

1. Derive the formula for escape velocity.
2. Estimate the total thermal energy in a homogeneous star of mass M , radius R , density " ρ ," and temperature T (assume a molecular weight of " m " per atom). If this thermal energy is its only energy source, how long could it shine at a luminosity L ?
3. A pulsar of mass M , radius R , rotates once every P_1 seconds. Assume it slows down due to its radio emissions of luminosity L . After " t " seconds, what is its new rotational period P_2 ? Explain whether or not this means angular momentum has been conserved, and why.
4. Given a mass accretion rate \dot{M} per second for a quasar, calculate its luminosity.
5. Using the Hubble Constant, estimate the age of the universe.
6. Assume that dark matter is uniformly distributed throughout space. What would a typical galactic rotation curve look like in such a universe?
7. A star converts a mass M of Hydrogen into Helium every second. How much mass is converted into energy? What is the flux at the surface of the star?
8. A star of mass M shrinks from a radius R_1 to a radius R_2 in an amount of time " t ." What is its average luminosity during this contraction?
9. A red laser pointer of wavelength λ_1 is onboard a spaceship. As the spaceship travels away from Earth at (subrelativistic) speed v , what wavelength do we observe here on Earth? What is the redshift? If we observed a galaxy with this redshift, how far away would it be?
10. How much more luminous is a star whose absolute magnitude is 5 less than another star's?
11. The nearest substantial galaxy is a distance D away. Estimate the mass density of the universe.

Discussion Section Evaluation

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- Course number: 123-200-201
- Date: June 5, 2008
- Write-in questions:

13. How many of the homework and exam solutions did you go back and look at? (There have been four homework solutions posted and solutions for one exam)

14. How useful did you find our extracurricular discussions (“metacognition,” summer research opportunities, etc)? (1 = not useful at all, 9 = very useful)

15. How many discussion sections would you say you have attended?

16. After taking this class, how has your knowledge of astronomy changed (1 = strongly decreased, 9 = strongly increased)

17. After taking this class, how has your interest in astronomy changed (1 = strongly decreased, 9 = strongly increased)

Please be specific in your comments on the back – every suggestion can be useful. I will eventually get these back, and will pay attention to your comments the next time I TA or teach.