SUGGESTIONS FOR STUDYING FOR THE FINAL

(includes MOST but not necessarily everything we have talked about)

Review for yourself:

The spectrum: it shows chemical abundances - where did they come from, what is the universe mainly made of?

Write a history of the Universe for yourself: origin and development of the whole universe, of galaxies within it, of stars within them, of planets and moons around them, of organic molecules and life on planets and elsewhere.

A list of useful things to review: Do not just memorize definitions. Ask yourself why these things were introduced.

MATERIAL COVERED IN THE FIRST THREE TESTS:

Forces in Nature

EM Radiation - wavelength, frequency and energy relations; atmosphere ``windows,'' Applications of radiation

Telescopes - optical, radio and space telescopes; principles and advantages of each

Spectra - spectral lines (emission and absorption: how do they occur); absorption spectra, emission spectra, and continuous spectra - how do they happen and in what types of objects? Example: interior of sun emits a continuous spectrum but sun's atmosphere absorbs some wavelengths (we see absorption spectrum).

HR Diagram

Main sequence (m.s.)

Giants, Supergiants, White Dwarfs

The more massive stars on m.s. are more luminous, hotter

Stellar evolution

Collapse of gas cloud

Heating by contraction

Equilibrium between gravitation + pressure

Nuclear "burning" $4H \rightarrow 1\ He$ + energy

$E = mc^2$ (Einstein)

Energy goes up, from interior, radiated away into space

Sun: atmosphere (temp vs. height) photosphere, chromosphere, corona- sunspots (nature and significance); plages; prominences; flares, filaments

Star becomes red giant

$H \rightarrow$ heavier elements

White dwarf

Supernova

Pulsar

Black Holes (Cygnus X-1): Properties and search

Halo: old stars, globular clusters, low abundance of heavy elements [Pop. II]

Stellar Populations: Pop. I (young stars)

Orion Nebula

Crab Nebula

Hot Interstellar Gas: gets hot through heating by very hot stars. Red light emitted.

Interstellar Dust: absorption of starlight - reddening of starlight

Reflection nebula: blue sky is same phenomenon as blue reflection nebula. Red setting sun is same phenomenon as reddening of starlight

Interstellar Molecules

Globular star clusters: 10 billion years old

Galactic or open star clusters: some only million years old

Variable stars: period-luminosity relation, cepheids used for distance determination

Spiral, elliptical, irregular galaxies

Sun-center of the Galaxy: 25,000 1.y.

Galaxy turns in 250 x 10^6 years

Galaxy: diameter 100,000 1.y.

Disk: dust, gas, young stars

Clusters of galaxies, superclusters, dark matter

Quasi-stellar objects (quasars), large redshifts

Radio galaxies

Special Relativity

Cosmology

Velocity-distance relation (Hubble law of redshifts)

Expanding Universe

Cosmological Principle

Big Bang, shape of universe

3° primordial background radiation

LAST PART OF COURSE (NOT COVERED ON FIRST THREE TESTS)

Terrestrial and Jovian planets

Origin of the solar system: Solar nebula theory; accretion of matter

History of Science up to Galileo

Kepler and Kepler's 3 Laws

Galileo's Contributions

Phases of the Moon and seasons on Earth

Origin and history of the Moon: surface features - Mare, Mare basins, impact craters, highlands, etc.

Mercury- Resonance Rotation

Venus - dense, CO_2 atmosphere; runaway greenhouse effect

Mars - lots of volcanoes (Mount Olympus) polar caps of H_2O and CO_2; Mariner Valley; atmosphere mostly CO_2; Viking I and II - search for life on Mars

Jupiter and its moons - largest planet; H and He mostly; great red spot; radiates more heat than it receives

Saturn - low density (would float); braided rings; Voyager results; icy moons

Uranus, Neptune and Pluto

Asteroids

Meteors, meteorites - Tunguska

Comets - "dirty snowballs," the Oort cloud

Intelligent life in the universe - what are the prospects; how (best way is by radio; listen rather than talk); what frequency (H_2O hole)?

How many technical civilizations (What are the assumptions?)