must be packed more closely. (x-ray analysis of both shows that to be the case) — p12

The heavy nucleus contains more than 99.9% of the total mass of the atom. The rest is due to electrons which travel around the nucleus. The nucleus contains "heavy" particles known as nucleons, which may be electrically neutral or have a positive charge. A neutral nucleon is called a neutron, and a positively charged nucleon is called a proton. These heavy particles are considered to be merely different states of the same particle. They have almost the same mass, and it is entirely possible for a proton to change into a neutron and vice versa. The probability of such change depends on many factors, but when it takes place spontaneously, it is said that the nucleus is radioactive or unstable.

Each electron has a negative charge numerically equal to that of the proton. A neutral atom has the same number of electrons in the electron cloud as it has protons in the nucleus. This number is called the atomic number. Chemical properties are determined by the number of the atoms in the atomic cloud.

$^{56}_{26}Fe$ +IRON Isotope
56 nucleons; 26 protons
mass number; atomic number
— p19

Normally, an iron nucleus draws to itself a cloud of 26 electrons, equal to the positive charge of 26 protons within the nucleus. If somehow, only 25 electrons surround a Fe nucleus, we have a net positive charge of 1 unit, and the atom is called an ion, written as Fe^+. A doubly charged iron ion, written as Fe^{++}, would have only 24 electrons in its cloud, and so on. It is also possible to have negative ions; thus a $_{17}Cl^-$ ion has 18 electrons on its cloud.

— p20

Experiment shows that the size of the nuclei increases as the number of particle increases. In fact, the volume of ^{238}U is just about $\frac{238}{56}$ times as much as the volume of the ^{56}Fe nucleus. This means we have come upon a property of matter which is remarkably uniform from element to element: all nuclei have about the same density. The variation of density in several solids are to be attributed to several causes:

1: the size of atoms differ because the size of electron clouds;
2: the atomic number (weight) of elements vary from 1 to over 200
3: atoms are packed together in different ways to form crystals, that are held apart by electric forces, due to repulsion

→ Precision limitation to (measurement).

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