Astronomy 101: Third Midterm Exam Guide  
Fall 2007, San Diego State University, 2007.11.20, Professor Leonard

The third midterm exam will be taken in class on Thursday, November 29. The examination will commence at the start of class, and you will have the full class period (1 hour, 15 minutes) to work on it. It will consist of 50 multiple choice questions.

Exam Day

When you arrive to class on the exam day, please do not take a seat until told to do so. Copies of the exam, with individual names on them, will be placed on all desks before you may sit down. Thus, before the room is set up, please wait outside the lecture room. Everything should be ready by the normal class-start time at the top of the hour.

Please bring the following to the exam:

1. A ParSCORE FORM No. F-289-PAR-L scantron form. These may be purchased at the campus bookstore and are pink in color. To save exam time, you may fill out parts of the form ahead of time. This includes:
   (a) **Top of form**: The ‘Name’ (Last, First, Middle), ‘Subject’ (Astro 101), Date (Nov. 29, 2007) and ‘Hour/Day’ (T/Th 11:00 AM or T/Th 2:00 PM, depending on your section).
   (b) **Right hand column of form**: Write and bubble in your RED-ID number in the spaces for ‘I.D. Number’. Leave the ‘Test Form’ and ‘Exam Number’ sections blank. Do not write anything on Side 2 of the form.

2. A number 2 pencil and a good eraser!

3. Your official “Exam cheat-sheet” (to be detached from the end of this packet), with your name at the top, and all the information you want inside the box.

Note that no calculators will be permitted during the exam.

About this Guide

This guide is intended to assist you with your preparation for the exam. It provides suggestions that I hope you will find useful.

→Disclaimer: This guide is not all-inclusive, and in no way should serve as a substitute for your own, self-directed preparation for the exam.

What Should I Study?

Everyone has their own best method for preparing for an exam. Here is my suggestion for a useful way to prepare for this particular test.

1. **Gather together all of the weekly reading assignments, course handouts, and on-line reading quizzes that have been given out/taken since the beginning of the course.** Specifically:
   (a) Weekly reading assignments 10, 11, 12, and 13. This exam will cover the material included on the weekly assignments for Weeks 10, 11, 12, and 13. (Note that there was no “Week 9” assignment, as classes were cancelled that week.)
   (b) On-line reading quizzes: “Week11_quiz”, “Week12_quiz”, and “Week13_quiz”. Full solutions to all three quizzes are all available at the textbook web-site or from the course homepage.

1Solutions to “Week13_quiz” will be available beginning at 12:05 AM, Wednesday November 28, on the textbook website.
If you are missing any of the weekly reading assignments, handouts, or reading quiz solutions, they are available for download from the course website:

http://sciences.sdsu.edu/~leonard/astro101

Once you are at the course web-site, simply click on the links for “Weekly Assignments”, “Class Handouts”, or “On-Line Reading Quiz Solutions”, to download and print out the material that you need.

2. Read the textbook. In my opinion, this is the single most important thing to do. While there may be a few questions on the exam drawn from material presented only in the lecture, the majority of the exam will come directly from the textbook readings. So, (re)read the sections of the textbook (Voyages To the Stars and Galaxies) that have been assigned in class. Specifically, here are the sections that we have covered since the last exam, and for which you are explicitly responsible:

Chapter 8: Section 8.1.1.
Chapter 9: Sections 9.2.1, 9.2.2, and 9.4.4.
Chapter 10: Sections 10.1, 10.2, and 10.3.1.
Chapter 13: Sections 13.4.3, 13.4.4, 13.5.1, and 13.5.3.
Chapter 15: Sections 15.5 and 15.6.
Chapter 16: Section 16.3.
Chapter 17: Sections 17.1, 17.2, and 17.3.1.

While reading the textbook sections, be sure to review the “reading guides” provided in the weekly handouts, as they give some indication of what I felt were the most important ideas contained in the assigned sections. As you go through each reading assignment, be sure to take a look at the on-line “tutorial” material that is available at the textbook web-site (http://ace.brookscole.com/voyages). This includes the active figures and exercises that were assigned.

3. Review the “Selected Powerpoint Slides” contained in the Course Reader. For each lecture, a small number of the Powerpoint slides shown in class are reprinted in your Course Reader. In general, these slides contain a substantial amount of writing (as opposed to pictures), and often provide a quick listing of the major points/ideas/people/terms that are important to have mastered in that particular subject area. While these slides do not encompass “everything” for which you are responsible, they do tend to emphasize the most important items that you want to be sure to understand. Thus, reviewing them is an important part of your exam preparation. (In fact, if you find yourself in the unfortunate circumstance of having little time to prepare for this exam, then simply reviewing these slides may be your best, and quickest, method of preparation.)

For this exam, we covered most of the slides contained on pages 70 (bottom slide) through the slides on page 108. However, as discussed in class, some of the slides were, in fact, skipped. Specifically, we skipped the slides on the following pages: 79 (bottom slide), 80, 92 (bottom slide) - 100 (top slide), 103 (bottom slide), 104, and 105 (top slide). These “skipped” slides were replaced with “summary” slides containing the information that you are responsible for knowing. As a convenience, they are reprinted on page 4 of this handout.

4. Look over the “Key Concepts, Terms, People and Ideas” list, from the course syllabus. Pages 9 – 16 of the syllabus (also reprinted in the Course Reader) provide a list of key items covered during the course. For this exam, the relevant terms are those beginning with the fourth term (“main-sequence star”) on page 14 through the last term on page 15 (“dark matter”), with the following terms skipped: Principle of equivalence, space curvature, gravitational time dilation, gravitational redshift, spacetime diagram, gravitational waves, and period-luminosity (P-L) relation. Being able to define/describe each of these terms is a useful way to be sure you have covered the major points of the chapters.

5. Review/retake the on-line reading quizzes. The reading quizzes were designed in format and content to roughly resemble the types of questions that you will encounter on the in-class exams. Thus, they
provide a useful, but by no means comprehensive, review of the material covered. Full solutions to all of the quizzes are available at the course and textbook web-sites, as indicated above.

6. **Review the Powerpoint slides from the lectures.** All of the Powerpoint slides that were shown in class are available at the course web site, and may serve as a useful reminder of what was covered during each of the lectures.

7. **Take the sample exam questions.** A sample of 5 questions is included in this guide that are indicative of the difficulty and content of the actual exam (in fact, an exam with 55 questions was written, and then 5 questions were randomly picked out of it to form the sample questions in this guide, with the remaining 50 serving as the exam itself). While 5 questions cannot encompass the full scope of the test, they should give you a sense of the types and level of difficulty of the questions that will be asked.

Where Can I go for Help?

Help is available before the exam through:

- **My office hours:** Tuesday and Thursday, 3:30 – 5:00 PM (Rm. 238 physics building). Note: No office hours on Thanksgiving day (Thursday, November 22)!

- **TA help room hours** (Rm. 215, physics-astronomy building):
  
  Monday: 12 – 2 PM; 5 – 6 PM  
  Tuesday: 12 – 2 PM; 5 – 6 PM  
  Wednesday: 12 – 2 PM; 5 – 6 PM  
  Thursday: 12 – 3 PM  
  Friday: 11 AM – 12 PM; 1 – 2 PM  

  → Meeting with any of the teaching associates will be helpful. Note, though, that the two teaching associates who are specifically involved with your section of Astronomy 101 are in the Astronomy Help Room at the following times:  
  
  Azalee Bostroem: Monday 1 – 2 PM and Thursday 1 – 2 PM  
  Emilio Enriquez: Thursday 12 – 1 PM and Friday 11 AM – 12 PM  

  Since Azalee and Emilio are affiliated with your course (and have attended the lectures), they will likely be able to provide more specific guidance than the other teaching associates, so definitely seek them out. But, you are of course encouraged to go to the Help Room whenever it is convenient for you!

- **Last-minute question-and-answer session.** On Wednesday, November 28 (the evening before the midterm), an extra help session will be held in Rm. 216 of the physics-astronomy building (i.e., the regular classroom for the 11 AM class) from 7:00 – 8:30 PM. I will be there to answer any questions that you may have; note that this is NOT a formal “review session”; no additional information about the exam or its contents will be given at this session. Rather, it is provided solely as last-minute help to answer any questions that may have cropped up during your studying.
Summary Slides for Skipped Sections of the Course Reader

**Supernova SN 1987A: What You Need to Know**

- SN 1987A was the closest supernova (only 160,000 LY away) of the last 100 years.
- By carefully studying it, we have confirmed that our basic understanding of the core-collapse supernova phenomenon is correct.

**Measuring Distances in Astronomy**

- **Parallax:** Ground-based telescopes measure distances out to 60 LY. Space-based telescopes (Hipparchos) reach out to 300 LY. Proven to be the most accurate and least controversial technique.
- **Cepheid Variable Star:** A type of supergiant star that is up to 10,000 times more luminous than the Sun. In 1910, Henrietta Leavitt determined that they could be used as standard candles.

(Note: This Focuser slide contains material from multiple-class slides.)

- General theory of relativity: Albert Einstein's theory of gravity (1915).
  - Basic prediction of General Relativity: Light should be affected by gravity.
    - Proven correct in 1919.
  - General Relativity is currently our best theory of gravity.
  - Note: Newton's theory of gravity still works extremely well, except when gravity is very strong.)
CLOSED BOOK, NO CALCULATORS

- Print your name and ID number on the SCAN-TRON FORM No. F-289-PAR-L.
- Mark all answers on SCAN-TRON FORM No. F-289-PAR-L. Use a #2 pencil. Completely fill in the appropriate bubble. Be sure to thoroughly erase all altered answers and stray marks! If the SCAN-TRON machine rejects your form for any (valid) reason, you will lose one point (of the 50 that are possible) from your test score.
- For true-false questions: mark bubble A if the statement is true, and bubble B if false.
- For multiple choice questions: mark the bubble corresponding to the single best answer.
- All questions carry equal weight. Read each question very carefully before answering.
- There is no penalty for guessing. Be sure to answer all questions! (Note that the SCAN-TRON machine will reject a form for which an answer is not recorded for every question.)
- Time limit: 75 minutes – budget your time appropriately! Don’t spend too much time agonizing over a tough question. Make a note of it on your exam (you may write in your exam booklet) and return to it after you have finished the others.
- Do not remove this exam booklet from the classroom. Failure to leave your test booklet on your desk will result in receiving a 0% grade for the exam.
- So: No stray marks, one answer per question, answer all questions, and leave the exam booklet on your desk when finished!

DO NOT OPEN THIS EXAM UNTIL TOLD TO DO SO!!

When you are finished, simply place the following THREE things in a stack on your desk:

- Test booklet (TOP of stack)
- Cheat-Sheet (MIDDLE of stack)
- SCAN-TRON (BOTTOM of stack)

→ DO NOT leave until told to do so. Every 15 minutes (after the initial 30 minutes), those who are finished with the exam will be permitted to leave the exam room.

GOOD LUCK!!!
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Multiple Choice/True-False

Select the best answer for each of the following questions, and indicate your choice by filling in the appropriate bubble on your SCAN-TRON form. Be sure to read all answers before making a selection. For true-false questions, mark bubble A if the statement is true, and bubble B if it is false.

1. Which of the following evolutionary stages is NOT part of the life of a star that will ultimately explode as a Type II supernova?
   (a) Begins life as a main sequence star with an initial mass greater than about 8M_{\text{Sun}}.
   (b) Spends a minimum of 10 billion years fusing hydrogen into helium in its core.
   (c) Evolves to become a supergiant star.
   (d) Rapidly fuses heavier and heavier elements until a core of iron is formed.
   (e) You can’t fool me; all of the above are part of the evolution of a star that ultimately will explode as a Type II supernova.

2. What is the source of the pressure that keeps white dwarf stars from contracting further?
   (a) Nuclear fusion.
   (b) Nuclear fission.
   (c) Compressed hydrogen gas.
   (d) The pressure exerted by the planetary nebula on the white dwarf’s surface.
   (e) Electrons resisting being packed too closely together.

3. T or F. It is possible with present technology to use the parallax technique to directly measure the distances to stars in the Large Magellanic Cloud (distance \approx 50,000 pc).

4. What range of physical size (i.e., diameter) do elliptical galaxies possess?
   (a) All are considerably smaller than the Milky Way.
   (b) They can range from dwarf galaxy size (i.e., much smaller than the Milky Way) to about the size of the Milky Way.
   (c) All are around the same size as the Milky Way.
   (d) All are larger than the Milky Way.
   (e) They can range from dwarf galaxy size (i.e., much smaller than the Milky Way) to several times the diameter of the Milky Way.

5. Stars and other objects that orbit the center of the Milky Way Galaxy farther out than our Sun orbit with a greater velocity than our Sun does. How do astronomers think this observation can be explained?
   (a) All these faster-moving objects must be escaping from the gravity of the Milky Way and will soon be lost from our Galaxy.
   (b) Each of the faster-moving outer objects must be the result of a supernova explosion (giving them extra speed).
   (c) It is the Sun that is moving too slowly because of a collision billions of years ago; the outer objects are really moving at the appropriate speed for their distance from the center.
   (d) There must be a great deal of “dark matter” of unknown composition outside the orbit of the Sun whose gravitational pull explains the faster motions we see out there.
   (e) No one has come up with any explanation for this puzzling observation.

(Answers – 1: B; 2: E; 3: B (False); 4: E; 5: D.)
Official Exam Cheat-Sheet

Below is a box within which you may write anything you would like to have access to while taking the exam. Please observe the following rules:

• Write your name at the top of this sheet, and detach it from the rest of the packet.

• All information must be written inside the box below. Nothing else is allowed to be written on this sheet (except for your name!). Nothing may be written on the back of the sheet.

• All information must be handwritten. It cannot be typed or zerographically reproduced.

• You will turn in this sheet along with your exam booklet and scantron at the conclusion of the test; it will be returned to you along with your graded scantron.

All writing must be contained within the box above!