KEEP THIS QUESTION SHEET. Mark your answers AND the correct ones I will give you at the end of the class on Thursday the 10th on this sheet; then use it while studying for the exam on the 15th. TAKE A SEPARATE PIECE OF PAPER AND PRINT YOUR NAME and your ANSWERS (just T or X for the 8 True/False and A, B, C, D, or E for the five multiple choice questions) NEXT TO THE NUMBER (1–13) FOR EACH QUESTION. THESE ANSWER SHEETS ARE TO BE HANDED IN AT THE BEGINNING OF CLASS ON THURSDAY, NOV 10th.

1. Energy transport in the cores of low mass (M) stars on the Main Sequence (< 0.5\(M_\odot\)) is mainly by radiation.

2. The Milky Way galaxy contains a stellar disk roughly 30 kpc in diameter and roughly 500 pc in thickness.

3. As a star evolves away from the main sequence its surface gets hotter.

4. When helium starts to fuse inside a solar-mass red giant it does so slowly at first; the rate of fusion increases gradually over many millions of years.

5. A nova is a sudden outburst of light coming from an old main-sequence star.

6. Much of the energy released during a supernova is emitted in the form of neutrinos.

7. A 12 \(M_\odot\) star will leave behind a white dwarf as a remnant.

8. A black hole contains so much mass within such a small volume that not even light can escape from it.

9. A Pop I star of 4 \(M_\odot\) is mainly supported by ________ pressure and generates most of its nuclear energy via the ________.
   A. thermal . . . . . pp-I chain
   B. thermal . . . . . CNO cycle
   C. thermal . . . . . pp-II chain
   D. radiation . . . . . pp-I chain
   E. radiation . . . . . CNO cycle

10. Type I supernovae differ from Type II supernovae in that
    A. Type I SN are usually several times more luminous
    B. Type I SN have Hydrogen lines in their spectra but Type II SN do not.
    C. Type I can arise from the collapse of a white dwarf over the Chandrasekhar limit, while Type II only arise from massive stars.
    D. Both A and B.
    E. Both A and C.

11. A rotating neutron star can most often be detected by
    A. its thermal X-ray emission
    B. the gravitational red-shift it induces on positron annihilation lines
    C. pulsed radio emission
    D. pulsed optical emission
    E. its gravitational effect on a nearby companion star

12. The mass of our galaxy out to its visible radius, about 15 kpc, is nearest to
    A. 4 \(\times 10^5\) \(M_\odot\)
    B. 4 \(\times 10^7\) \(M_\odot\)
    C. 4 \(\times 10^9\) \(M_\odot\)
    D. 4 \(\times 10^{11}\) \(M_\odot\)
    E. 4 \(\times 10^{13}\) \(M_\odot\)

13. A non-rotating black hole of \(10^6\) \(M_\odot\) has an event horizon of radius
    A. 3 \(\times 10^6\) cm
    B. 3 \(\times 10^4\) km
    C. 3 \(\times 10^6\) m
    D. 3 \(\times 10^{11}\) cm
    E. 3 \(\times 10^{13}\) cm