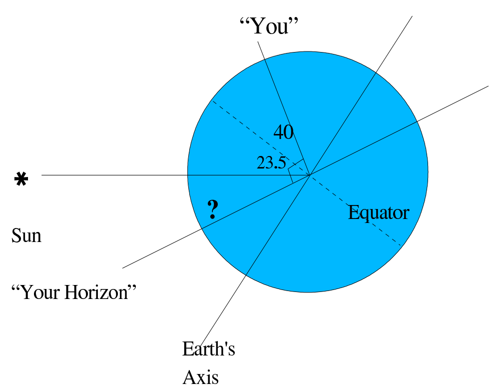
ASTR 120
Fall 2006
Homework Assignment No. 1 – **Solutions**

1. $D_{\odot} = 1.4 \times 10^{11}\, cm$
   $d = 4.2ly = 4.2ly \times 9.46 \times 10^{12} km/ly \times 10^5 cm/km = 3.97 \times 10^{18} cm$
   Simply divide:
   $$\frac{d}{D_{\odot}} = \frac{3.97 \times 10^{18} cm}{1.4 \times 10^{11} cm} = 2.8 \times 10^7 Suns$$

2. $$\frac{1.99 \times 10^{30} kg \times .75}{1.67 \times 10^{-27} kg/atom} = 8.9 \times 10^{56} atoms$$

3. A star rises approximately 4 minutes earlier each night (see p. 23 of textbook). So 7 days later, it will rise $4 \times 7 = 28$ minutes earlier, i.e. at 8:02 pm.

4. The angle marked "?" is the one we want to solve for:



(Angles are not actually measured; Not to scale)

   $90° - (40° + 23.5°) = 26.5°$

5. (a) Both would be shorter. A 'day' is the period of rotation. $P \propto \frac{1}{\omega}$ where ω is the angular velocity, or rate of rotation. Thus faster rotation yields a shorter day.
   (b) Both would be longer. (Opposite of above.)
   (c) The Solar day would be shorter. The Earth would have to rotate 1° *less* than a full circle (360°) to get from one solar noon to the next if its rotation was retrograde. (See picture on p. 35 of text; then think of the opposite case.)
   The Sidereal day would remain the same.

6. (a) Full
   (b) Third quarter
   (c) New
   (d) First quarter
7. (a) More common. Some of the eclipses that are partial now (i.e. with the Moon's actual diameter) would be full if its diameter were doubled.
   (b) The angular size of the Moon would be less than that of the Sun, so it would never be able to completely block the Sun from view.
8. For an 'inferior' planet with sidereal period P and synodic period S:

$$\frac{1}{P} = \frac{1}{E} + \frac{1}{S}$$

and E = Earth's period (i.e. 1 year = 365.25 days) So

$$P = \frac{1}{\frac{1}{E} + \frac{1}{S}} = \frac{1}{\frac{1}{365.25} + \frac{1}{115.88}} = 87.97\, days$$

Extra Credit:

Angular size (θ) = Object's actual size / Distance to observer. So, the angular size of the Sun seen from Earth is

$$\theta = \frac{12104\, km}{0.719\, AU} = \frac{12104\, km}{0.719\, AU \times 1.496 \times 10^8\, km/AU} = 1.1 \times 10^{-4}\, radians$$

$$1.1 \times 10^{-4}\, radians \times (\frac{180°}{\pi\, rad}) = 0.0063° = 0.38' = 22.69''$$