

Building Blocks of the Solar System

Gasses

- gasses at any distance from the Sun
- densities $\sim 1/10,000$ at 1 atmosphere of pressure

Hydrogen (H)

Helium (He)

Volatiles (Ices)

- solids in outer solar system, liquids or gasses inside the asteroid belt
- densities near 1

Water (H₂O)

Carbon Dioxide (CO₂), (dry ice)

Methane (CH₄), (natural gas)

Ammonia (NH₃)

Minerals

Feldspar (K, Na, Ca Al silicates) - the white or pink mineral in granite
- density 2.6 - 2.7

Pyroxene (Ca, Mg, Fe silicates) - the dark mineral in granite
- density 3.2 - 4.0

Olivine (Mg, Fe silicates) - olive-green color (gem form called peridot)
- density 3.2 - 4.4

Metal

Iron/Nickel alloy - density 7.9 - 8.5

Differentiation - The separation of planetary materials into layers based on density and compatibility. For typical sub-stellar objects, differentiation begins when the object reaches 800 to 1,000 miles in diameter.

Cooling rate and crystal size

Cooling a melt slowly gives large crystals (like rock candy.) Cooling a melt quickly gives small crystals (like fudge or divinity.) Cooling a melt extremely quickly gives no crystals (like a lollipop.) Cooling molten rock deep underground (magma) leaves rocks with large crystals like granite. Cooling molten rock at the surface (lava) leaves rocks with small crystals like basalt. Cooling molten rock in midair (or mid-vacuum) gives volcanic glass (obsidian.)