

Please read all instructions carefully. Most students lose points simply because they fail to read the instructions completely. Feel free to use your book, notes, and a calculator to complete the assignment. I encourage you to discuss the problems with your classmates to enhance learning, but do NOT copy someone else's work. You are ultimately responsible for your work. You have over a week to complete this assignment – late papers will NOT be accepted!

PART ONE: Math Review

The following questions are just a simple mathematical exercise in case you need a refresher on your math skills. I strongly encourage you to review Appendix C of the text if you have difficulty with this section. **SHOW YOUR WORK!**

Some useful relations:

$$1 \text{ AU} = 149,600,000 \text{ km} = 1.496 \times 10^8 \text{ km}$$

$$1 \text{ mile} = 1.6 \text{ km}$$

$$\text{Speed of light (c)} = 300,000 \text{ km/s}$$

1. **a)** The planet Jupiter is approximately 5.2 AU away from the Sun. What is this distance in kilometers?

Distance in km = _____ km

b) What is the above distance in miles? _____ mi

2. **a)** Ceres is a large asteroid in the asteroid belt. It was being considered as a possible new planet candidate during the recent planet definition debate. Ceres orbits the Sun at a distance of $4.139 \times 10^8 \text{ km}$. What is this distance in AU?

Distance in AU = _____ AU

b) Ceres' radius is estimated to be around 475 km. How many times larger than Ceres is the Earth? (See Appendix A or E for the Earth's radius)

The Earth is _____ times larger than the asteroid Ceres.

(continued...)

Name: _____

3. In our universe age model, we equated the age of the universe (14 billion years) to one calendar year. How many years does each second of the model represent? (Hint: 1 year = 3.15×10^7 seconds)

Each second of the model = _____ years.

4. The New Horizons spacecraft is racing towards Pluto at a speed of about 25 km/s. What is its speed in miles per hour (mph)? Assuming that it travels to Pluto in a straight line at the above speed and that Pluto is 40 AU away, how long (in years) will the spacecraft travel before reaching Pluto? If it were traveling to the nearest star, Proxima Centauri, which is about 4.2 ly away, how long would the journey last? (Hint: Time = Distance / Speed)

Speed of the spacecraft = _____ mph

Time to Pluto = _____ years

Time to Proxima Centauri = _____ years

5. Imagine that you are observing the light from a distant star that is 100 million ly away. By analysis of the starlight received, you are able to tell that the image seen is that of a 10 million year old star. You are also able to predict that the star has a total lifetime of 50 million years after which it will end its life in a spectacular supernova.

a) How old does the star appear to us here on Earth?

b) How long will it be before we witness the supernova?

c) Has the supernova already occurred? If so, when did it occur? If not, when will it occur?

(continued...)

Name: _____

PART TWO: Multiple Choice

6. Imagine that you take images of two stars. From the observations, both stars appear to be the same age. Given your conclusions, which one of the following situations could be true? Circle all correct answers.

- a) Both stars are the same age and at the same distance from you
- b) Both stars are the same age but at different distances from you
- c) The stars are actually different ages, but at the same distance from you
- d) The star that is closer to you is actually the older of the two stars
- e) The star that is farther from you is actually the older of the two stars

7. We have seasons on Earth because:

- a) The Earth's rotational axis is tilted with respect to its orbital plane
- b) The Earth is closer to the Sun during summer
- c) The Earth rotates slower in summer, giving us longer days and hence more sunlight
- d) The Sun burns hotter during the summer
- e) Global warming is responsible for seasons on Earth

8. **Even** numbered questions 26 – 34 on page 23 of text (end of chapter 1). Circle the right answer:

- | | | | |
|-----|-----|-----|-----|
| 26. | (a) | (b) | (c) |
| 28. | (a) | (b) | (c) |
| 30. | (a) | (b) | (c) |
| 32. | (a) | (b) | (c) |
| 34. | (a) | (b) | (c) |

9. **Odd** numbered questions 27 – 35 on page 54 of text (end of chapter 2). Circle the right answer:

- | | | | |
|-----|-----|-----|-----|
| 27. | (a) | (b) | (c) |
| 29. | (a) | (b) | (c) |
| 31. | (a) | (b) | (c) |
| 33. | (a) | (b) | (c) |
| 35. | (a) | (b) | (c) |

(continued...)

Name: _____

BONUS QUESTIONS: For full credit, SHOW YOUR WORK!

1. What is a light hour (in words and in kilometers)?

2. The parallax of the star Bellatrix (3rd brightest star in Orion) is 0.01342 arcsec. When we see it in the sky, how much older is the star we see compared to its real age now?

