

Astronomy 102: Assignment 3, star formation and stellar evolution

1. Explain the concept of hydrostatic equilibrium. How does the gravitational collapse of a protostar affect its temperature? Think of an everyday situation (other than one given in the lectures) in which gas that is heated will expand and another where cold gas contracts. [6]
2. A Type II Cepheid variable has a period of 30 days. What is its absolute magnitude if it follows the relation in Fig 12-14 of Seeds? If the observed apparent magnitude is +12, what is the distance in parsecs? (Hint, see Table 9.1 in Seeds.). How could interstellar extinction due to dust affect our calculation if it were present? [6]
3. What are the 3 processes of heat transfer? Give an everyday example of each. Which two are the most important in stars? Which process causes granulation on the solar surface? Thermos flasks often have an interior vacuum, which ONE process does this not insulate against? [6]
4. The p-p chain and CNO cycles both turn hydrogen into helium, so why does the CNO cycle need hotter temperatures? What is the name of the process that turns helium into carbon? Draw a Hertzsprung-Russel diagram (with axes labelled) showing the positions of a three solar mass star when a) it is burning hydrogen in its core, b) it is burning hydrogen in a shell around a helium core and c) burning helium in its core. [6]
5. How can the main sequence turn-off be used to estimate the age of a star cluster? Draw 2 HR diagrams (with labelled axes) showing the difference between a young cluster and an old cluster.[6]

Total: 30.