Chp 2-Review Questions. Decoding the Hidden Messages in Starlight

1. For each of the following wavelengths, state whether it is in the radio, microwave, infrared, visible, ultraviolet, X-ray, or gamma-ray portion of the electromagnetic spectrum and explain your reasoning:
a) 2.6 μm
b) 34 m
c) 0.54 nm
d) 0.0032 nm
e) 0.620 μm
f) 310 nm
g) 0.012 m
2. A cellular phone is actually a radio transmitter and receiver. You receive an incoming call in the form of a wave of frequency 880.65 MHz, what is the wavelength (in meters) of this wave?
3. Using Wien's law and the Stefan-Boltzmann law, explain the color and intensity changes that are observed as the temperature of a hot, glowing object increases.
4. If you double the Kelvin temperature of a hot piece of steel, how much more energy will it radiate per second?
5. The bright star Bellatrix in the constellation Orion has a surface temperature of 21,500 K. What is its wavelength of maximum emission in nanometers? What color is this star?
6. The bright star Antares in the constellation Scorpius (the Scorpion) emits the greatest intensity of light at a wavelength of 853 nm. What is the surface temperature of Antares? What color is this star?
7. Explain how Bohr's model of the atom accounts for spectra.
8. Why do different elements display different patterns of lines in their spectra?
9. What is the Doppler effect? Why is it important to astronomers?
10. If you see a blue star, what does its color tell you about how the star is moving through space? Explain your answer.
11. With the aid of a diagram, describe a refracting telescope.
12. With the aid of a diagram, describe a reflecting telescope.
13. Which dimensions of the telescope determine its light-gathering power?
14. What is the purpose of a telescope eyepiece?
15. Quite often advertisements appear for telescopes that extol their magnifying power. Is this a good criterion for evaluating telescopes? Explain your answer.
16. Explain some of the disadvantages of refracting telescopes compared to reflecting telescopes.
17. What is the angular resolution of a telescope?
18. What is adaptive optics?
19. What is a charge-coupled device (CCD)? Why have CCDs replaced photographic film for recording astronomical images?
20. Why can radio astronomers make observations at any time during the day, whereas optical astronomers are mostly limited to observing at night? (*Hint: Does a radio work any better or worse in the daytime than at night?*)
21. Why must astronomers use satellites and Earth-orbiting observatories to study the heavens at X-ray and gamma-ray wavelengths?

Chp 2-Discussion Questions. Decoding the Hidden Messages in Starlight

1. The human eye is most sensitive over the same wavelength range at which the Sun emits the greatest intensity of light. Suppose creatures were to evolve on a planet orbiting a star somewhat hotter than the Sun. To what wavelengths would their vision most likely be sensitive?
2. Why do you suppose that ultraviolet light can cause skin cancer but ordinary visible light does not?
3. If you were in charge of selecting a site for a new observatory, what factors would you consider important?
4. Discuss the advantages and disadvantages of using a small telescope in Earth's orbit versus a large telescope on a mountaintop.

Chp 2-Collaborative Group Exercises. Decoding the Hidden Messages in Starlight

1. The Doppler effect describes how relative motion impacts wavelength. With a classmate, stand up and demonstrate each of the following: (a) a blueshifted source for a stationary observer; (b) a stationary source and an observer detecting a redshift; and (c) a source and an observer both moving in the same direction, but the observer is detecting a redshift. Create simple sketches to illustrate what you and your classmate did.
2. Stand up and have everyone in your group join hands, making as large a circle as possible. If a telescope mirror were built as big as your circle, what would be its diameter?
3. Are there enough students in your class to stand and join hands and make two large circles that recreate the sizes of the two Keck telescopes? Explain how you determined your answer.