

AS102/PHYS104 Astronomy  
Test #2, April 8, 2020, 12:00pm – 1:50pm

- There is no need to connect via zoom for the test.
  - During the test I will be available via email and Zoom.
  - This test is open book, open notes, open Moodle, open google, open Internet.
  - Do not copy/paste in words from any source: You must write your answers in your own words.
  - There must be no communication between people during test.
  - Show/explain you work on mathematical questions.
  - Each question can be answered in just one or two sentences.
  - You must stop work on the test at 1:50pm.
  - All responses must be submitted to Moodle before 2:00pm. If Moodle fails, email your work to me.
- 
1. (10 pts.) In the distant future, NASA sends a space probe to another solar system, where it discovers eight terrestrial planets and no jovian planets. Propose a hypothesis to explain why this solar system would be so different from ours.
  2. (12 pts.) In the distant future, NASA sends a space probe to another solar system, where it finds two terrestrial planets that are fairly close together. The surface of one planet is covered in craters, while the other planet has only a few craters. Propose four different hypotheses that might explain this difference. (Please number your hypotheses.)
  3. (8 pts.) Astronomers discover a planet orbiting around another star. The star is very much like our Sun, and the planet is almost a twin to Jupiter. The planet has the same mass as Jupiter, is the same distance from its star as Jupiter is from our Sun (5.2 AU), has the same orbital period (12 years), is the same temperature, and has the same density and chemical composition as Jupiter. However, when we take a close-up picture of the planet, we find that its clouds are not lined up in East/West bands like Jupiter. Instead the clouds appear to randomly swirl around. Propose a hypothesis to explain why this planet's clouds would not be organized into East/West bands like we see on Jupiter.
  4. (10 pts.) Today, the planet Mars is 1.5 AU from the Sun, but suppose that instead it had formed at 0.72 AU from the Sun. How would you expect the atmosphere of Mars to be today? Please choose one of the three options, and then write a sentence or two explaining your answer.
    - a. The atmosphere of Mars would be similar to how the atmosphere of Mars is today.
    - b. The atmosphere of Mars would be similar to how the atmosphere of Venus is today.
    - c. The atmosphere of Mars would be very different from either how Mars or Venus are today.
  5. (10 pts.) Suppose we discover a binary star system with two stars, one which is 0.5 solar masses and the other which is 3 solar masses. One of the stars is a main sequence star and the other is a red giant. Which is which? Please choose one of the three options, and then write a sentence or two explaining your answer.
    - a. The 0.5 solar mass star must be the red giant.
    - b. The 3 solar mass star must be red giant.
    - c. This information does not indicate which star is the red giant.

6. (10 pts.) Suppose that a star formed from a nebula that contained no hydrogen, and the star was equal in mass to our Sun. Instead the nebula is mostly helium, with traces of other elements. Once this star is done forming, where would it likely be in comparison to our Sun if we plot it on an H-R diagram?
7. (10 pts.) A space probe is 67.3 AU away from the Earth. How much time does it take for its radio signals to travel across this distance to reach us?
8. (10 pts.) Star A is 7 light years away from us. Star B is 42 light years away from us. However, in our sky, both stars are the same apparent magnitude. Which star has greater luminosity? How many times more luminosity does this star have? (Be sure to explicitly answer both questions.)
9. (10 pts.) There is a moon called Simon which orbits in a circle around a planet called Theodore every 12 days, at a distance of 50,000 km. There is a moon called Dave which orbits in a circle around a planet called Alvin every 12 days, at a distance 75,000 km. Complete the following sentence: \_\_\_\_\_ is \_\_\_\_\_ times more massive than \_\_\_\_\_. Then, explain your mathematical calculations.
10. (10 pts.) A comet has an elliptical orbit around our Sun. At its closest point, it is 0.500 AU from the sun, and at its farthest point is 20.5 AU away from the Sun. How many years does it take this comet to orbit our Sun?