37.18. **Model:** For a neutral atom, the number of electrons is the same as the number of protons, which is the atomic number Z. An atom's mass number is $A = Z + N$, where N is the number of neutrons.

Solve: **(a)** For a ^{197}Au atom, $Z = 79$. So, $N = 197 - 79 = 118$. A neutral ^{197}Au atom contains 79 protons, 79 electrons, and 118 neutrons.

(b) Assuming that the neutron rest mass is the same as the proton rest mass, the density of the gold nucleus is

$$\rho_{\text{nucleus}} = \frac{197 m_{\text{proton}}}{\frac{4\pi}{3}\left(7.0 \times 10^{-15} \text{ m}\right)^3} = \frac{197\left(1.67 \times 10^{-27} \text{ kg}\right)}{\frac{4\pi}{3}\left(7.0 \times 10^{-15} \text{ m}\right)^3} = 2.29 \times 10^{17} \text{ kg / m}^3$$

(c) The nuclear density in part (b) is 2.0×10^{13} times the density of lead.

Assess: The mass of the matter is primarily in the nuclei and the volume of the matter is essentially due to the electrons around the nuclei.