

## Online STUDY QUESTIONS #12 – ANSWERS

### ORIGIN OF THE SOLAR SYSTEM

1. The Oort Cloud is a spherical shell of icy material and comets which is about 20,000 AU, surrounding our solar system. It is the left over material from the great cloud of gas from which the sun and planets formed.
2. a few: planets all revolve around the sun in the same direction; all planets (with the exception of Venus which rotates upside down) rotate on their axes in the same direction; rocky planets are found in the inner solar system whereas the gas giants are found in the outer solar system; all the planets orbit the sun in the same plane; there is left over debris from the era of planet formation
3. gravity
4. Stars use fusion which results in taking light elements and making heavier ones, planets do not have fusion.
5. Fusion is the coming together of nuclei of atoms of lighter elements to form new, heavier elements.
6. Fusion releases enough energy pushing outward that the inward collapse due to gravity is halted. A star performs a careful balancing act between gravity pulling in and pressure (fueled by fusion) pushing out.
7. H and He (hydrogen and helium)
8. H and He are very light elements, and at the temperature of Earth, they have a velocity that is faster than the escape velocity of Earth, so Earth can't hold onto them. Jupiter's escape velocity (61 km/s) is greater than the average velocity of its H and He and so Jupiter has no trouble hanging onto H and He. Jupiter's escape velocity is so large because of its mass and radius.
9. The escape velocity of the moon is only 2.3 km/s, way below the average velocity that gases would have on its surface.
10. The inner solar system was too warm for ices to form, so the inner planets formed from dust particles: iron, carbon, silicates, which is a slow process (basically, dirt isn't efficient at sticking together when it collides). The outer solar system was cold enough for ices to form, and ices are very sticky so they accrete efficiently and quickly. The outer planets formed fast and accreted so much material, they were able to grow large enough so that the mean speed of H and He was less than the escape velocities of these giant planets.
11. The average velocity of gas atoms depends on the mass of the individual atoms and the ambient temperature.
12. Jupiter's strong gravity herded the much of the material that did not become planets and rubble from planets that got destroyed in collisions into an area around the Sun called the asteroid belt. This might have helped life evolve on Earth by protecting it from frequent collisions with large, life killing asteroids.