

## OpenStax Astronomy, Ch.17: WS Problems (Apr-2021)

### Review Questions

1. What two factors determine how bright a star appears to be in the sky?
2. Explain why color is a measure of a star's temperature.
3. What is the main reason that the spectra of all stars are not identical? Explain.
4. What elements are stars mostly made of? How do we know this?
5. What did Annie Cannon contribute to the understanding of stellar spectra?
6. Name five characteristics of a star that can be determined by measuring its spectrum. Explain how you would use a spectrum to determine these characteristics.
7. Do stars that look brighter in the sky have larger or smaller magnitudes than fainter stars?
8. The star Antares has an apparent magnitude of 1.0, whereas the star Procyon has an apparent magnitude of 0.4. Which star appears brighter in the sky?
9. Based on their colors, which of the following stars is hottest? Which is coolest? Archenar (blue), Betelgeuse (red), Capella (yellow).
10. Order the seven basic spectral types from hottest to coldest.
11. What is the defining difference between a brown dwarf and a true star?
12. How would two stars of equal luminosity—one blue and the other red—appear in an image taken through a filter that passes mainly blue light? How would their appearance change in an image taken through a filter that transmits mainly red light?
13. Star X has lines of ionized helium in its spectrum, and star Y has bands of titanium oxide. Which is hotter? Why? The spectrum of star Z shows lines of ionized helium and also molecular bands of titanium oxide. What is strange about this spectrum? Can you suggest an explanation?
14. The spectrum of the Sun has hundreds of strong lines of nonionized iron but only a few, very weak lines of helium. A star of spectral type B has very strong lines of helium but very weak iron lines. Do these differences mean that the Sun contains more iron and less helium than the B star? Explain.
15. Suppose hominids one million years ago had left behind maps of the night sky. Would these maps represent accurately the sky that we see today? Why or why not?
16. Why can only a lower limit to the rate of stellar rotation be determined from line broadening rather than the actual rotation rate? (Refer to the Figure 17.14 Using a Spectrum to Determine Stellar Rotation.)
17. Why do you think astronomers have suggested three different spectral types (L, T, and Y) for the brown dwarfs instead of M? Why was one not enough?
18. Two stars have proper motions of one arcsecond per year. Star A is 20 light-years from Earth, and Star B is 10 light-years away from Earth. Which one has the faster velocity in space?
19. Suppose there are three stars in space, each moving at 100 km/s. Star A is moving across (i.e., perpendicular to) our line of sight, Star B is moving directly away from Earth, and Star C is moving away from Earth, but at a 30° angle to the line of sight. From which

star will you observe the greatest Doppler shift? From which star will you observe the smallest Doppler shift?

20. What would you say to a friend who made this statement, "The visible-light spectrum of the Sun shows weak hydrogen lines and strong calcium lines. The Sun must therefore contain more calcium than hydrogen."?

21. Star A and Star B have different apparent brightnesses but identical luminosities. If Star A is 20 light-years away from Earth and Star B is 40 light-years away from Earth, which star appears brighter and by what factor?