NSCI 314 - LIFE IN THE COSMOS

STUDY GUIDE 3

THIS IS A STUDY GUIDE FOR THE FINAL EXAM, WHICH WILL BE ON WEDNESDAY, DECEMBER 10, AT 4 - 6 PM. THE FINAL EXAM WILL BE COMPREHENSIVE, BUT THERE WILL BE MORE EMPHASIS ON THE MATERIAL COVERED AFTER THE SECOND MIDTERM EXAM. APPROXIMATELY 50% OF THE EXAM QUESTIONS WILL COVER THE MATERIAL AFTER THE SECOND MIDTERM EXAM, AND THE OTHER 50% WILL COVER THE EARLIER MATERIAL. YOU SHOULD USE THE STUDY GUIDES FOR THE TWO MIDTERM EXAMS AND THE BASIC SCIENCE QUIZ TO HELP YOU STUDY THE EARLIER MATERIAL. (IF YOU HAVE LOST THEM, THEY ARE AVAILABLE ON THE COURSE WEBSITE (http://physics.csusb.edu/~karen), ON “BLACKBOARD,” OR FROM ME. THIS STUDY GUIDE COVERS ONLY THE MATERIAL FROM AFTER THE SECOND MIDTERM EXAM.

DO NOT MEMORIZE A LOT OF NUMBERS, DEFINITIONS, AND FACTS. YOU SHOULD KNOW SOME OF THE MOST IMPORTANT DEFINITIONS AND FACTS AND HAVE A ROUGH “BALLPARK” IDEA OF SOME IMPORTANT NUMBERS. HOWEVER, IT IS MUCH MORE IMPORTANT TO CONCENTRATE ON UNDERSTANDING CONCEPTS, SO THAT YOU CAN EXPLAIN WHY THINGS ARE THE WAY THEY ARE (OR MIGHT BE). IN PARTICULAR, YOU SHOULD BE ABLE TO UNDERSTAND AND EXPLAIN A SENTENCE OR TWO ABOUT EACH OF THE FOLLOWING TOPICS.

**Drake equation (I will include the equation itself on the exam)**
- meaning of a technological civilization
- know the meaning of each factor in the equation
- what arguments can be made for each factor being larger vs. smaller
- pro and con arguments for inevitability of development of intelligence
- pro and con arguments for inevitability of development of technology
- what is the least well-known factor?
- what can be concluded from the equation?
- approximate relationship between number of civilizations, spacing between civilizations, and feasibility of communication

Note: I am not expecting you to remember the values of the factors in the Drake equation that I used for our “optimistic estimate,” our “pessimistic estimate,” or “my best estimate.”
interstellar communication
  feasibility of communication vs. travel
  meaning of “SETI”
  advantages of radio waves over other types of communication
  deliberate vs. accidental signals:
    what types of each have we sent?
    at what approximate distance could aliens with our level of technology
don't detect our signals?
  how could aliens detect the presence of humans on earth?
  the “water hole”:
    what is it?
    approximately where is it in the spectrum?
    what defines the edges of it?
  targeted search vs. non-targeted search
  how to communicate information:
    the language problem
    what kind of information do we send?
    binary numbers and how to use them to send pictures
  first contact:
    principles
    possible human responses

UFOs
  possible explanations other than alien spacecraft
  reliability of eyewitness accounts
  psychological issues
  government conspiracy
  intervention in human history

the Fermi paradox
  what is it?
  responses that are reasonable (why?)
  responses that are not reasonable (why?)
  timescale for galactic colonization
interstellar space travel
  basic problem
  acceleration - definition and desired value
  relativity:
    special vs. general
    time dilation
    twin paradox
  energy and fuel requirements
    why a spaceship can't travel at or above the speed of light
  interstellar hazards
  antimatter
  possible propulsion methods:
    chemical
    ions
    nuclear
    matter-antimatter annihilation
    warp drive?
    light sails
    Bussard ramjets

limitations on lifetimes of technological civilizations
  impacts:
    Cretaceous-Tertiary boundary and other mass extinctions
    effects of a large impact
    how to protect ourselves against a large impact
  population growth:
    exponential growth and doubling time
    how to delay the problem
    how to solve the problem
  war:
    could we destroy all life on earth via nuclear war?
  pollution
  disease, including “new” diseases
  loss of interest in communication