ASTR1102-002

Practice Questions for Exam #2

1. Why do sunspots appear to be darker than most of the Sun's photosphere?

2. Sometimes the Sun's surface displays virtually no sunspots, while at other times its surface displays a relatively large number of sunspots. What is the typical length of time between sunspot minimums and sunspot maximum; that is, what is the typical length of the "sunspot cycle"?

3. Sunspots appear to be associated with regions of the Sun's surface where the magnetic field is especially _____ (weak or strong).

4. The north and south magnetic poles of the Earth reverse every 11 years. (True or False?)

5. Heat can be transported from the center to the surface of a star either by radiative diffusion, or by convection. Which one of these two processes is principally responsible for transporting heat in the surface layers of the Sun?

6. By tracking the changing position of sunspots across the surface of the Sun over many hours and days, astronomers have determined that the Sun rotates once every 24 hours. (True or False?)

7. Which of the following properties of the Sun can best be studied during a total solar eclipse?

   a. Sunspots.
   b. The Solar Corona.
   c. Photospheric granulation.
   d. Nuclear fusion in the Sun's core.

8. The central temperature of the Sun is _____. (Fill in the blank.)

   a. approximately 5800 K.
   b. approximately 16 million K.
   c. orange.
   d. not known.

9. If the Sun was not in **hydrostatic equilibrium**, how long would it take for the Sun's structure to noticeably change?

   a. A few hours.
   b. Tens of thousands of years.
   c. Approximately 10 million years.
   d. Approximately 10 billion years.

10. If the Sun was undergoing **Kelvin-Helmholtz contraction**, how long would it take for the Sun's structure to noticeably change?

    a. A few hours.
    b. Tens of thousands of years.
    c. Approximately 10 million years.
    d. Approximately 10 billion years.

11. Because heat generated through **nuclear fusion reactions** in the central core of the Sun is replenishing the heat that the Sun is steadily losing at its surface, how long can the Sun "live" without experiencing a noticeable change in its structure?

    a. A few hours.
    b. Tens of thousands of years.
    c. Approximately 10 million years.
    d. Approximately 10 billion years.

12. What is the **average density** of material in the Sun? State your answer in units of kilograms per cubic meter and compare it to the density of water (1000 kg/m^3).

    HINT: You can calculate the average density by dividing the Sun's total mass ($M_\odot = 2 \times 10^{30}$ kg) by the Sun's volume. Given the Sun's radius ($R_\odot = 7 \times 10^8$ meters), what is the Sun's volume?

13. According to the mathematical (theoretical) model of the Sun that has been developed by astronomers, what is the **central density** of the Sun? (See, for example, Table 16-2 or Figure 16-3.)

14. According to the mathematical (theoretical) model of the Sun that has been developed by astronomers, what is the **central temperature** of the Sun? (See, for example, Table 16-2 or Figure 16-3.)

15. How many neutrons are in the nucleus of the most common isotope of hydrogen (^1H)?

16. How many protons are in the nucleus of a ^1H atom?

17. How many protons are in the nucleus of a deuterium (^{2}H) atom?

18. How many neutrons are in the nucleus of a deuterium (^{2}H) atom?

19. How many protons are in the nucleus of a tritium (^{3}H) atom?

20. How many neutrons are in the nucleus of a tritium (^{3}H) atom?

21. How many protons are in the nucleus of a ^{3}He atom?

22. How many neutrons are in the nucleus of a ^{3}He atom?

23. How many protons are in the nucleus of a ^{4}He atom?

24. How many neutrons are in the nucleus of a ^{4}He atom?

25. How many protons are in the nucleus of a ^{12}C atom?

26. How many neutrons are in the nucleus of a ^{12}C atom?

27. How many neutrinos are created when four ^{1}H nuclei combine (via the proton-proton chain, nuclear fusion reaction) to form one ^{4}He nucleus?

28. What happens to the positron (e^{+}) shortly after it is created during the first step of a “proton-proton chain” nuclear reaction?