Multiple Choice Solutions for Mid-Term Exam #2

Cabanela Exam

1. D
2. A
3. E
4. D
5. E
6. D
7. B
8. B
9. B
10. A
11. A
12. C
13. B
14. A
15. A
16. C
17. D
18. B
19. A
20. D
21. D [in review, this question wasn't terribly fair since it required you to remember "spectral type" was related to temperature, and was a topic we had only briefly discussed. I dropped it from tally.]
22. B
23. B
24. C
25. D
26. A
27. C
28. A
29. E
30. C

Craig Exam

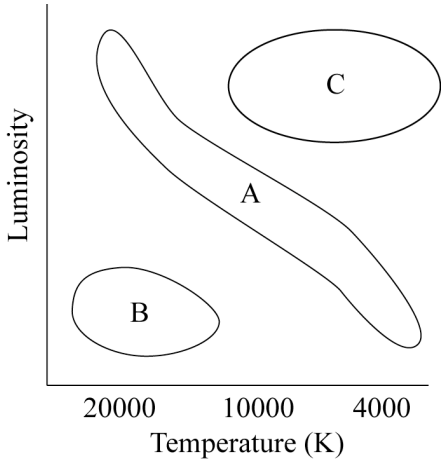
Due to the printing error that eliminated the letters in front of the answers, these exams were hand graded.

1. outward pressure and gravity
2. nuclear fusion
3. hydrogen into helium.
4. the distance between two adjacent peaks of the wave.
5. X-rays, ultraviolet, infrared, radio
6. X-rays, ultraviolet, infrared, radio
7. Visible light travels through space faster than radio waves.
8. Absorption spectrum
9. C
10. how much energy an object emits per second.
11. cooler than
12. The blue star has a hotter surface temperature than the orange star.
13. Star C
14. Nothing can be concluded.
15. Seeing what spectral lines they show
16. Temperature
17. you observe the two stars in a binary star system and apply Kepler's Laws.
18. larger than
19. Star B has larger diameter than star C
20. Star B
21. down by a factor of larger than four
22. II
23. mass of the star
24. smaller and hotter
25. mass they are formed with
26. much longer than
27. the mass of particles going into a nuclear reaction is more than the mass of particles coming out. The missing mass is converted into energy.
28. Both the astronauts and the Space Station fall at the same rate
29. the same as
30. B and D

Two of the questions were ambiguous so everyone received an extra point on the exam.

Short Answer Solutions for Mid-Term Exam #2:

1. To the right is a sketch of a HR Diagram.



   1. Identify the kinds of stars located at locations *A, B,* and *C*. **List your three kinds of stars in order from smallest to largest radius.**

      For 3 points:
      White dwarfs (B),
      Main sequence (A),
      Red giants (C)

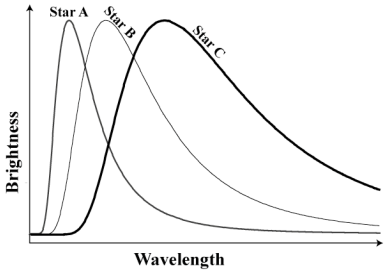
   2. Which stars have the longer lifetimes (where by "lifetime" I mean time during which hydrogen fusion powers the star), the stars located at the upper left hand side of feature "A" or those in the lower right hand side of feature "A"? **Briefly explain why those stars have the longer lifetime.**

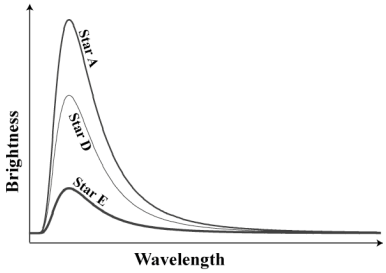
      3 points: Stars in the lower right portion of the main sequence have a longer lifetime.

      2 points: Those stars have longer lifetime because they are less massive (and so burn their hydrogen at a lower rate)

      2 points for clarity

2. The stars A, B, C, D, and E are all part of a star cluster, which means ***they are all about the same distance from us***. We have discussed three properties of stars in class: temperature, luminosity, and diameter.





The questions below ask you to compare some of these properties for the stars in this cluster based on the two diagrams shown above.

1. Star A is hotter/cooler/same temperature as Star C (circle one).
   Star A is hotter/cooler/same temperature as Star E (circle one).
   Briefly explain how you reached these conclusions:

   The temperature of a star depends on the wavelength of its peak brightness/energy output. Hotter stars peak at shorter wavelengths. Therefore A is hotter than C since its peak is at shorter wavelength and A is the same temperature as E because they peak at the same wavelength.

   +1 point for each correct circle,
   +2 points for reasoning.

2. Star A has higher/lower/equal luminosity as Star E (circle one).
   Briefly explain how you reached this conclusion:

   Because star A has higher brightness at all wavelength <u>and A and E are the same distance</u>, we can conclude A is more luminous than E.

   +1 point for correct circle,
   +2 points for reasoning (must mention stars are at same distance for full credit)

3. Star A is larger/smaller/same diameter as Star C (circle one).
   Star A is larger/smaller/same diameter as Star E (circle one).
   Briefly explain how you reached these conclusions:

   Because star A is hotter than star C, yet they are about the same brightness, it must be smaller (since hotter stars put out more energy per area). Because stars A and E are at the same temperature, the put out the same energy per area, but star A is more luminous, so it must be larger.

   +2 points for circles
   +2 points for reasoning.

3. The three stars in the handle of the Big Dipper are called Alkaid, Mizar, and Alioth and have measured parallax angles of 0.022 arcseconds, 0.042 arcseconds, and 0.030 arcseconds respectively. They appear to be roughly same the brightness from Earth.

    1. List the stars from farthest to closest, and explain your reasoning.

       The larger the parallax angle, the smaller the distance to the star, therefore if we list the stars from smallest to largest parallax angle, we are listing them from farthest to closest:

       Alkaid (0.022 arcseconds) --- Farthest
       Alioth (0.030 arcseconds)
       Mizar (0.042 arcseconds) --- Closest

       +2 points for ordering the stars right.
       +2 points for reasoning.

    2. Which star is most luminous, or do they all have the same luminosity? Explain your reasoning.

       Alkaid, the furthest star, is the most luminous. Since they all appear to be about the same brightness, we can note the inverse square law

       $$B = \frac{L}{4\pi d^2} \longrightarrow L = 4\pi d^2 B$$

       lets us know if they all have the same brightness, the most distant stars are the most luminous. You could safely just have argued that for things to appear the same brightness while being at different distances, the farther things must be more luminous.

       +1 point for Alkaid as the most luminous star.
       +2 points for reasoning.

    3. Would your answer to (b) change if you were located on a planet orbiting the star Alkaid? Explain your reasoning.

       Since luminosity is a property of the star and does NOT depend on our distance from it, no, the answer would not change. This is just like saying that the luminosity of a light bulb (listed in Watts) doesn't depend on where we view it from.

       +1 point for saying "no, the answer wouldn't change" or equivalent.
       +2 points for your reasoning.