OpenStax Astronomy, Ch.5: WS Problems (Apr-2021)

Review Questions

1. What distinguishes one type of electromagnetic radiation from another? What are the main categories (or bands) of the electromagnetic spectrum?

2. Explain how emission lines and absorption lines are formed. In what sorts of cosmic objects would you expect to see each?

3. What kind of motion for a star does not produce a Doppler effect? Explain.

4. Explain why light is referred to as electromagnetic radiation.

5. Explain why astronomers long ago believed that space must be filled with some kind of substance (the “aether”) instead of the vacuum we know it is today.

6. Explain what the ionosphere is and how it interacts with some radio waves.

7. Explain why we have to observe stars and other astronomical objects from above Earth’s atmosphere in order to fully learn about their properties.

8. Explain how we can deduce the temperature of a star by determining its color.

9. Explain why glass prisms disperse light.

10. Explain how we use spectral absorption and emission lines to determine the composition of a gas.

11. Is it possible for two different atoms of carbon to have different numbers of neutrons in their nuclei?

12. Explain why astronomers use the term “blueshifted” for objects moving toward us and “redshifted” for objects moving away from us.

13. If spectral line wavelengths are changing for objects based on the radial velocities of those objects, how can we deduce which type of atom is responsible for a particular absorption or emission line?

14. With what type of electromagnetic radiation would you observe:

    A. A star with a temperature of 5800 K?

    B. A gas heated to a temperature of one million K?

    C. A person on a dark night?

15. Why is it dangerous to be exposed to X-rays but not (or at least much less) dangerous to be exposed to radio waves?

16. Go outside on a clear night, wait 15 minutes for your eyes to adjust to the dark, and look carefully at the brightest stars. Some should look slightly red and others slightly blue. The primary factor that determines the color of a star is its temperature. Which is hotter: a blue star or a red one? Explain.

17. Water faucets are often labeled with a red dot for hot water and a blue dot for cold. Given Wien’s law, does this labeling make sense?

18. Suppose you are standing at the exact center of a park surrounded by a circular road. An ambulance drives completely around this road, with siren blaring. How does the pitch of the siren change as it circles around you?

19. The greenhouse effect can be explained easily if you understand the laws of blackbody radiation. A greenhouse gas blocks the transmission of infrared light. Given that the incoming light to Earth is sunlight with a characteristic temperature of 5800 K (which peaks in the visible part of the spectrum) and the outgoing light from Earth has a characteristic temperature of about 300 K (which peaks in the infrared part of the spectrum), explain how greenhouse gases cause Earth to warm up. As part of your answer, discuss that greenhouse gases block both incoming and outgoing infrared light. Explain why these two effects don't simply cancel each other, leading to no net temperature change.

20. What is the temperature of a star whose maximum light is emitted at a wavelength of 290 nm?