Questions for Week 3

1. The value for H_0 is 2.4 x 10^{-18} s^{-1}. However, astronomers prefer to measure Hubble's constant in units of km s^{-1} Mpc^{-1}. Determine what H_0 is in these units.

2. For the Galaxy M87 in Question 1(b) from Week 2, use the value of the cosmological redshift parameter you determined to calculate the distance between the Milky Way and M87.

3. The light from a distant galaxy is observed with a telescope on the Earth.
   (a) It is found to be redshifted.
      (i) Explain what is happening between the Earth and the distant galaxy.

      (ii) What has happened to the wavelength of the radiation emitted by a spectral line from the distant galaxy when it is measured on the Earth?

   (b) The wavelength of the H_ε spectral line from the distant galaxy is observed to be at 398.3 nm. When measured in the laboratory the same line has a rest wavelength of 396.9 nm.

      (i) Calculate the redshift parameter, z.

      (ii) At what speed is the galaxy moving with respect to us?

      (iii) Determine how far away the galaxy must be.

(c) Use the Hubble constant to estimate the age of the universe in billions of years.

4. According the European Space Agency's Planck Satellite science team, the approximate age of the Universe is in fact 13.8×10^9 years.

(i) Use this information to estimate the size of the Hubble constant.

(ii) What important assumption about H_0 have you made in your calculation?