

Sample exam 2 (The solar system, telescopes and light)

Open book, exercises, notes; no other textbook, no collaboration. You have 50 minutes.

Short answer — answer all questions.

1. (2 points) Give the **full reference** of a new source you will be using for your poster.

3. (2 points) State “similar” or “different” when comparing a **neutron** with a **neutrino**.

a. Electrical charge

b. Mass

4. (2 points) State “**absorption**” or “**emission**” for the best type of **spectrum** to find out the information requested:

a. The identity of a hot gas in a nebula

b. The identity of a cool gas in a star’s “atmosphere”

5. (3 points) In the Hertzsprung–Russell diagram below, label the following areas:

a. Main Sequence

b. Red giants

c. White dwarfs

7. (3 points) Match the equations with the appropriate scenario of use of the equation

$$T = 3 \times 10^6 / \lambda_{\max}$$

Determining how fast a galaxy is receding from us

$$E = \sigma T^4$$

Determining what main wavelength the Earth radiates

$$\frac{v}{c} = \frac{\lambda_{\text{star}} - \lambda_{\text{laboratory}}}{\lambda_{\text{laboratory}}}$$

Determining how much luminosity a nebula has

8. (2 points) Which of the following qualities of a **telescope** depend on the **diameter** of the **objective lens**? Circle *all* correct answers.

a. Magnification

b. Resolution

c. Light-gathering capability

d. Weight

9. (1 point) The planet nearest the **Pleiades** right now is _____ .

10. Your astronomical research on binary stars has ground to a halt! The telescopes you use cannot resolve these distant pairs of stars with the telescope you use currently. Your two faithful assistants, George and Annie, have suggestions:

- Annie says, "I have a friend who will let us use a radiotelescope for cheap. With a 'lens' diameter that big, we're bound to be able to resolve those stars."
- George says, "Let's just get a new eyepiece lens with a shorter focal length; that'll boost the magnification and then we'll be able to resolve those stars."

Do you choose Annie's plan, George's plan or neither plan? Please **explain** your answer.

11. Carl Sagan, the famous astronomer at Cornell University, said that "we are all made of star stuff." (This quote is from a 1973 book of his, titled *The Cosmic Connection*). How *literally* true is that statement? Explain what parts of "us" are made of "star stuff", if any, and what stellar processes (be as specific as you can) made that "stuff" anyway. Hint: for instance, there is iron in your blood.

13. You do the spectroscope experiment, as we did in class, but this time, you start with gaseous helium. You dutifully write down the wavelengths of emission. You notice a power dial on the side of emission lamp and, just for fun, decide to turn up the power. The color of the helium lamp changes and you look through the spectroscope. The emission wavelengths are different! Alarmed, you turn the power back down and the gas emits the original wavelengths. Explain these observations, specifically with regard to the helium gas; in other words, **what happened to the helium?** You may assume that you did not break the gas discharge tube or lamp!