

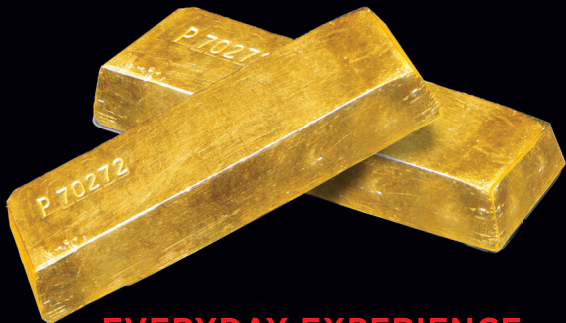
ASTROLYMPICS

DENSITY

DEFINITION: how much mass is in a certain volume

The density of an object or a substance is the amount of mass it contains in a volume. To put it another way, density is derived from the mass of the atoms and molecules that make up a material and how tightly packed these are in a certain space. Density can be determined for various states of matter, including solids, liquids, and gases. One common way to use density is to compare two objects. A piece of driftwood floats on top of water because it has a lower density than the sea below; on the other hand, an iron anchor has a higher density than the salt water so it sinks to the bottom.

Units: kilograms per cubic meter (kg/m^3); grams per cubic centimeter (g/cm^3)



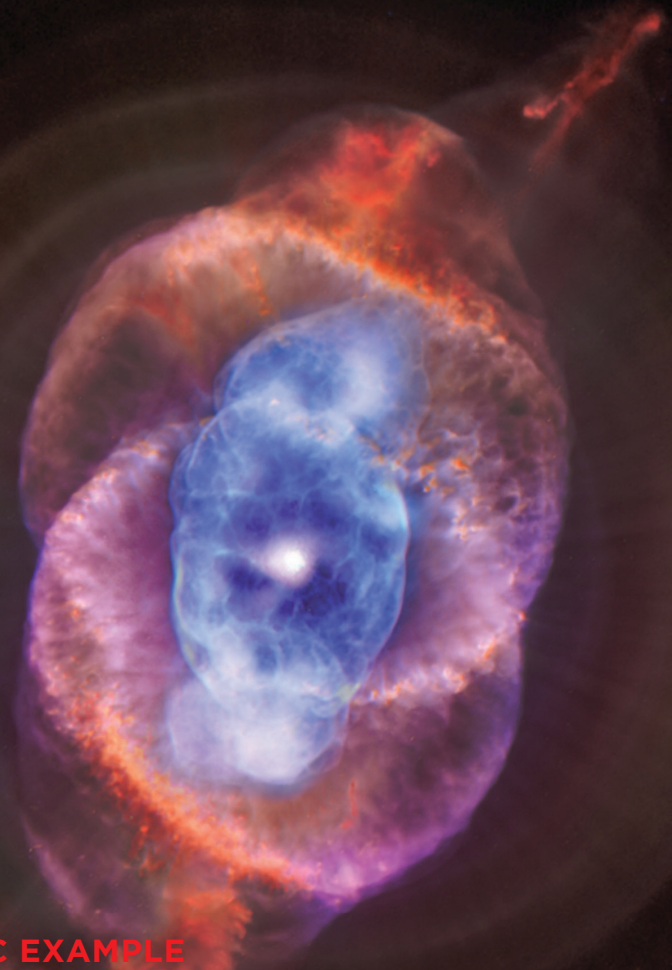
EVERYDAY EXPERIENCE

Gold: Gold is denser than lead, but less dense than platinum. $19,320 \text{ kg/m}^3$

COSMIC EXAMPLE

Neutron star: These stellar cores, which often emit X-rays that Chandra can detect, are some of the densest objects in the Universe. $1 \times 10^{18} \text{ kg/m}^3$ ($1,000,000,000,000,000,000 \text{ kg/m}^3$)

The Cat's Eye Nebula, from NASA's Chandra and Hubble telescopes, shows a phase that Sun-like stars undergo at the end of their lives. Material from the star's outer layers puffs off, and a hot core is left behind that eventually collapses to become a white dwarf star.



PARALYMPIC EXAMPLE

Sailing: Boats are largely hollow and float because their total volume has a much lower density than water.

Air: 1.2 kg/m^3 ; **Water:** 1.025 kg/m^3