Sullivan
W08
ASTR 150

Review Sheet for Final Exam (19 March)

(Review session is Tue. 18 Mar. 2:30-3:30 pm in room PAA A110)

The best preparation for the final exam is to review: all the homeworks, your lecture notes, and the assigned text readings. The 60-minute final exam will be entirely multiple choice questions; bring a scantron form.

What follows is a listing of major topics to review.

- meteors, meteorites (main types and their origins); their age and how radiometric dating works
- evidence for origin of meteorites in asteroids
- differentiated bodies; densities of liquid water, ice, rock, iron; volatile and refractory materials; how can we have both in the same meteorite?
- asteroids, near Earth objects
- Kuiper Belt objects and the debate over Pluto
- comets: structure (nucleus, coma, tail(s)), composition and origins
- impact craters; crater counts and estimating a surface's age
- the Moon; maria and highlands; origin of Moon (why Earth-impact idea is favored)
- evidence for heavy bombardment in early solar system

- gravity; orbits (Kepler's Laws and Newton's physics)
- tides and their effects on Earth's rotation rate and the Moon's orbit
- electromagnetic radiation; spectral signatures of planet surfaces; "blackbody" radiation

- basic timeline for early Earth-Moon history from 4.6 to 3.5 Ga
- Earth: reasons for plate tectonics, lack of craters, strong magnetic field; aurorae
- Earth: heat of formation, heat from radioactive decay, and heat from solar radiation; cooling rate (dependent on size of planet)
- Earth's atmosphere: gravity "versus" heat energy and escape velocities of atoms/molecules
- Earth's atmosphere: composition, origin, effects of life, greenhouse effect
- how would Earth be different if it had more mass? was smaller? was closer to Sun? had less atmosphere? had no water in its atmosphere?
- Venus (especially in comparison with the Earth): interior, surface features, and atmosphere; runaway greenhouse
- Mars (especially in comparison with the Earth): interior, surface features, and atmosphere; evidence for liquid water on or near the surface now and in the past; why early Mars was warm and able to have liquid water on its surface
- Jupiter (atmosphere and interior) and its four Galilean moons, especially Io and Europa and tidal effects on them; evidence for liquid water below Europa's icy surface
- Saturn (atmosphere and interior) and its rings; moons Titan and Enceladus
- terrestrial planets versus Jovian planets – basic differences

- formation of the solar system and the evidence we have for the various parts of the story
- extrasolar planets (especially in comparison with our solar system); Doppler effect

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- requirements for life (liquid water, carbon and other key elements, available energy); basic properties of all life
- broad history of life on Earth; rise of oxygen in Earth's atmosphere
- extreme conditions harboring life on Earth; best candidate locales for extraterrestrial life
- habitable zone concept; changes with time
- SETI; logic of the Drake equation

- **Overall**: how do the properties of a planet depend on its mass? its size? its distance from the Sun? the amount of atmosphere? the composition of atmosphere? presence of a magnetic field?
- Overall: what determines whether a planet or moon has an atmosphere? a magnetic field? refractory or volatile materials? a geologically young or old surface?

Finally, think about all these topics in terms of these larger course themes:

Course themes

1. What are the basic facts of the solar system?
2. Why is there such a huge variety of places and conditions in the solar system?
3. How did the solar system get to its present state?
4. What is the relationship between planets & life? (the new field of astrobiology)
5. What is the cosmic context for planet Earth (and for *us*)?
6. What techniques do we use to date objects and planetary bodies? How do we determine what something is made of?