



THE FINAL IS DECEMBER 15th: 7-10pm!

Review Session

Final Exam



- **Date:** Monday, Dec 15th
- **Place and Time:** In the Greg 100 classroom 7pm until 10pm. The test is designed for 2 hours.
- **Format:** 80 multiple choice problems and 4 bonus questions (extra credit).
- **Bring:**
 - Yourself, well-rested and well-studied.
 - A student ID
 - A #2 pencil
 - On the test you will be given numbers or equations (if any) that you will need. You may **not** use your book or your class notes. However, you may bring **1 piece of regular, 8.5"×11" paper** with notes written on it. You may write whatever notes you like on (both sides of) the paper. It is a very good idea to write your own sheet, as the exercise of deciding what is important, organizing it, and writing it down, is a good way to study.



Final Exam

- **Topics included:** There will be 20 questions on the material from Exam #1, 20 questions on the material from Exam #2, and 40 questions on the new material— Extraterrestrial life to the early Universe. Lecture and reading material are both included. My goal is to test for understanding of the concepts we have discussed, and how they fit together.
- **Study tips.** We have covered a lot of material in a short time, so here are some tips on how to approach your studies for the exam.
 - Topics covered in lectures should be stressed.
 - Homework questions have good examples of questions that may show up on the exam. An excellent way to begin studying is to review the homework problems, particularly those you missed (or got right but were not so sure about). Be sure you understand what the right answer is, and more importantly, **why** it is right.
 - You will need to understand and be able to use any equations that have been introduced in class. Calculations using these equations will be kept simple--it is possible to do the exam without a calculator, but you can bring one if you wish.

Sample Questions



Which of the following statement is true?

- a) Comets tails stream behind them as the comet moves.
- b) Saturn is the only planet with rings.
- c) Planetary orbits are elliptical.
- d) The planets are always arranged on a straight line to the Sun.



Sample Questions

What is an imaginary circle on the celestial sphere that intersects the celestial equator at 2 points, is tilted by 23.5 degrees with respect to the celestial equator, and defines the Zodiac?

- a) The Celestial Median.
- b) The Zenith.
- c) The analemma.
- d) The Ecliptic.



Sample Questions

While flying in a jet, your weight will

- a) Slightly increase.
- b) Slightly decrease.
- c) Stay the same.
- d) Depends if you fly East or West.



Sample Questions

A star in the lower-left part of the HR diagram, compared to a star in the middle of the diagram, is?

- a) larger.
- b) cooler.
- c) smaller.
- d) brighter.

Sample Questions



Which planet is the hottest?

- a) Mercury.
- b) Venus.
- c) Jupiter.
- d) Earth.



Sample Questions

In what category of galaxies do we find the biggest galaxies in the Universe?

- a) Grand design spirals.
- b) Large spiral galaxies, like the Milkyway.
- c) Irregular galaxies.
- d) Ellipticals.

Sample Questions



At what point in the time did the universe cool to a temperature of about 3K?

- a) At the end of the inflationary period.
- b) At the end of the Planck era.
- c) Very recently.
- d) At about 100,000 years after the Big Bang.

Review



- Motions of the sky
 - Diurnal motions and yearly motions.
 - How does the Sun move? Rise in the East, set in the West?
 - What are the equinoxes and solstices?
 - Compare diurnal motion on NP, SP, and equator
 - What is the North Star? Precession? What are circumpolar stars?
- Stars and Constellations
 - What do they do? What are they made from? How do they move?
- Seasons
 - What causes them. What season is it now?
- Phases of the Moon
 - What causes them? Rise and set times. How do they relate to the lunar day? The far side? Rotation? The “Dark Side”?
- Eclipses
 - What causes solar and lunar eclipses? What’s the difference?



- Solar System Overview
 - Geocentric and Heliocentric
- Kepler's 3 Laws
- Newton's 3 Laws and Universal Law of Gravity
 - Is there gravity in space? On the moon?
- The Solar System
 - The Earth and Moon
 - How does the Moon-Earth system interact?
 - The Terrestrial Planets– Mercury, Venus, Earth, Mars
 - Jovian Planets– Jupiter, Saturn, Uranus, Neptune
 - Pluto
 - Asteroids
 - Kuiper Belt
 - Oort Cloud
 - Comets– Which way does the tail point? Compare far from Sun with near to Sun appearance.
 - What are “falling stars”?
 - How do the planets align?

$$F = \frac{GM_1M_2}{r^2}$$



- Comets
 - What is the tail? Which way does it point? Compare far from Sun with near to Sun appearance.
- Solar System Formation
 - Solar Nebula Theory
 - Planet formation
- Extrasolar planets



- The Sun
 - Photosphere: granules
 - Chromosphere: supergranules, spicules
 - Corona: CMEs
- What is hydrostatic equilibrium?
- Limb darkening– Why?
- Sunspots– why?
- What makes the Sun shine?
 - How do we know?
 - How much longer?
- What makes the Sun stay up?



- Light– particle or wave?
- Color of light– speed, energy, wavelength
- Why is the sky blue? Reflection nebula blue? And the setting Sun red?
- Brightness changes with distance? Apparent brightness?
- Blackbody emission– continuous spectrum
 - Wien’s Law
 - Stefan-Boltzmann
- Intrinsic brightness compared to relative brightness
- What does a telescope do?
 - Light gathering, resolution, and magnification
 - Why in space?
- Reflecting vs. refracting telescopes.



- Doppler shift– toward (blue) and away (red)
- Quantum mechanics– electrons can be wave-like
 - Electrons around nucleus have certain orbits– defines emission and absorption of each atom
 - When excited, atoms emit certain lines (like in class)– fingerprint or barcode of atom
- What is parallax?
- HR diagram– why?
 - Where are the main sequence, the white dwarves, giants, supergiants, red dwarves?
 - Where are most stars?
- Spectral class (O, B, A, F, G, K, M)
- Where do massive stars live on the HR diagram? What is the Mass-Luminosity relation?



- Star formation– stars form in clouds, condense from dust.
 - Young stars compared to old stars?
- A star's life on the main sequence.
- How does a star's demise vary?
- How do giants and supergiants differ from MS stars?
- Star < 0.08 solar masses– Brown Dwarf (nothing)
- From 0.4 to 0.08 solar masses– Red Dwarf (long life)
- From 0.4 to 4 solar masses– Low mass star (white dwarf)
 - What is a planetary nebula?
 - What keeps a White Dwarf up?
- From 4 to 8 solar masses– Intermediate mass star (white dwarf)
 - How does their demise differ from that of low mass stars?



- From 8 to 25 solar masses– High mass star (supernova and neutron star)
 - Why does nuclear burning stop at iron?
 - What is a supernova? What's left behind?
 - What is the source of most of Earth's heavy elements?
- > 25 solar masses – black hole
- What will happen to the Sun?
- What is a white dwarf?
- What is a neutron star?
 - What is a Pulsar?
- What is a blackhole?
- What is the deal with special relativity?
 - What is the speed of light measured on a spaceship?
 - Distance contraction and time dilation
- What is general relativity?



- Aliens?
- What is the habitable zone? Define life?
- What is extraterrestrial life?
- What is the Drake equation?
- What is SETI?
- Should we not try to contact aliens?
- Biomolecules in space?
- Extremophiles? Most likely type of ET?
- What is the Milkyway?
 - Components of the Milkyway? What do they mean? Types of stars? Ages? What is a globular cluster?
 - Spiral arms? What are they? From?
 - Where are we? Why was there confusion about where we were?
 - What will happen to the Milkyway?
- Galaxies are distributed how? Why are galaxies important?
- What are galaxy collisions?



- What are quasars? Radio loud galaxies? BL Lac galaxies?
- What is the unification scheme of active galaxies?
- Dark Matter?
 - How do we know? What is it?
- Gamma Ray Bursts
- Hubble's Law.
- Expansion of the Universe.
- Early Universe was? Density? Temperature?
- Cosmic Microwave Background
- The early universe
- Big Bang?
- Big Bang Nucleosynthesis?
- What is the fate of the Universe?