Astronomy 2110 Homework #1

Spring 2024

Due Thursday, Jan. 25 at the beginning of class.

For full credit you must write your solutions neatly and include all work. Do not forget the units!

Note: Sometimes you might have to look up data in the appendices of *Universe*. Also, use drawings if that is helpful.

There are 10 problems, each worth 10 points.

1) The diameter of the Sun is 1.4×10^{11} cm, and the distance to the nearest star, Proxima Centauri, is 4.2 ly. Suppose you want to build an exact scale model of the Sun and Proxima Centauri, and you are using a ball 30 cm in diameter to represent the Sun. In your scale model, how far away would Proxima Centauri be from the Sun? Give your answer in kilometers using powers-of-ten notation.

2) The average distance from the Earth to the Sun is 1.496×10^{8} km. Express this distance in (a) AU; (b) light-years; (c); parsecs. (d) What unit would be most convenient for expressing distances to solar-system objects?

3) The age of the Universe is about 13.7 billion years. What is the age in seconds using powers-of-ten notation?

4) Suppose you have a telescope that can give you a clear view of objects and features that subtend angles of at least 2 arcseconds. What is the diameter in kilometers of the smallest crater you can see on the Moon? (which has an average distance of 384,000 km).

5) What is the celestial equator? How is it related to the Earth's equator? How are the north and south celestial poles related to Earth rotation?

6) How many degrees is the angle from the horizon to the zenith? Does your answer depend on what point on the horizon you choose?

7) On November 1 at 8:30pm you look toward the eastern horizon and see the bright star Bellatrix rising. At approximately what time will Bellatrix rise one week later, on November 8th?

8) Is there any place on Earth where all the visible stars are circumpolar? If so, where? Is there a place on Earth where none of the stars are circumpolar? If so, where? Explain your answers.

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9) The coordinates of the Sun on the celestial sphere of the summer solstice are R.A. = 6^h 0^m 0^s, Dec = 23° 27'. What are the RA and Dec of the Sun at the winter solstice? Explain your answer.

10) How would the length of the sidereal and solar days change (a) if Earth's rate of rotation increased; (b) if Earth's rate of rotation decreased; and (c) if the Earth's rotation was retrograde (that is if Earth rotated at the same speed but in the opposite direction from which it is revolving around the Sun)?