

Introduction To Modern Astronomy I

Final Review

- Final exam: 7:30 PM to 10:15 PM on Dec. 18, 2006
- 100 multiple-choice questions
- 17 chapters from Chap. 1 to Chap. 17
- 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 (8 sections; excluding 1-2, 1-3, 1-4, 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 (8 sections; excluding 2-6, 2-8; covering box 2-1 and box 2-2)
 - 2-1. Ancient civilization, positional astronomy
 - 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
 - Box 2-1: celestial coordinates, right ascension, declination,
 - 2.5. Seasons, tilt of Earth's axis of rotation, ecliptic plane, two reasons of why summer is hotter (or winter is colder), 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 (6 sections; excluding 3-6)
 - 3-1. Phases of the Moon (new, waxing crescent, first quarter, waxing gibbous, full, waning gibbous, third quarter, waning crescent, and new); the cause of the phases
 - 3-2. Synchronous rotation of Moon; synodic month (29.5 days), sidereal month (27.3 days)
 - 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 (8 sections; excluding 4-3)
 - 4-1. Ancient geocentric models; direct motion, retrograde motion of planets; Ptolemaic systems: cycles on cycles; deferent, epicycle
 - 4-2. Heliocentric model of Copernicus; 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 of shape of orbit; second law of orbital speed, perihelion, aphelion; third law of orbital period and size ($P^2=a^3$)
 - 4-5. Galileo's usage of telescope; phases of Venus
 - 4-6. Newton's three laws of motion; first law of inertial; second law of force ($F=ma$); third law of action and reaction
 - 4-7. Newton's law on universal gravitation; orbital motion caused by gravitational force; conic sections
 - 4-8. Tidal force; high tide, low tide; spring tide, neap tide

- Chap. 5 --- The Nature of Light (9 sections, all covered; box 5-1 and box 5-5)
 - 5-1. Speed of light
 - 5-2. Wave property of light; Electromagnetic radiation; different types of electromagnetic radiation; wavelength; frequency; color
 - 5-3. Blackbody; Blackbody radiation
 - Box 5-1. three temperature scales
 - 5-4. Wien's law on wavelength of maximum emission ; Stefan-Boltzmann's law on total energy of blackbody radiation
 - 5-5. Dual properties of light: particle and wave
 - 5-6. Spectral lines; Kirchhoff's laws on spectrum: continuous spectrum, emission line spectrum, and absorption line spectrum
 - 5-7. Structure of atom
 - Box 5-5: periodic table
 - 5-8. Bohr's model of atom; orbit and energy level; emission; absorption
 - 5-9. Doppler effect; red shift and blue shift

- Chap. 6 --- Optics and Telescopes (7 sections; excluding 6-4, 6-6)
 - 6-1. Refraction; Refraction telescope; focal point; light-gathering power; magnifying power
 - 6-2. Reflection telescope; objective mirror;
 - 6-3. Angular resolution; diffraction limit; seeing
 - 6-5. Spectrograph; grating
 - 6-7. Telescope in orbit; Optical window, radio window; advantages in orbit

- Chap. 7 --- Comparative Planetology I: Our Solar System (8 sections, excluding 7-3, 7-8)
 - 7-1. Solar system; Terrestrial planets versus Jovian planets in size, mass, density and composition
 - 7-2. Seven large satellites
 - 7-4. Chemical composition; Light elements, heavy elements; Ices in the solar system
 - 7-5. Asteroids; comets
 - 7-6. Impact craters; meteoroids; geologic activity; internal heat
 - 7-7. Magnetic field of planets; core of conducting fluid; dynamo

- Chap. 8 --- Comparative Planetology II: the Origin of Our Solar System (6 sections, excluding 8-6)
 - 8-1. Requirements of solar system model
 - 8-2. Abundance of Chemical elements; Origins of H and He, and heavy elements; interstellar medium
 - 8-3. Solar system age; radioactive age-dating
 - 8-4. Solar nebula hypothesis; protosun
 - 8-5. Protoplanetary disk; condensation temperature; ice particles; planetesimals; protoplanets

- Chap. 9 --- The Living Earth (all 7 sections)
 - 9-1. Active Earth; Three sources of energy; Greenhouse effect; Greenhouse gas
 - 9-2. Earth's interior structure; crust, mantle, and core (outer and inner cores); seismic waves
 - 9-3. Plate tectonics; Pangaea; Asthenosphere, lithosphere; Seafloor spreading, subduction; Earthquake
 - 9-4. Earth's magnetosphere; solar wind
 - 9-5. Earth's atmosphere; Composition (Nitrogen and Oxygen); Effects of living organism; Photosynthesis and oxygen
 - 9-6. Temperature profiles; troposphere and convection; stratosphere and ozone
 - 9-7. Earth's biosphere; Global warming; Ozone hole

- Chap. 10 --- Our Barren Moon (5 sections, excluding 10-4)
 - 10-1: Surface. Craters, Terrae, Maria
 - 10-2: Manned exploration
 - 10-3: Interior. No plate tectonics
 - 10-5: Formation. Collision-ejection theory. Tidal force

- Chap. 11 --- Mercury (4 sections)
 - 11-1: Difficulty in observing Mercury
 - 11-2: Rotation. 3-2 spin-orbit coupling
 - 11-3: Surface. No plate tectonics. No atmosphere
 - 11-4: Interior. Large core

- Chap. 12 --- Venus (6 sections)
 - 12-1: Morning Star, Evening Star. Elongation.
 - 12-2: Retrograde rotation of Venus
 - 12-3: Thick atmosphere. High temperature. Sulfuric acid clouds
 - 12-4: Hot-spot volcanism. Clouds.
 - 12-5: Climate evolution. Venus versus Earth. Recycle of greenhouse gases. Runaway greenhouse effect.
 - 12-6: Surface (Volcanism) and Interior (no plate-tectonics)

- Chap. 13 --- Mars (8 sections, excluding 13-6, 13-7 and 13-8)
 - 13-1: Best observation of Mars, opposition.
 - 13-2: Illusion of seasonal color changes. Canal illusion.
 - 13-3: Surface. Craters. Volcanoes, Olympus Mons. Dichotomy (southern highlands versus northern lowlands)
 - 13-4: Water on Mars. Polar ice caps. Frozen water
 - 13-5: Climate evolution. Atmosphere. Runaway icehouse effect. Frozen water. Locked carbon dioxide

- Chap. 14 --- Jupiter and Saturn (12 sections, excluding 14-5, 14-8, 14-11, 14-12)
 - 14-1: Orbital motion, opposition. Cloud-top. Dark belts. Light Zones. Great Red Spot
 - 14-2: Differential rotation of Jupiter and Saturn
 - 14-3: Atmosphere. Composition (hydrogen and helium). Saturn's helium deficiency. Great Red Spot.
 - 14-4: Energy of atmospheric motion; Internal energy source. Temperature gradient.
 - 14-6: Oblateness. Core. Internal structure of Jupiter and Saturn
 - 14-7: Magnetic field. Liquid metallic hydrogen
 - 14-9: Saturn's rings. Rings and gaps.
 - 14-10: Ring's composition. Ring particles. Roche Limit.

- Chap. 15 --- Satellites of Jupiter and Saturn (10 sections, excluding 15-5, 15-7, 15-10)
 - 15-1: Jupiter's Galilean satellites, Io, Europe, Ganymede, Callisto. Synchronous rotations
 - 15-2: Relative density and composition of the four Galilean satellites
 - 15-3: Origin of the Galilean satellites. Jovian nebula.
 - 15-4: Io. Volcanoes. Tidal heating
 - 15-6: Europe. World of water ice. Geological activity. Tidal heating
 - 15-8: Titan. Atmosphere and appearance of Titan
 - 15-9: Jupiter's small moons; Capture of asteroids

- Chap. 16 --- Uranus, Neptune, and Pluto (9 sections, excluding 16-5, 16-6, 16-7, 16-8)
 - 16-1: Chance discovery of Uranus; Predicted discovery of Neptune
 - 16-2: Uranus's atmosphere. High concentration of Methane, color. Unusual rotation axis. Exaggerated seasonal change
 - 16-3: Neptune's atmosphere. Dynamic atmosphere. Great Dark Spot. Internal heat. Gravitational contracting.
 - 16-4: Internal structure of Uranus and Neptune (rocky core, liquid water/ammonia, liquid hydrogen/helium, atmosphere)
 - 16-9: Pluto. Charon. Kuiper Belt. (Pluto not a planet any more)

- Chap. 17 --- asteroids and comets (9 sections)
 - 17-1: Discovery of asteroids. “Missing planet”
 - 17-2: Asteroid belt. Formation. Gravitational effect of Jupiter. Planetesimals failing to form a planet
 - 17-3: Asteroid’s shape and composition. “rubble pile”
 - 17-4: Trojan asteroids. Lagrange points. NEO. Iridium layer. Dinosaurs extinction
 - 17-5: Meteoroid, Meteor. Meteorite.
 - 17-6: Meteorite’s trace on solar system formation
 - 17-7: Comet. Nucleus. Coma. Hydrogen envelope. Dust tail. Ion tail. Radiation pressure. Solar wind
 - 17-8: Comet origin. Kuiper Belt. Oort cloud
 - 17-9: Meteoritic swarm. Meteor shower