Assignment 3

1. Problem 9-8: Although in some respects Earth and Venus are 'twin planets', they have very different atmospheres. For example, the surface pressure on Venus is almost 2 orders of magnitude larger than that on Earth.
   a. Calculate the mass of each atmosphere in unit of kilograms.
   b. Recalculate these values for Earth, including Earth's oceans as part of its 'atmosphere'. (If all of the water above Earth's crust were spread evenly over the planet, this global ocean would be ~3 km deep.)
   c. Compare the values for the two planets and comment.

   Hint: Appendix E may have atmospheric parameters of the two planets that you would need.

2. Problem 6-15.
   a. What is the minimum impact velocity of a meteoroid when it enters the Earth's atmosphere?
   b. In general, smaller meteoroid is slowed down more substantially. Determine the minimum radius of an iron meteoroid ($\rho = 8000$ kg m^{-3}) make it through Earth's atmosphere without being substantially slowed down.
      Hint: what is the condition to "substantially slowed down" a meteoroid? We talked about it in the class. You can also find the definition in S.6.4.3.
   c. Determine the minimum radius for a meteoroid of similar composition to make it through Venus's atmosphere without being substantially slowed down.
      Hint: Appendix E may have numbers you need in this calculation.

3. Problem 9-4: Mercury's mean density is $\rho = 5430$ kg/m^3. This value is very close to the planet's uncompressed density. If Mercury consists entirely of rock ($\rho_r = 3300$ kg/m^3) and iron ($\rho_i = 7950$ kg/m^3), calculate the planet's fractional abundance of iron by mass.

4. Problem 10-4

5. Problem 11-8: Calculate the fractional abundance of ^{234}U in naturally occurring uranium ore.
   Hint 1: Use the first decay chain shown in Figure 11.17.
   Hint 2: ^{235}U can be ignored.

6. Problem 12-3. Suppose a comet has a velocity of 40 km/s at perihelion. The perihelion distance is 1 AU. Calculate the aphelion distance, the velocity of the comet at aphelion and the orbital period of the comet.
   Hint: The orbital parameters of an object can be determined if we know the heliocentric distance and velocity of the object at any one position on its orbit. S.2.1.6 shows you how that can be done.

7. Problem 12-4(a). Show that if the exponent $\zeta = 4$ in equation (12.1a), then the mass is divided equally among equal logarithmic intervals in radius.

8. Problem 13.3: Calculate the Roche limit of Jupiter and Saturn assuming a satellite density of 1 g/cm^3, appropriate for dirty snowballs. Compare your results with the observed ring sizes

and then comment, e.g., what could you possibly infer about the origin of these rings? You could assume the rings have not moved much radially since their formation.