PROBLEM SET 1 SOLUTIONS
Physics 2021

1. τ = 14 x 10^9 years x 365.25 days/year x 24 hr/day x 60 min/hr x 60 sec/min

   = 4.42 x 10^{17} seconds

2. 1.4 deg x 60 arcmin/deg = 84 arcmin

   84 arcmin x 60 arcsec/arcmin = 5040 arcsec

3. d = 206,265 (D / α)

   a. d = 206,265 [(2.6 cm) / (3600 arcsec/deg)] = 150 cm = 1.50 m

   b. d = 206,265 [(2.6 cm) / (60 arcsec/deg)] = 8938 cm = 89.4 m

   c. d = 206,265 [(2.6 cm) / (1 arcsec/deg)] = 536,290 cm = 4363 m

4. d = 50,000 m α = 20 arcsec

   D = α d / 206,265 = (20 arcsec) (50,000 m) / (206,265 arcsec) = 4.8 m

5. Latitude = 40° N Sun is at -23.5^o N

   Distance from the zenith is 40.0 – (-23.5) = 63.5^o

   Altitude from the horizon is 90.0 – 63.5 = 26.5^o

6. In the northern hemisphere the Sun appears toward the south and in the southern hemisphere the Sun appears toward the north. The houses are designed to admit as much sunlight as possible.

7. At 19° north latitude the Sun is on the zenith at midday twice during the year because its latitude is less than 23.5^o.

8. It rises 4 minutes earlier each day, so in one week it rises 7 x 4 = 28 minutes sooner, which is at 8:02 pm.