QUIZ 4 Spring 2008 .... YOUR NAME:________________

1. **True or false**

1 _T_ Blue main sequence stars are more massive than red main sequence stars.

2 _F_ White dwarfs are mainly supported against gravity by gas pressure. (e^- degeneracy pressure)

3 _F_ Red giants are primarily burning Hydrogen in their core. (shell burning)

4 _T_ Iron is the most tightly bound element.

5 _F_ Solar mass stars spend most of their life as Red Giants.

6 _T_ Electron degeneracy pressure is not important in the hydrostatic equilibrium of a protostar.

2. **A white dwarf has about the same radius as:**

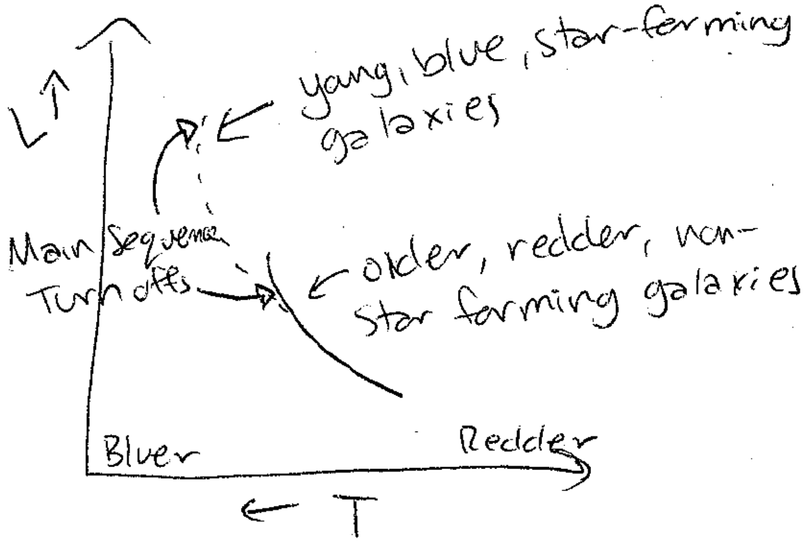
___ The Sun

1 _X_ The Earth

___ A basketball

___ There is no way to determine the size of any white dwarf.

3. (10 pts) **There are blue galaxies and red galaxies. Explain why the galaxies that are blue are forming stars and why the galaxies that are red are not forming stars (or at least a relatively lower number of stars). Use an HR diagram to explain why this is true.**



Because high mass (bluer) ☆'s die quicker than low mass (redder) ☆'s, galaxies that are blue must be forming massive stars to replenish those lost due to normal evolution.

4. **True or false**

1 F Old stellar populations have a bluer main sequence turnoff than younger stellar populations

2 F High mass stars mainly create light elements and low mass stars create heavy elements.

3 F The lagrange point in a binary system is the point between two stars that feels equal force from the two stars.

4 F Stars on the main sequence burning Hydrogen are brighter than the red giants that they become.

5 F Neutrinos are the dominant particle in the solar wind

6 T Neutrinos are created in by nuclear reactions in the core of the sun.

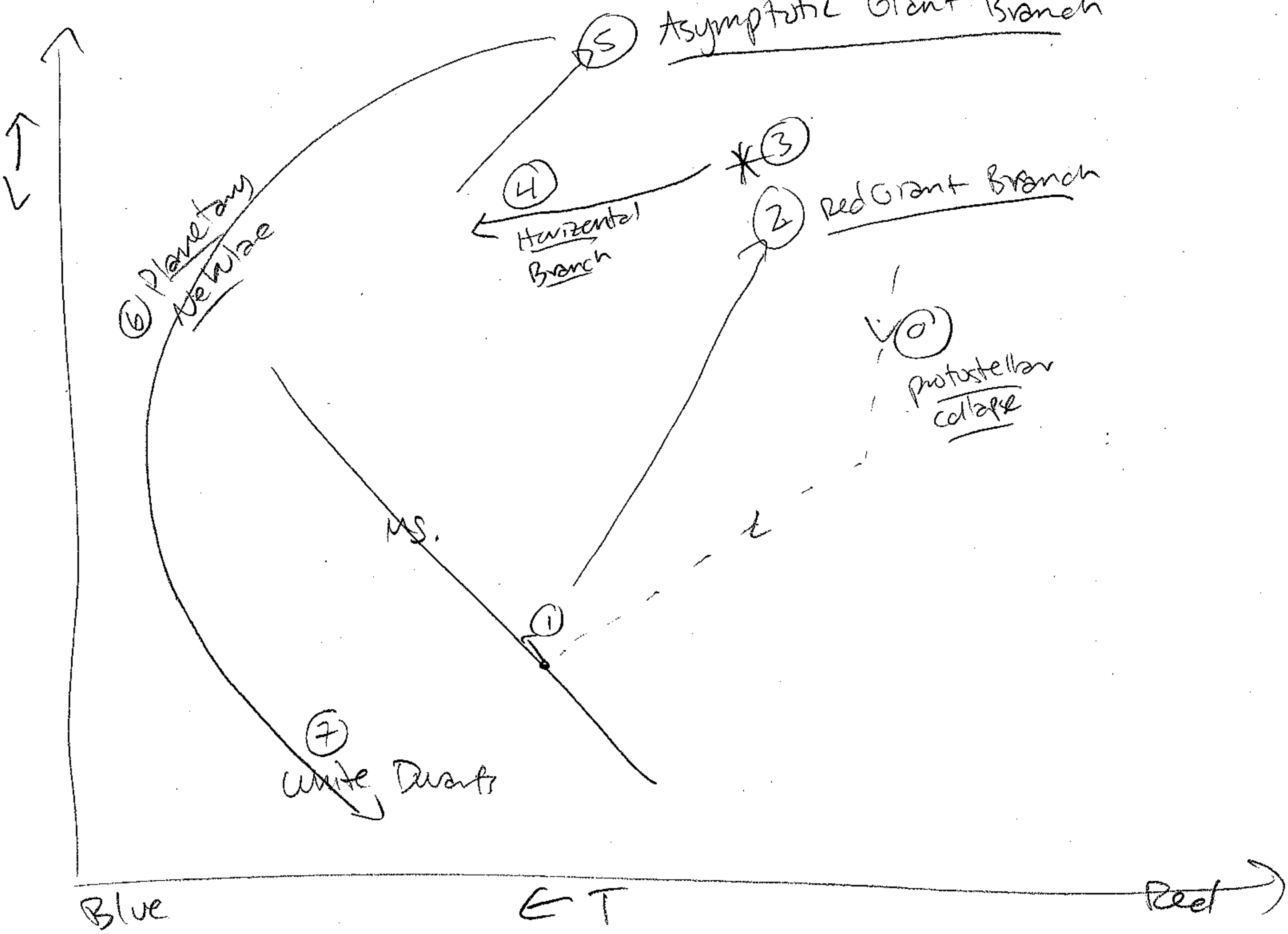
7 F Stars with mass between 0.08M. and 1.4M. are called brown dwarfs. ($<0.08M_\odot$ are)

8 T The sun is brighter today than when it formed 4.5 billion years ago.

5. **Describe the life of a 1 solar mass star. Include an HR diagram to support your discussion.**

(15) *SEE ATTACHED REVIEW NOTES*

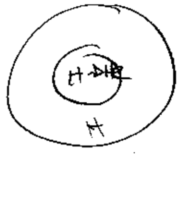
(1) Evolution of $1 M_\odot$ ★



⓪ Protostellar collapse: collapse of giant gas cloud to form star: if $M_{proto\star} < 0.08 M_\odot$ ⇒ never gets hot enough to start fusion ≡ Brown Dwarf

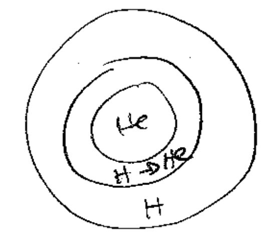
① Main Sequence: H → He via pp chain: $4H \rightarrow He^4 + (\text{energy}) + 2\,(\text{neutrinos})$

- Radius & Luminosity increase slightly on M.S.



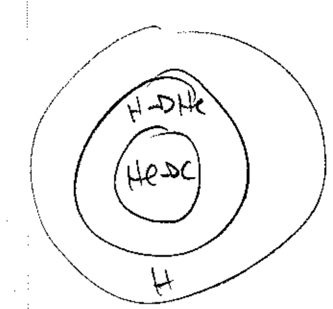
② Red Giant Branch : H → He fusion stops in core, shell burning

- radius expands
- Luminosity ↑

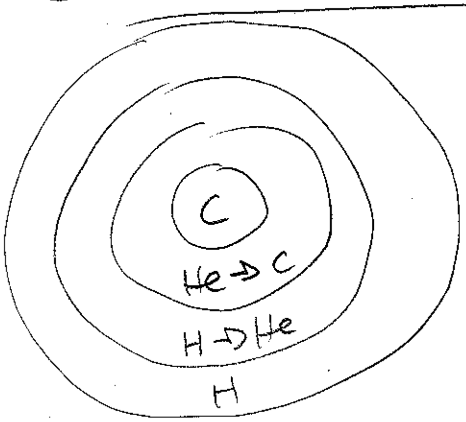


③ Helium Flash : He core is supported by electron degeneracy pressure (no temperature dependence)
⇒ when triple-α process starts to fuse He → C
no core expansion ⇒ run away fusion

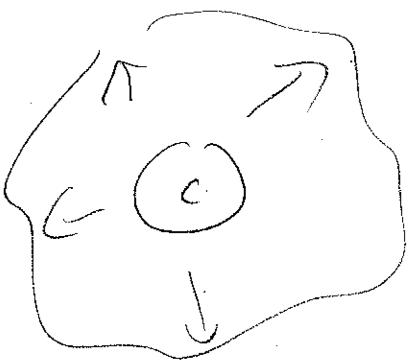
④ Asymptotic Giant Branch : "Helium Fusion M.S"
⇒ He → C in core



(5) <u>Asymptotic Giant Branch</u> : He → C fusion stops in core, shell burning



(6) outer shells escape into <u>planetary</u> <u>nebulae</u>



(7) End stage: forever cooling <u>White</u> <u>Dwarf</u> : supported against gravity by e^- degeneracy

- upper mass of WD : $1.4 M_\odot$ (Chandrasekhar Limit)

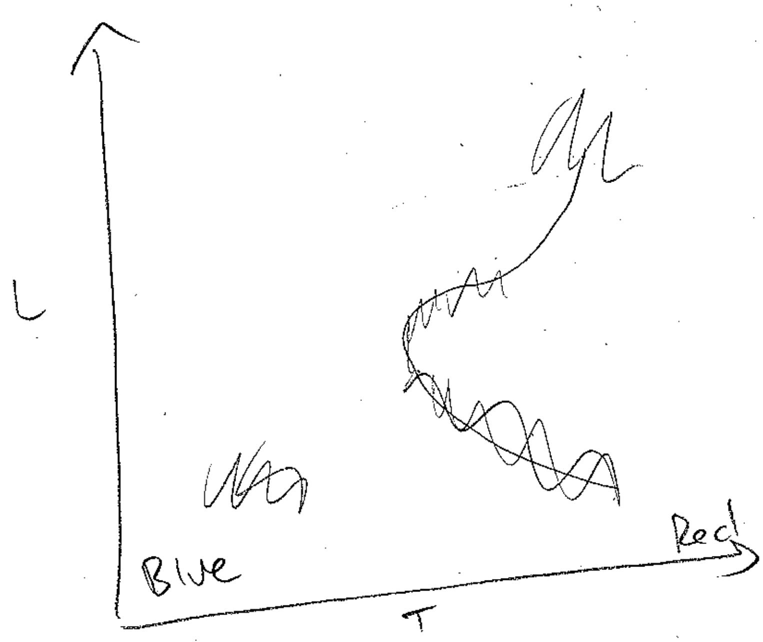
  ⇒ if $M > M_{CH}$ then e^- degeneracy cannot support against gravity

- WD are <u>small</u> ~ radius of Earth

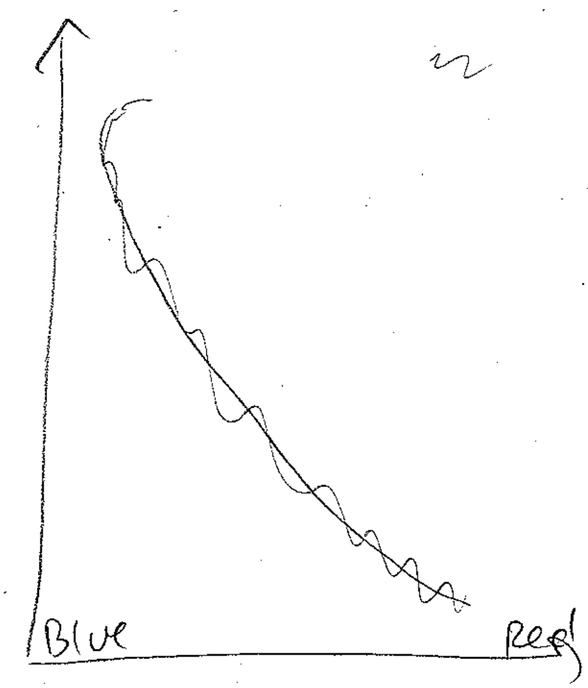
(2) General Differences between Low/High Mass ☆ Evolution

(i) Massive ☆'s can burn all the way up to Fe (Iron)
⇒ Iron is most stable element ⇒ requires energy to fuse more massive elements

(ii) High mass ☆'s evolve much faster than low mass ☆'s
⇒ lets us look @ the Main Sequence Turnoff as a proxy for age
⇒ populations of ☆'s get redder as they get older



Old



Young