

ASTRONOMY 315 STUDY GUIDE

CLASS GRADE:

Your overall letter grade in the class is determined by the total points accumulated on four out of the following five:

- Three one hour-exams, each worth 25% of your final grade.
- A comprehensive final exam, worth 25% of your final grade.
- Daily homework grade, worth 25% of your final grade.

You will be allowed to drop your lowest performance, either one of the hour-exams, the final exam, or your homework grade. For example, if you are satisfied with your performance on the four hour-exams and your homework, you could choose to not take the final.

EXAMINATIONS:

EXAMS	DATES & TIMES	TOPICS
#1	Fri. Oct. 19 12 noon	Astronomical Units, Planetary Motions, Kepler's Three Laws, and Synodic & Sidereal Periods
#2	Fri. Nov. 9 12 noon	Motions of Earth & Moon, Seasons & Calendar, Astro Coordinates Systems, Rise/Set Times & Locations, and Eclipses & Shadow Lengths
#3	Tue. Dec. 4 12 noon	Structure and Origin of the Planets in the Solar System, Luminosity and Solar Radiations, Blackbody Temperatures, and Escape Velocities
Final	Fri. Dec. 14 8-10 am	Fossils of the Solar System, Asteroids, Comets, and Meteorites

Exam letter-grades are determined by a curve that is fixed by both me and the overall class' performance on that exam.

On a one time basis only, you may make arrangements with me to make up a missed exam.

You may bring one page of notes, both front and back, for each exam. This is cumulative in that you can bring one page of notes for current exam plus the notes from all the previous exams, making three pages all together by the third exam.

Most questions on the exams require pure problem solving, in that they ask for a numerical answer, while others require more conceptual problem solving rather than numerical calculations.

TEXT: No textbook is required. The Class notes will be available via Blackboard under "Lectures" tab.

If you feel you absolutely need a text and are planning on taking Stellar Astronomy 316, you can use the A316 text. It has about 80% of the material we will cover.

Astronomy – A Physical Perspective, L. Kutner, Cambridge 2nd ed.

INSTRUCTOR:

Dr. Richard Vawter, <http://www.ac.wvu.edu/~vawter>
361 Communications Building, 650-3823, vawter@physics.wvu.edu
Office Hours: 9-12 am MTWF.

HOMEWORK:

You will be assigned homework problems (which you can find under Homework on Blackboard) will be graded by me. Your cumulative score through out the quarter represent 25% of your grade, the same as one exam. **Late homework will not normally be accepted;** however you can turn in problems ahead of time.

EXAMINATION TOPICS

TOPICS for EXAM #1

I. Models in Science (Class Notes)

1. Model approach to understanding
 - (A) Models, Data, Observations, and Facts
 - (B) Inductive and Deductive Reasoning
2. Scientific Methodology
 - (A) The Enlightenment Cycle
 - (A) The Game of Physics
3. The Role of Measurement
 - (A) Operational and Derived Quantities
 - (B) Uncertainty and Significant Figures
4. Laws of Nature
 - (A) Laws, Theories, and Hypotheses in Science.

II. History of Cosmological Models

1. Geocentric Models
 - (A) Babylonian
 - (a) Priests were Astronomers
 - (B) Pythagorean
 - (a) Philosophers were Astronomers
 - (C) Aristotelian
 - (a) Two Sphere Universe
 - (D) Ptolemaic
 - (a) Many Sphere Universe
 - (b) Epicycles

2. Heliocentric Models

- (A) Copernican
 - (a) Tycho's Model
 - (b) Galileo Galilei
- (B) Orbital Motion of the Earth
 - (a) Types of Years
 - (1) Sidereal and Synodic Periods
 - (2) Anomalistic Year
 - (b) Retrograde Motion
- (C) Planetary Orbits
 - (a) Ellipses
 - (1) Semimajor axis and focus
 - (2) Perihelion and Aphelion
 - (b) Kepler's Three Laws
 - (c) Conjunctions, Oppositions
 - (d) Maximum Elongations

3. Mechanical Universe

- (A) Galileo
 - (a) Rise of Experimental Science
 - (1) Telescope
 - (2) Tower of Piza
 - (b) Velocity and Acceleration
- (B) Newton
 - (a) Newton's Three Laws of Motion
 - (1) Inertia and Mass
 - (2) Force and Acceleration
 - (b) Newton's Law of Gravity
 - (1) Centripetal Force
 - (2) Center of Mass
 - (3) Inverse Square Law
 - (4) Kepler's Three Laws

TOPICS for EXAM #2

III. Observing the Sky

1. The Celestial Sphere (Chapter 6)
 - (A) Rotation of Earth on Its Axis
 - (a) Celestial Poles and Equator
 - (b) Zenith and Meridian
 - (c) Nightly Motions of Stars
 - (1) Circumpolar Star
 - (d) Time of Day
 - (1) Local Solar Time and Sundials
 - (2) Mean Solar Time, Sidereal, and Clock Time
 - (3) Time Zones
 - (B) Constellations
 - (a) Zodiac
2. Motion of the Earth
 - (A) Revolution of Earth About the Sun
 - (a) Tropical, Sidereal, and Anomalistic Years
 - (b) Gregorian Calendar (Leap Year) and Lunar Calendar
 - (c) Ecliptic Plane
 - (d) Shape of Earth's Orbit
 - (1) Perihelion & Aphelion

- (B) Tilt of Earth's Axis of Rotation
 - (a) Seasons
 - (1) Equinoxes and Solstices
 - (2) Anasazi
 - (b) Arctic Circle and Tropic of Cancer
 - (c) Precession
 - (1) Astrological Sign
 - (2) Glacial Periods
3. Motions of the Moon
 - (A) Phase of Moon
 - (a) Full and New Moon
 - (c) Terminator
 - (B) Lunar orbit
 - (a) Nodes
 - (b) Lunar Months - Sidereal and Synodic
 - (C) Eclipses
 - (a) Lunar and Solar Eclipses
 - (b) Predicting Eclipses
 - (1) Eclipse Seasons
 - (2) Stonehenge

TOPICS for EXAM #3

IV. Solar System

1. Formation of the Solar System
 - (A) Solar Nebula
 - (a) Age of Sun, Planets, Comets, and Asteroids
 - (b) Radioactive Dating
 - (B) Formation of the Solar Disk
 - (a) Direction of the Revolution and Rotation of Planets
 - (b) Shape of Planetary Orbits
 - (C) Formation of the Planets
 - (a) Condensations and Accretion
 - (b) Planetesimals
 - (c) Terrestrial and Jovian Type Planets
 - (d) Titius-Bode Rule

2. The Earth
 - (A) Earth's Internal Structure
 - (a) Crust and Core
 - (b) Age and Composition
 - (c) Continental Drift
 - (d) Earthquakes
 - (B) Origin of Earth's Atmosphere
 - (a) Outgassing of Volcanoes
 - (b) Impact of Comets
 - (c) Biological Activity

3. The Moon and Mercury
 - (A) Surface of Moon and Mercury

- (a) Craters, Maria, Lava Flows, and Highlands
 - (b) Lack of Atmospheres
- (B) Origin of Moon
 - (a) Cratering Record
 - (b) Fission, Capture, and Binary Accretion Models
- (C) Lunar Tides
 - (a) Tide Extremes
 - (b) Tidal Locking
 - (1) Future of Earth-Moon System
- (D) Rotation of Mercury
 - (a) The 3:2 Spin-orbit Coupling
 - (b) Solar and Sidereal Day on Mercury

4. Mars
 - (A) Surface Features
 - (a) Craters, Sinuous Rilles, Polar Caps, Volcanoes, Canyons, and the Giant Rift
 - (B) Atmosphere
 - (a) Temperature and Pressure
 - (b) Chemical Composition
 - (c) Wind Erosion
 - (1) Sand Dunes
 - (C) Life on Mars
 - (a) Presence of Water
 - (1) Ancient Riverbeds
 - (2) Permafrost and Chaotic Terrain
 - (b) Organic Molecules
 - (1) Viking Landing Experiments
 - (D) Martian Climate

- (a) Tilt of Axis
 - (b) Eccentricity of the orbit
5. Venus
- (A) Rotation
 - (a) Retrograde Motion
 - (b) Solar and Sidereal Day on Venus
 - (B) Atmosphere
 - (a) Greenhouse Effect
 - (b) Temperature, Density, and Composition
 - (c) Motion of Atmosphere
6. Jupiter
- (A) Atmospheric Motions
 - (a) Belts and Zones
 - (b) Red Spot
 - (B) Rapid Rotation
 - (a) Flattening of Poles
 - (b) Differential Rotation
 - (C) Interior of Jupiter
 - (a) Chemical Composition
 - (b) Internal Source of Heat
 - (1) Self-gravity
 - (c) Magnetic Field
 - (1) Radiation Belts
7. Saturn
- (A) Atmospheric Motions
 - (a) Rapid Rotation and Polar Flattening
 - (b) Differential Rotation
- (B) Composition and Internal Structure
- (a) Density and Temperature
 - (C) Comparison With Jupiter
8. Uranus, Neptune, and Pluto
- (A) Composition and Structure
 - (B) Anomalous Tilt of Uranus
9. Satellite Systems
- (A) Galilean Moons: Io, Europa, Ganymede, and Callisto
 - (a) Cratering Records
 - (b) Tidal Locking
 - (c) Volcanic Activity on Io
 - (i) Tidal Pumping
 - (ii) Atmosphere
 - (d) Internal Structures and Geological Activity
 - (e) Sizes and Composition
 - (B) Outermost Moons of Jupiter
 - (a) Retrograde Motion
 - (b) Captured Asteroids
 - (C) Satellites of Saturn
 - (a) Icy Moons
 - (b) Tidal Locking
 - (D) Rings
 - (a) Roche's Limit
 - (b) Chemical Composition
 - (c) Formation
 - (d) Gaps and Orbital Resonances
 - (i) Cassini's Division
 - (e) Tilt and Precession
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ADDITIONAL TOPICS for FINAL EXAM

1. Fossils of the Solar Nebula
- (A) The Minor Planets: The Asteroids
 - (a) Titius-Bode Rule and Orbital Resonances
 - (b) Sizes, Shapes, and Compositions
 - (c) Trojan and Apollo Asteroids
 - (B) Comets
 - (a) Nucleus and Tail
 - (b) Dirty Snowball Theory
 - (c) Orbits and Origin of Comets
 - (C) Meteorites
 - (a) Impacts on Earth
 - (1) Meteor Showers
 - (2) Shooting Stars
 - (b) Origin of Meteorites
 - (1) Fractured Asteroids
 - (2) Dead Comets
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