Problem Set #4

Due Friday, March 25 by 5pm to Dickinson 104

Unless otherwise indicated, all problems come from "The Cosmic Perspective," 8e

1. Problem 17.40 *Homes to Civilization* -- Choose ***two*** of the given stars to write about.
2. Problem 17.48 *Construction of Elements*
3. Problem 17.49 *Expansion of the Crab Nebula*
4. The cells of the table below provide 10 stages of star formation and evolution for low mass stars (M < 8 $M_\odot$) and high mass stars (M > 8 $M_\odot$) in no particular order.

(a) Planetary Nebula	**(f)** O spectral class main sequence star
(b) G spectral class main sequence star	**(g)** Large, diffuse Cloud of Gas and Dust
(c) Neutron Star	**(h)** White Dwarf
(d) Supernova	**(i)** Nova
(e) Red Giant	**(j)** Gravitationally Collapsing Cloud of Gas and Dust

   a. Rank, for earliest to latest, the stages for **low mass stars**. Do not include any stages that do not apply. Explain your ranking, with specific attention to stages included and excluded.
   b. Rank, from earliest to latest, the stages of **high mass stars**. Do not include any stages that do not apply. Explain your ranking, with specific attention to stages included and excluded.
5. Problem 18.50 *Neutron Star Density*
6. Problem 18.52 *The Crab Pulsar Winds Down*
7. A newly formed neutron star has a surface temperature of ~10^{12} K, but this surface temperature falls to ~10^6 K within a few years.
   a. By what factor does a neutron star's luminosity change in these first few years? *(Note: assume that the neutron star doesn't change in size*)
   b. The faintest objects you can observe with your naked eye have a brightness of approximately 10^{-10} W/m^2. Given that the radius of a typical neutron star is 10 km, how close (in parsecs) would a neutron star have to be to be observable to the naked eye after it cooled to 10^6 K?
   c. What fraction of stars visible to your naked eye do you think are neutron stars? Explain. (*Hint: Consult Table F.1 in Appendix F to help you think about this last part.*)