

ISP 205
Review Questions, Week 7

This is not required homework. It will not be graded. Answers will be supplied next week.

1. What is the most abundant chemical element in Jupiter (i.e. what is it mostly made of?) Describe the internal structure of Jupiter. *Jupiter is made mostly (75%) of hydrogen. Most of what is not hydrogen is helium. The internal structure is that there is probably a small ice/rock core buried way down in the center, with about 15 times the mass of the Earth. On top of this is a vast layer of hydrogen+helium, that is a conventional gas on the outside but gets denser and denser as you go in, progressing through liquid and then metallic phases.*
2. Why do the Galilean satellites of Jupiter have a progressive range of properties that depend strongly on their distance from Jupiter. *These moons are in elongated (elliptical) orbits that cause them to be continuously stretched then squeezed by tidal forces as they orbit Jupiter. This heats up their interiors, making them geologically active (=volcanoes, lava flows, etc). The effect gets stronger the closer the moon is to Jupiter.*
3. What makes Jupiter's moon Europa so particularly interesting? *It has a very large ocean of water (H₂O), beneath a thin outer crust of ice. This ocean exists as a liquid because of geological heating from a rocky interior (see question 2). The mix of water plus a geothermal energy source is very much like the "black smoker" volcanic vents deep in the Earth's oceans, which host living organisms. So you have to wonder if there might be life in Europa's ocean.*
4. What makes Saturn's moon Titan so particularly interesting? *It has an atmosphere made principally of nitrogen (like Earth's atmosphere), with a surface pressure very similar to the surface air pressure here on Earth. In addition, the atmosphere contains many hydrocarbon compounds. There probably is no life there, because it is too cold, but the similarities to Earth and the presence of lakes, cloud cover, etc (but using methane in place of water) make for a fascinating comparison to climate processes here on Earth..*
5. What is the basic difference in composition between asteroids and comets? How does this connect with where in the Solar System asteroids and comets spend most of their time? *Asteroids are made out of rock; comets are made out of ice. That is because asteroids were formed in the inner part of the solar system, where only rocky solids could condense from the primordial gas cloud, while comets were formed in the outer part of the solar system where it was cool enough that ice particle could also condense. The orbits of asteroids are still confined to the inner solar system, while the orbits of comets usually take them far out in the solar system although some comets do dive into the inner solar system on very elongated orbits.*
6. What is the age of the solar System and how do we know it? *4.5 billion years. It is measured using the radioactive decay age-dating method on meteorites that are pieces of asteroids in which the rock was formed back at the time that the planets were originally starting to be built up.*