EPS 200 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Answers** Star Lifetimes Questions (and a little bit about planetary orbits)

1. What is the general name that encompasses gamma rays, x-rays, ultraviolet, visible light, infrared, microwaves, and radio waves? **Electromagnetic Radiation**

2. Draw and label two waves, one with a longer wavelength, and one with a shorter wavelength.

 **Longer Wavelength Shorter Wavelength**

3. List the colors of the visible spectrum from longest wavelength to shortest wavelength.

 **Red, orange, yellow, green, blue, indigo, violet (Roy G. Biv)**

4. Rank these star colors from hottest to coolest. Orange, Red, Yellow, Blue, White

 **Hottest -- Blue, White, Yellow, Orange Red -- Coolest**

5. a. Which stars are the hottest, **larger stars** or smaller stars?

 b. Why? **Larger stars have more pressure inside them, because of their large mass.**

6. How do we know what stars are made of, if we can’t actually go to those stars?

 **We look at the wavelengths of radiation given off by the stars. When elements are heated, each element gives off specific wavelengths of radiation.**

7. What is the name of the instrument we use to analyze the matter in stars?

 **Spectroscope**

8. Why are there no green stars?

 **Stars do not just emit one color of light. They emit a range of wavelengths. Green is in the middle of the visible spectrum of light, so a star whose light is centered on green wavelengths will give off every color of the visible spectrum. When *every color* is combined, the result is a white star, not a green star.**

9. a. About **90** percent of all stars are *main sequence* stars.

b. What defines a main sequence star? **Its energy is being produced by hydrogen fusing to become helium.**

10. Main sequence stars exist in a state of dynamic equilibrium. There is a balance between pressure pushing outward from the inside of the star and pressure pushing inward from the outside of the star.

1. What is the source of the pressure pushing outward from the inside of the star?

**Hydrogen fusion creates heat which causes the star to expand outward.**

1. What is the source of the pressure pushing in from the outside of the star?

**The star has a lot of mass, so gravity pulls the star inward.**

11. a. At some point, the sun will leave the main sequence and become a **red giant.**

b. Why will the sun expand at that time?

**As hydrogen fuses to become helium, the denser helium will sink to the center of the sun, forcing the fusing hydrogen outward (causing the sun to expand outward)**

1. Why will the sun turn redder?

**As the fusing hydrogen in the sun is forced outward, the pressure is no longer as strong as it was in the center of the sun. This lower pressure causes nuclear fusion to slow down.**

 12. a. After nuclear fusion ceases in our sun, it will become a **white dwarf.**

b. Why will its color change (again) during this process? **When nuclear fusion stops, the sun will collapse inward. This collapse will increase pressure, causing the sun to heat up and turn from red to white.**

13. According to leading theories, where did all elements heavier than iron originate?

 **Elements heavier than iron were created in the intense pressure of a supernova explosion**

14. a. Which stars have the shortest lifetimes? **The most massive stars** Longest lifetimes? **The least massive stars**

 b. Why? **Massive stars pull together with stronger gravity. This creates stronger pressure, which causes nuclear fusion to happen very rapidly. This causes the star to burn up its nuclear fuel in a short amount of time.**

15. Suppose we are looking at a truly white star.

1. How will that star’s color appear different to us if the star is moving toward us?

**The star’s color will be shifted toward the blue end of the spectrum. Instead of white, it will appear bluer than before.**

1. What if it is moving away from us?

**The star’s color will be shifted toward the red end of the spectrum. Instead of white, it will appear yellow**

1. These color changes are caused by the **Doppler** effect.

**Use the diagram below to answer the following questions. Mark the correct letter as indicated on the chart. The boxes represent stars**

 **High**

A

D

 **Brightness**

E

**(brightness units)**

C

B

 **Low**

 **High Low**

 **Temperature (o C)**

16. Which of the stars are main sequence stars? **A, E, C**

17. Which star is the brightest? **A**

18. Which star would be considered a red giant? **D**

19. What star is the faintest, or dimmest? **B**

20. Which star has the hottest surface temperature? **B**

21. Which letter could represent the present day Sun? **E**

21.5 What is this type of diagram called? **A Hertzsprung-Russel Diagram**

22. Describe three pieces of evidence that support the Big Bang theory.

1. **The universe is filled with *cosmic background radiation*. Soon after the Big Bang, this radiation filled the universe, and it still does today. At first, this was very high energy radiation. As space has expanded since the Big Bang, this radiation has stretched into much longer microwave radiation (the wavelength that is emitted by objects that are only 2.7 degrees above absolute zero).**
2. **Almost all other galaxies are moving away from us, and farther galaxies are moving away faster.**
3. **The Big Bang theory predicted the amounts of various elements that should exist in the universe. These amounts (e.g. 75% hydrogen and 23% helium) have been confirmed.**

22.5 What does Hubble’s Law tell us?

**The farther away galaxies are, the faster they move away from us.**

While we’re at it…

23. What is the relationship between a planet’s distance from the sun and its orbital speed?

 **More distant planets orbit more slowly**

24. What accounts for this difference?

 **More distant planets are pulled toward the sun by a weaker force of gravity. Stronger gravitational pull = faster revolution.**