________ it in several areas.

However, what is called the *standard model* of the Big Bang was unable to answer certain questions. This led to a ___________ known as the *inflationary model* of the Big Bang, advanced in 1980 by Alan Guth, an astrophysicist at M.I.T. The inflationary model fits an exactly flat universe (recent experiments ______________ that out universe is, indeed, exactly flat.)

If the inflationary model of the Big Bang is basically __________, then the physical universe is composed of many separate regions, one of which consists of everything that we can ________. Therefore, we might __________ to this particular region as "our" universe. The universe in the inflationary model is gigantic, and the observable part is only a tiny ________ of the whole. In the standard model, the observable universe is most of the entire universe, not just one of many universes.

The inflationary model of the Big Bang is astronomers´ best theory of the origin of our universe. Of course, our current state of knowledge is ________. It is _________ that in the future, there will be improvements in the theory of how the universe formed, evolved, and will end.

2. Summarise the main points of the article.

3. Complete the questions we might ask about our universe:

a) What type of ______________ fill the universe? How much ________?
b) How rapidly _________________?
c) How old ____________________?
d) What is the overall ____________?
e) What is the ultimate ____________?

V. Video – The Search for Extraterrestrial Intelligence

(http://astronomy.com/News-Observing/Liz%20and%20Bills%20Cosmic%20Adventures/2012/01/Episode%2012.aspx)

Before you listen – check the vocabulary:

Curious – quest - to thrive – favourable – alas – variable – jumping-off point – to harbour – habitable – detectable – likely – to spring up – to found – opposing view – worth – alien - harmful

Watch and answer the questions:

What do we mean by extraterrestrial intelligence?

What does the Drake equation express? What is it used for? What are the variables?

After you watch: What values would you feed in the equation?

VI. Language focus: Probability

1. Order the sentences below so that the first one expresses probability most strongly and each succeeding sentence expresses it slightly less strongly.

a) There could be life on Jupiter.
b) It is unlikely that there is life on Jupiter.
c) There must be life on Jupiter.
d) There is no life on Jupiter.
e) There is life on Jupiter.
f) There is probably life on Jupiter.
g) There might be life on Jupiter.

2. Notice the use of modals in the above article: "*The galaxies must have been closer to one another…"*. Explain the differences between the pairs of sentences:

a) There must be life. – There must have been life.
b) There may be life. – There may have been life.
c) There could be life. – There could have been life.
d) There might be life. – There might have been life.
e) There can´t be life. – There can´t have been life.

3. Identifying probability. There are many ways to express probability. Circle the word or words that indicate probability in each of these sentences.

- a) Light seems to travel in waves.
- b) The accumulation of carbon dioxide in the air is believed to be warming the earth to a dangerous level.
- c) Pulsars are thought by some scientists to be rapidly spinning neutron stars.
- d) Current research suggests that obesity is hereditary.
- e) The universe appears to be expanding.
- f) As far as we know, the Earth is 4.6 billion years old.
- g) It is possible that the universe is expanding and contracting in some rhythmic way.

4. Formulate answers to the questions below with either *must be, may be, could be* or *might be* following the pattern of the first pair of sentences below.

- a) Is the greenhouse effect warming our Earth?

  <u>The greenhouse effect may be warming our Earth.</u>
- b) Are the pandas in China becoming extinct?
- c) Are the ocean´s tides slowing the rotation of the Earth?
- d) Are quasars violently exploding galaxies?
- e) Is the radioactive fallout from nuclear test explosions harmful to the atmosphere?