

Introduction To Modern Astronomy I

Final Review

- Final exam: 7:30 PM to 10:15 PM on Dec. 17, 2007
- 100 multiple-choice questions
- 15 chapters from Chap. 1 to Chap. 15
- For each chapter, all sections are covered, except those explicitly excluded
- For each chapter, all boxes are excluded, except those explicitly included

- Chap. 1 --- Astronomy and the Universe
(Eight sections but excluding 1-2, 1-3, 1-4 and 1-8)
 - 1-1. Scientific methods, hypothesis, model, theory and laws of physics
 - 1-5. Angular measure, angular diameter, angular size, angular distance
 - 1-6. Powers-of-ten notation
 - 1-7. Units of astronomical distances, AU, light year, parsec

- Chap. 2 --- Known the Heavens (Eight sections but excluding 2-1, 2-6 and 2-8; also include box 2-2)
 - 2.2. Constellations
 - 2.3. Diurnal motion of stars, Earth rotation, Annual motion of stars, Earth orbital motion, Polaris
 - 2.4. Celestial sphere, celestial equator, celestial poles, zenith
 - 2.5. Seasons, tilt of Earth's axis of rotation, ecliptic plane, two reasons for summer hot (or winter cold), equinoxes (vernal and autumn), solstices (summer and winter), Sun's daily path
 - 2.7. Timekeeping, meridian, noon, apparent solar day, mean sun, mean solar day, time zone, universal time
 - Box 2-2. sidereal time, sidereal day

- Chap. 3 --- Eclipses and the Motion of the Moon (Six sections but excluding 3-6)
 - 3-1. Phases of the Moon; causes of the phases
 - 3-2. Synchronous rotation of Moon; synodic month, sidereal month
 - 3-3. Solar and lunar eclipses; causes and configurations
 - 3-4. Lunar eclipses; umbra, penumbra; totality
 - 3-5. Solar eclipses; eclipse path; totality

- Chap. 4 --- Gravitation and the Waltz of the Planets (Eight sections but excluding 4-3 and 4-5)
 - 4-1. Geocentric models; direct motion, retrograde motion of planets; Ptolemaic systems: deferent, epicycle
 - 4-2. Heliocentric model; explanation of retrograde motion; planetary configuration; Inferior planets, elongation, evening stars, morning stars; superior planets, conjunction, opposition; synodic period, sidereal period of planets
 - 4-4. Kepler's three laws of planetary motion; first law on orbital shape; second law on orbital speed, perihelion, aphelion; third law on orbital period and size
 - 4-6. Newton's three laws of motion; first law on inertial, speed, velocity, acceleration; second law on force ($F=ma$); third law on action and reaction
 - 4-7. Newton's law on universal gravitation
 - 4-8. Tidal force of Moon; high tide, low tide

- Chap. 5 --- The Nature of Light (Nine sections; also including Box 5-1)
 - 5-1. Speed of light
 - 5-2. Electromagnetic waves; different types from radio to gamma ray; wavelength and frequency
 - 5-3. Blackbody and blackbody radiation
 - Box 5-1. three temperature scales
 - 5-4. Wien's law on radiation; Stefan-Boltzmann's law on radiation
 - 5-5. Dual properties of light: particle nature and wave nature
 - 5-6. Kirchhoff's laws on spectra: continuous spectrum, emission line spectrum, and absorption line spectrum
 - 5-7. Structure of atom
 - 5-8. Bohr's model of atom, orbit and energy levels; emission and absorption
 - 5-9. Doppler effect; red shift and blue shift

- Chap. 6 --- Optics and Telescopes (Six sections)
 - Note: this whole chapter is not covered in the final exam

- Chap. 7 --- Comparative Planetology I: Our Solar System (Eight sections but excluding 7-2, 7-5 and 7-8)
 - 7-1. Terrestrial planet; Jovian planets; differences on size, density, mass
 - 7-3. Spectroscope method and chemical composition
 - 7-4. Chemical composition of planets; heavy elements versus light elements on temperatures; ices in the solar system
 - 7-6. Impact craters; meteoroids; geologic activity
 - 7-7. Magnetic field; conducting fluid.

- Chap. 8 --- Comparative Planetology II: the Origin of Our Solar System (Seven sections but excluding 8-7)
 - 8-1. Constrains on solar system models
 - 8-2 Abundance of chemical elements; origins of H and He; origins of heavy elements; interstellar medium
 - 8-3. The age of solar system; radioactive age-dating method
 - 8-4 Solar nebula hypothesis; gravitational energy; protosun; protoplanetary disk
 - 8-5. Formation of terrestrial planets; condensation temperature; planetesimals; protoplanets
 - 8-6. Formation of Jovian planets.

- Chap. 9 --- The Living Earth (Seven sections but excluding 9-6 and 9-7)
 - 9-1. Dynamic Earth; three energy sources: radiation, tidal force, and internal heat; convection; greenhouse effect; greenhouse gas
 - 9-2. Earth's interior structure; crust, mantle and core (outer and inner cores); chemical differentiation; seismic waves; melting point.
 - 9-3. Plate tectonics; Pangaea; subduction; seafloor spreading
 - 9-4. Earth's magnetosphere
 - 9-5. Evolution of Earth's atmosphere; outgassing; effects of organism; photosynthesis; respiration; oxygen

- Chap. 10 --- Our Barren Moon (Five sections but excluding 10-2 and 10-4)
 - 10-1: Synchronous rotation; Dark maria; Light-colored highlands
 - 10-3: No plate tectonics; Causes of Moonquakes
 - 10-5: Formation of the Moon; Collision-ejection theory

- Chap. 11 --- Mercury, Venus and Mars (Nine sections but excluding 11-3, 11-4 and 11-9)
 - 11-1: Morning star; Evening star; Elongation; Opposition
 - 11-2: Rotation of Venus: retrograde rotation
 - 11-5: Venus: plate tectonics, young surface; Mars: crustal dichotomy, old surface, ancient geological activity;
 - 11-6: Venus's thick atmosphere, high temperature, sulfuric acid clouds; strong green house effect; Mars's thin, cold atmosphere; weak green house effect; seasonal changes of polar ice caps.
 - 11-7: Evolution of atmosphere; Outgassing; Runaway greenhouse effect; Runaway icehouse effect; Recycle of greenhouse gases
 - 11-8: Water on Mars; Ancient liquid water; frozen water

- Chap. 12 --- Jupiter and Saturn (Eleven sections but excluding 12-5 and 12-11)
 - 12-1: Opposition. Cloud-top. Dark belts. Light Zones. Great Red Spot
 - 12-2: Fast rotation; Differential rotation; Atmosphere composition
 - 12-3: Storm systems; Circular winds; Great red spot
 - 12-4: Internal energy source; Temperature gradient; Zonal winds; Cloud heights of dark belts and light zones;
 - 12-6: Oblateness, rotation, core; Internal structure
 - 12-7: Strong magnetic field; Liquid metallic hydrogen
 - 12-8: Saturn's system of rings.
 - 12-9: Ring particles; Roche limit
 - 12-10: Ring's composition. Ringlets.

- Chap. 13 --- Jupiter and Saturn's Satellites of Fire and Ice (Ten sections but excluding 13-5, 13-7 and 13-10)
 - 13-1: Jupiter's Galilean satellites. Synchronous rotations; Rhythmic relationship
 - 13-2: Galilean satellites' size and density.
 - 13-3: Origin of the Galilean satellites; Jovian nebula.
 - 13-4: Io: active volcanoes; Internal heat; Tidal heating
 - 13-6: Europe: smooth, icy surface; Geological activity; Underground ocean
 - 13-8: Titan's thick Atmosphere
 - 13-9: Jupiter's small moons; Retrograde orbit; Capture of asteroids

- Chap. 14 --- Uranus, Neptune, Pluto and Kuiper Belt: Remote Worlds (Ten sections but excluding 14-5 and 14-7)
 - 14-1: Chance discovery of Uranus; calculated discovery of Neptune
 - 14-2: Uranus's unusual rotation axis; exaggerated seasonal change
 - 14-3: Neptune's atmosphere; great dark spot; Internal heat; Gravitational contracting.
 - 14-4: Internal structure of Uranus and Neptune.
 - 14-6: Uranus and Neptune's rings; Occultation measurement
 - 14-8: Neptune's satellite; Triton, tidal heating; capture
 - 14-9: Pluto; Charon; Synchronized motions
 - 14-10: Trans-Neptunian objects; Kuiper Belt

- Chap. 15 --- Vagabonds of the Solar System (Eight sections but excluding 15-6)
 - 15-1: Discovery of asteroids; “missing planet”
 - 15-2: Asteroid belt; formation; gravitational effect of Jupiter; Planetesimals failing to form a planet
 - 15-3: Asteroid’s shape and composition. “rubble pile”
 - 15-4: NEO; impact on Earth; dinosaurs extinction
 - 15-5: Meteoroid; meteor; Meteorite.
 - 15-7: Comets: Nucleus, coma, hydrogen envelope, dust tail. ion tail; radiation pressure; solar wind pressure
 - 15-8: Comet origin; Kuiper Belt. Oort cloud; meteoritic swarm; meteor shower