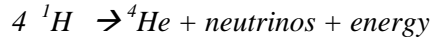


ISP 205

Review Questions, Week 10

This is not required homework. It will not be graded. Answers will be supplied next week.

1. What is the Sun's source of energy? *Nuclear reactions convert hydrogen into helium, and as a result convert a fraction 0.007 of the hydrogen's mass into energy ($E=mc^2$). The reaction is*



2. Every little piece of the Sun attracts every other little piece of the Sun through the force of Gravity. Why don't all of the pieces just pull themselves together into an infinitesimally small clump at the center? *Gas pressure holds the Sun up. The individual atoms inside the sun are flying around in random directions and constantly bouncing off each other in new random directions. This keeps them from falling to the center. This is what we mean by gas pressure. Gas pressure is proportional to the density (the number of atoms per unit volume), and also to the average speed of the atoms (measured by the gas temperature).*

3. Using the Hertzsprung-Russell diagram in Figure 1, match the number with the type of star that is located at that position:

- a) Our Sun #2
- b) Very cool main sequence star. #3
- c) Very hot main sequence star. #1
- d) White dwarf. #6
- e) Supergiant. #5
- f) Red Giant. #4

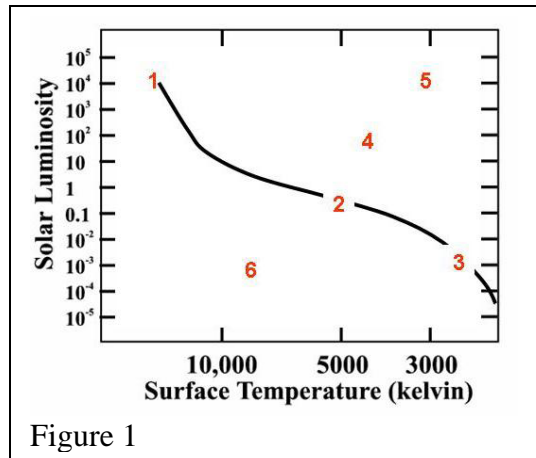


Figure 1

4. If you compare two stars that have the same surface temperatures, but one star is 10,000 times more luminous than the other, what are the relative diameters of the two stars?

$$\text{Luminosity} = (\text{surface area}) \times (\text{Energy emitted per unit surface area})$$

If the temperatures are the same, the energy emitted per unit surface will be the same.

So the more luminous star must have 10,000 times more surface area than the less luminous star.

Surface area of a sphere = πD^2 (where D is the diameter).

So the diameter must be $\sqrt{10,000} = 100$ times larger.

5. Referring to Figure 1, which star on the H-R diagram sketch is most massive: Star 1, star 2, or star 3? *Star 1 has the most mass. The position of stars on the main sequence is determined by their mass. Star 3 has the least mass.*
6. Referring to Figure 1, what nuclear reaction, located where in the star, is powering stars 1, 2 and 3? *All stars on the main sequence are powered by burning hydrogen into helium in their central cores.*

7. The dashed red line on the H-R diagram in Fig. 2 sketches the evolutionary path of a star similar to the Sun. Match each of the numbered points along the path with the description of what is happening to the star.
- Expelling outer envelope. #5
 - Inert core; He and H burning shells. #4
 - Burning H in core. #1
 - He burning core; H burning shell. #3
 - Core is inert; burning H in shell. #2

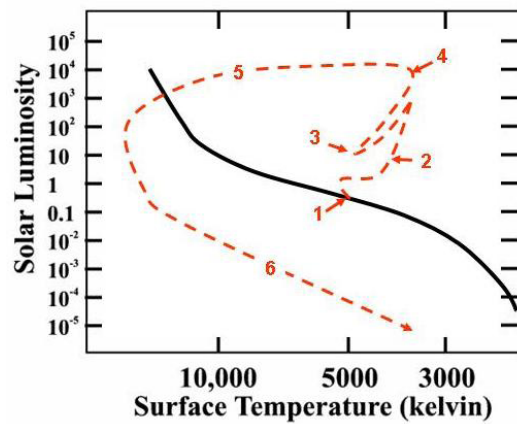


Figure 2