Review Topics for Final Exam
ASTR 170B1 section (001)

Optional review session: Thursday (December 12) in room N210 from 5:30-7:30 pm

Your Professor and TA are anxious to help you during office hours, study and review sessions, and by appointment.

Exam: Friday (December 13) 10:30 am to 12:30 pm in our classroom (N210)
Format: Closed book & closed notes. No laptops or cell phones allowed.

YOU MAY BRING
A calculator, but most problems will only use round numbers or powers of ten.
A handwritten, double-sided “crib” sheet of notes on letter-sized paper.

YOU MUST BRING
Exams #1 & 2 and all answer sheets. You may not use these during Exam #3.
Your CAT card, a pencil, and a scratching device (penny, toothpick, etc.)

The final exam will consist of two parts: A required section emphasizing new concepts discussed since the second exam and an optional “Resurrection Points” section allowing you to earn back points missed on Exams #1 and 2. The exam questions relate primarily to topics discussed in class and emphasized in homework and in-class interactive questions.

The required section will include 24 new questions in six subject areas as follows: Low Mass Stars, High Mass Stars, The Milky Way Galaxy, Other Galaxies, Large Scale Structure of the Universe, and Cosmology. This section of the Final Exam will use a “scratch” form. A short essay question will also be included.

“Resurrection Points” give you the opportunity to earn back points from both previous exams. Each of the twelve subject areas matches one from a previous exam and has four multiple choice questions. In any section(s) you choose, you must answer all four questions. As in the original exams, a short essay question will be available. Also, you must turn in Exams #1 and 2 (with all answer forms). This section of the Final Exam will use a standard Scantron answer sheet.

--------------------- General Aspects ---------------------

Suggested study methods:
1. Review and practice all our previous homeworks and quizzes. The solutions will be posted online along with follow-up questions to guide your studying.

2. Understand and practice concepts; don’t memorize details. For example, do you really understand what “density” means and how it is measured? Do you really understand the meaning of the term “morphology”?

3. Review all the Daily Skills (numerical & communication)
4. Review and practice scientific notation, powers of ten, fractions, percent, exponents

5. Test your understanding by:
   - trying the “Followup Questions for Study” posed after each quiz question
   - posing variations of the homework problems and quizzes

ARITHMETIC CONCEPTS:
   - scientific notation
   - powers of ten and exponents
   - squares and square-roots
   - “scaling”
   - fractions, ratios, percent
   - metric prefixes: kilo (k), milli (m), nano (n), mega (M), giga (G), tera (T) as well as their powers of ten and associated words

UNDERSTAND THESE TERMS:
   - radius, diameter, circumference, area, volume
   - fusion, fission, electron, proton, neutron, atom, molecule
   - pressure, temperature, energy
   - mass, weight, density
   - kinetic energy
   - angle measurements (degree, arcminute, arcsecond)
   - parsec, light-years, light-minutes, AU

UNDERSTAND THE SIZE SCALES & DISTANCES FOR ALL OBJECTS WE HAVE DISCUSSED

IDENTIFY TYPES OF OBJECTS FROM PICTURES WE HAVE SEEN IN CLASS

-------- Required Subject Areas --------

A/B. Low & High Mass Stars
   - How do stars work (fusion, hydrostatic equilibrium, etc.)? What forces are involved?
   - What is luminosity?
   - What evidence do astronomers have that stars "evolve"?
   - HR diagrams of clusters, white dwarfs, supernovae, pulsars, black holes
   - What happens within a star to make it grow old?
   - How to calculate main sequence lifetime from a star’s mass and luminosity
   - How to calculate the mass of a star, black hole, etc. in a binary system
     - Kepler’s Third Law
   - How to calculate a star’s temperature via Wien’s Law
   - How to calculate a star’s luminosity using its surface area & the Stefan-Boltzmann Law
   - Why do high mass stars die differently from low mass stars?
   - What determines whether a star becomes a white dwarf, neutron star, or black hole?

C. The Milky Way Galaxy
   - What is that band of light we call the Milky Way?
   - Why do different wavelengths give different views?
   - Where are we located in it and how do we know?
   - How do we know how fast are we moving within our Galaxy?
   - How do we measure distances by parallax and “standard candles” such as Cepheid variables?
   - What are the size and shape of our galaxy and how do we know?
- How to calculate the mass of our galaxy using the Sun's orbit and Kepler's Third Law
- Types of objects are within our Galaxy such as:
  - stars; 'open' and 'globular' star clusters; nebulae
  - molecular clouds
  - interstellar dust
  - supermassive black hole – how do we know?
- "Rotation curves" and evidence for "dark matter"

D. Other Galaxies
- Elliptical, spiral, barred, irregular, peculiar
  - Hubble's classification scheme (tuning fork)
- How are these types different and similar?
- What happens when galaxies collide and why?
- Why are the spiral arms blue but the bulge red?

E. Large Scale Structure of the Universe
- The Local Group
- Clusters of galaxies; clusters of clusters; strings; voids
- What happens when galaxies collide? (tidal effects, star bursts, mergers, etc.)
- Gravitational lenses

F. Cosmology
- Be able to describe the Big Bang model and evidence for it:
  - Hubble's Law
  - Cosmic Microwave Background (CMB)
  - Galaxies appear different farther back in space & time
  - Gravitational lensing
  - Quasars, active galaxies (only if covered in class on last day)
- Why does the CMB have a ‘thermal spectrum’? Why is that aspect important?
- What's the significance of the linear slope in Hubble's Law?
- What is the image we call the Hubble Deep Field?
- What is the evidence for ‘dark energy’?
- What is look-back time? How far back in space & time can we see?