

# REVIEW FOR THIRD EXAM

1. Jupiter – know about interior (metallic hydrogen) and atmosphere; know internal heat is from continued gravitational contraction; strong magnetic field; Great Red Spot and other spot features; bands; has a slight ring
2. Saturn – as with Jupiter, and comparisons with Jupiter; know about shepherding satellites; know internal heat is from helium draining
3. Uranus – discovery (Herschel); rings; atmosphere; peculiar magnetic field; extreme rotation tilt; know that it lacks internal heat
4. Neptune – discovery (Adams, Leverrier); rings (arcs); atmosphere; also a peculiar magnetic field; comparisons with Uranus; Neptune does have internal heat
5. Dwarf Planets – know this is a new class of objects; know the criteria for that class; know its current members include Pluto, Eris, Ceres (formerly an asteroid), Haumea, and Makemake; know that Pluto, Eris, and Haumea have moons; know that *Dawn* and *New Horizons* are NASA missions to study Ceres and Pluto, resp.
6. Pluto – know about its discovery (Tombaugh); its primarily an iceball world; has an eccentric orbit, has a highly inclined orbit to the ecliptic, has a significant tilt of its rotation axis; its main moon is Charon, but it has a few newly discovered moons
7. Comparative Planetology –
  - Jupiter and Saturn both have internal heat sources: know how the sources differ and why
  - Uranus and Neptune have magnetic fields that are greatly tilted from their rotation axes: know why this is odd
  - Uranus seems to lack internal heat, but Neptune displays internal heat: know why this is odd
  - for a while, Pluto was thought to be an escaped moon from Neptune: why is that no longer favored?
8. Solar System Moons –
  - Galilean moons: Io, Europa, Ganymede, Callisto - know order and distinguishing properties, such as Io having volcanos, Europa having subsurface oceans, Ganymede being the largest Solar System moon, and Callisto being the most cratered of the four; understand how tidal effects from Jupiter affect these moons; understand how these moons represent a miniature solar system

- Titan - large moon of Saturn, know about its nitrogen rich atmosphere and surface properties, especially from recent new studies with Cassini and Huygens
  - Triton - large moon of Neptune that has a retrograde orbit and shows geyser activity at its surface; know that its orbit is degrading
  - Charon - moon of Pluto, relatively large in that it is not too much smaller than Pluto; know that Pluto and Charon are *both* in synchronous rotation with each other
9. Comets – know about components (nucleus, coma, two tails), highly eccentric orbits, the Oort cloud (and escape speed argument), Halley’s comet; know that most of their time is spent far from the Sun at a distance of about *twice* their semi-major axis
  10. Asteroids – know about the asteroid belt and Kuiper belt; impacts with Earth; asteroids also called minor planets; they are usually not massive enough for gravity to enforce a spherical shape; know about asteroid rotation and light curves, and asteroid compositions; know that some are *rubble piles*
  11. Meteors – know about meteor showers, that most are associated with debris left from cometary orbits; understand how to reason out the best time to view meteor showers; know terminology: meteors vs meteorites vs meteoroids; know about radioactive decay (and how to solve a problem involving the half life)
  12. Extra-solar planets
    - know about the different search techniques: eclipse, Doppler shift, astrometric, photometric, (microlensing)
    - know that the Doppler shift method had yielded most discoveries, but that the transit method (the Kepler mission) has produced more exoplanet candidates
    - know basic characteristics of detected planets: tend to be jovians, some are very odd in being in small short-period orbits (so-called hot Jupiters), some are multi-planet systems; super-Earth planets have been discovered as well (easier around smaller stars)
  13. Life in the Universe
    - Essentials for life – water, carbon-based, radiation and heat; know about the habitable zone
    - Searching for life – know about SETI; searches for life in the solar system; the rationale behind radio searches
    - Fermi question: “Where are they?”, and why this is relevant
    - Galactic colonization – relevant issues, typical time required
    - Drake equation – a useful way to estimate the number of inhabitable planets and intelligent civilizations based on assigned probabilities