Prof. L. Sparke Astronomy 103 Name_____
Fall 2006 Disc._____

Homework 8: Due **Wednesday, Nov 15, 2006**, in class (or turn them in before then to my mailbox, 5th floor, Sterling Hall). Circle the correct option and give a short answer.

1. You are looking for animals in a field at night. So you want a pair of binoculars that convert
   A. visible light into infrared light
   B. ultraviolet light into visible light
   C. infrared light into visible light
   D. X-rays into infrared light

Explain why you chose this answer.

2. The Sun's temperature is about 6000 K while the Earth averages about 300 K. Each square meter of the Sun's surface emits how many times more energy than a square meter of Earth?
   A. 20 B. 400 C. 8000 D. 160,000

Explain how you arrived at this answer.

3. An star has a luminosity 400 times greater than the Sun (i.e., 400 $L_\odot$) and a temperature twice as high as the Sun. Its radius is
   A. 1/5 that of the Sun
   B. 1/2 that of the Sun
   C. twice that of the Sun
   D. 5 times that of the Sun
   E. 25 times that of the Sun

Explain how you arrived at this answer.

4. We see granular cells on the surface of the Sun; their centers are brighter than the edges because
   A. the centers are composed of different gases than the edges
   B. the centers are hotter than the edges
   C. the centers are denser than the edges
   D. the centers are cooler than the edges

What is going on in the Sun that causes these cells to form?

5. An astronomer measures the spectrum of a star and finds a spectral line at 499 nm wavelength. In the laboratory, this spectral line occurs at 500 nm. According to the Doppler effect, the object is moving
   A. away from us at 499/500 the speed of light
   B. away from us at 1/500 the speed of light
   C. toward us at 1/500 the speed of light
   D. toward us at 499/500 the speed of light

Explain why you chose this answer.

6. An astronomer observing the Sun's equator finds that the Balmer Hβ spectral line (λ = 486 nm) is blueshifted by 0.0066 nm when measured at one edge of the Sun's disk compared to when it is measured at the other side of the Sun's disk. If this is a this Doppler shift due to the Sun rotating, then the rotational speed is (try drawing a diagram),

A. 4 km/s B. 2 km/s C. 1 km/s D. 0.5 km/s

The Sun's radius is 700,000km; from your answer, how long does it take to make one rotation?

7. What causes the characteristic red color of gas in a nebula (gas) around a hot star?

A. electrons dropping from level n=2 to n=1 in hydrogen atoms
B. thermal (blackbody) radiation
C. electrons dropping from level n=3 to n=2 in hydrogen atoms
D. scattering of starlight from dust grains in the nebula

Why does this light always have the same red color (what determines its wavelength?)?

8. All the stars in a globular cluster are at least 10 billion years old. So you would expect to find

A. luminous blue stars, with a few red giant stars, white dwarfs, and dim red stars
B. dusty gas, stars along the entire main sequence from bright blue to dim red, but no bright red giant stars
C. mainly white dwarf stars and the planetary nebular stages of dying stars, but no faint red stars, red giants or bright blue stars
D. many red giants, white dwarfs and dim red stars, but no dust and gas

Explain why you chose this answer.

9. If we know the spectral type of a star (O, B, G, etc.) , that tells us its

A. mass B. radius C. luminosity D. temperature E. all of the above

Explain why you chose this answer.

10. Compared to the Sun's lifetime on the main sequence, the time that it will spend burning helium in its core will be

A. much shorter, as the Sun then will have less mass
B. much longer, because the Sun's radius will be larger, so its density and temperature will be lower
C. much longer, because the helium nucleus is nearly 4 times heavier than a hydrogen atom, and $E = mc^2$
D. much shorter, because turning 1 gram of helium into carbon produces much less energy than turning one gram of hydrogen into helium