Physics 167 – Astronomy

Homework #1

Chapter 1

1. Photos of Saturn and photos of galaxies can look so similar that children often think the photos show similar objects. In reality, a galaxy is far larger than any planet. About how many times larger is the dameter of the Milky Way Galaxy than the diameter of Saturn's rings? (Data: Saturn's rings are about 2.7×10^5 km in diameter; the Milky Way is about 1.0×10^5 light years in diameter.)

2. Imagine that you could drive your car at a constant speed of 100 km/h, even across oceans and in space. How long would it take to drive
a. around the Earth's equator? (Earth's circumference is 4.0×10^4 km.)
b. from the Sun to the Earth?
c. from the Sun to Pluto? (Pluto distance is 5.9×10^9 km.)
d. to Alpha Centuri (4.4 light-years away)?
Which of the above could be completed in one 100-year human lifetime?

3. Suppose you wanted to reach Alpha Centuri in 100 years.
a. How fast would you have to go, in km/h?
b. How many times faster is the speed you found in (a) than the speeds of our fastest current spacecraft (around 5.0×10^4 km/h)?

Chapter 2

4. The Sun has an angular diameter of about $0.5°$ and an average distance from Earth of about 150 million km. What is the Sun's approximate diameter? Compare your answer to the actual value of 1.39×10^6 km (find the percent difference between the two values).

5. Estimate the diameter of the supergiant star Betelgeuse, using its measured diameter of about 0.5 arcsecond and distance of about 600 light years. Compare your answer to the size of our Sun and the Earth-Sun distance (find the ratio of your answer to the size of the Sun, and the ration of your answer to the Earth-Sun distance).

6. The Moon's precise equatorial diameter is 3476 km, and its orbital distance from Earth varies between 356,400 km and 406,700 km. The Sun's diameter is 1.39×10^6 km, and its distance from Earth ranges between 147.5 and 152.6 million km.
a. Find the Moon's angular size at its minimum and maximum distances from Earth.
b. Find the Sun's angular size at its minimum and maximum distances from Earth.
c. Based on your answers to (a) and (b), is it possible to have a total solar eclipse when the Moon and Sun are both at their maximum distances? Explain.

7. A planet in another solar system has a circular orbit and an axis tilt of 35°. Would you expect this planet to have seasons? If so, would you expect them to be more or less extreme than the seasons on Earth? Explain your answers briefly.

8. Suppose you lived on the Moon, in which case you would see Earth going through phases in your sky. Assume you live near the center of the face that looks toward Earth.
a. Suppose you see a full Earth in your sky. What phase of the Moon would people on Earth see? Explain.
b. Suppose people on Earth see a full moon. What phase would you see for Earth? Explain.
c. Suppose people on Earth see a waxing gibbous moon. What phase would you see for Earth? Explain.
d. Suppose people on Earth are viewing a total lunar eclipse. What would you see from your home on the Moon? Explain.