

Qualifying Exam of Stellar Astrophysics (2025)

1. Draw an evolutionary track of a star with a Zero-Age-Main-Sequence mass of 1 solar mass on the Hertzsprung–Russell diagram (starting from pre-main sequence). Label and give brief but clear description of every important phase including pre-main sequence, main sequence, red giant branch, horizontal branch, asymptotic giant branch, planetary nebula, and white dwarf. (30%)
2. What is ‘Chandrasekhar limit’? Why the limit exists? (25%)
3. What is ‘helium flash’? It only happens in stars with a certain mass range. Describe qualitatively (no need to give specific numbers) and give physical reasons in what mass ranges the helium flash occurs. (25%)
4. During most of the period of evolution, stars can be considered as quasi-statistical-equilibrium. Explain why stars swell up after evolving after main sequence. (20%)

Reference

- Equation of states of non-relativistic and relativistic electron gas is $P \propto \rho^{5/3}$ and $P \propto \rho^{4/3}$, respectively.