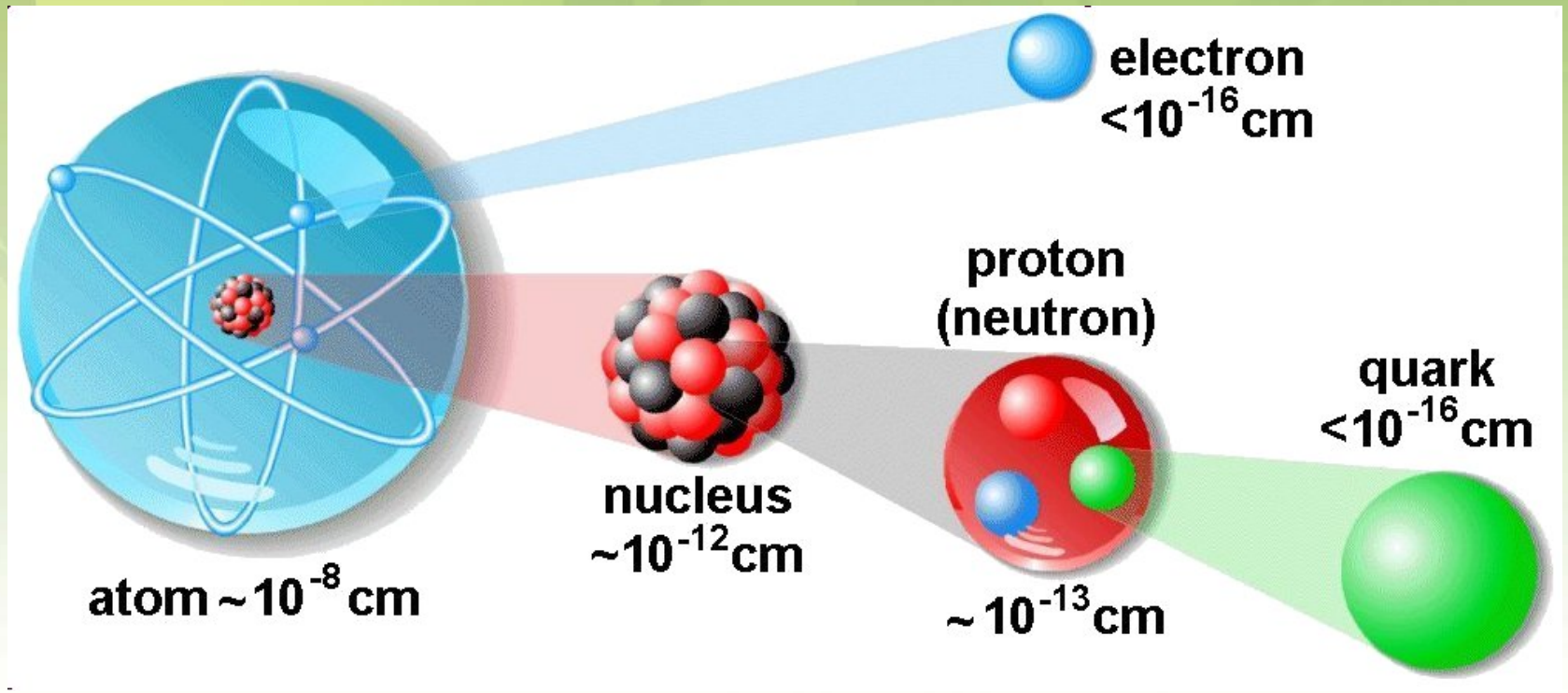
ATOMIC STRUCTURE

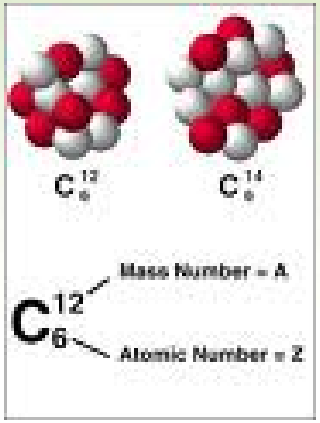


ATOMS AND ELEMENTS

- A positive nucleus attracts electrons.
  - In a neutral atom the number of electrons and number of protons are the same
  - Number of protons determines the element
  - Number of protons is called the atomic number
  - Protons and Neutrons determine the mass of the atom
  - The atomic number is the number of protons and neutrons
  - Elements have different isotopes

ISOTOPES

- Different isotopes of elements have different number of neutrons.
  - They have the same number of protons or atomic number so they are chemically similar
  - They have different mass numbers
    - Mass number is the number of protons and neutrons
  - Their nuclear behavior is very different

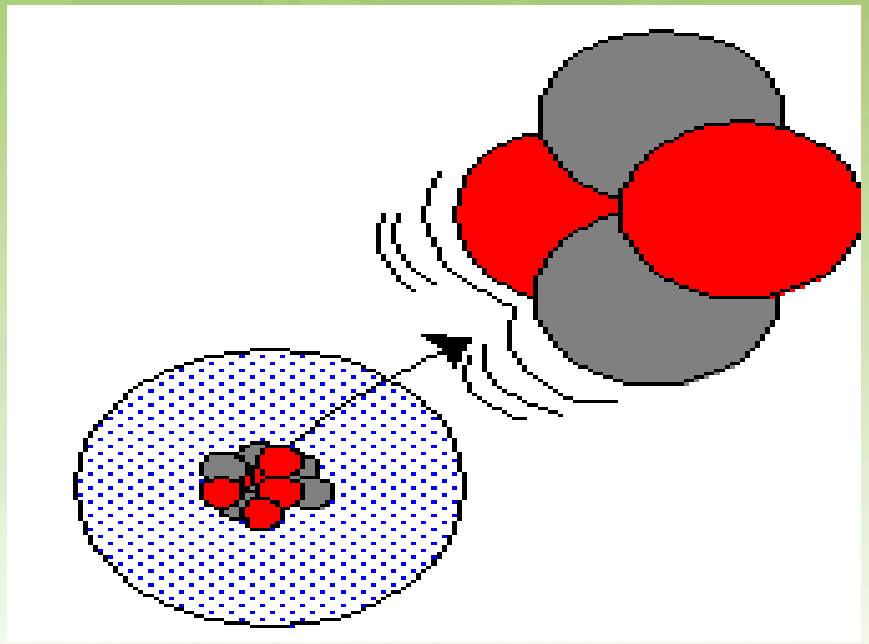


Building Nuclei –Two Forces

- The electric force acts repulsively between protons.
  - Tends to tear the nucleus apart
  - The electric force is weak but extends over long distances
- The nuclear force acts attractively between the nucleons (protons and neutrons).
  - Protons to Protons, Protons to Neutrons, and Neutrons to Neutrons
  - The nuclear force is strong but acts over short distances
- Larger nuclei need more neutrons than protons.
  - All nuclei with atomic numbers greater than 83 are unstable

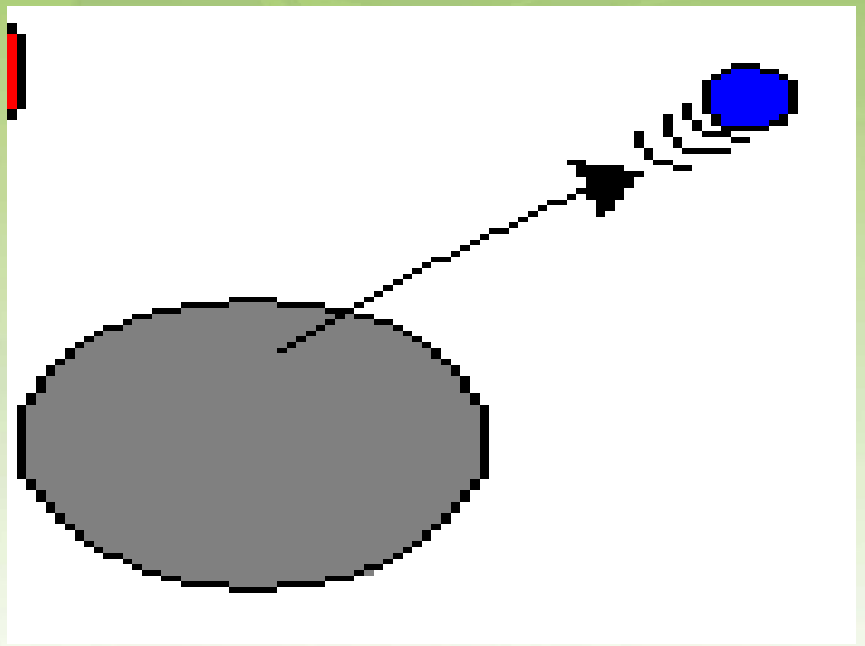
ALPHA PARTICLES

- Positive particle released from nucleus
- Consist of 2 protons and 2 neutrons
- Piece of paper protects you from alpha particles
- No external damage
- Can cause serous internal damage



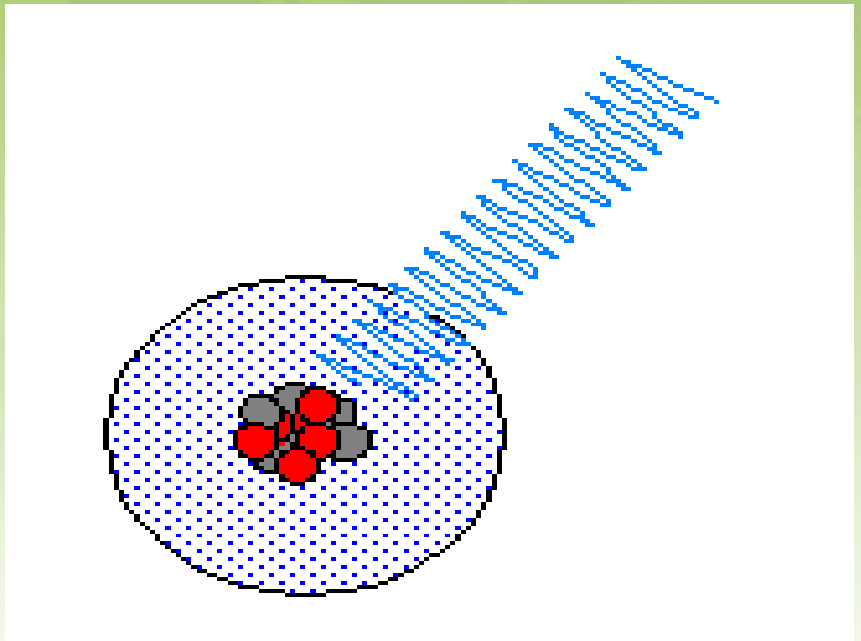
BETA PARTICLES

- Particle released from nucleus
- Neutron splits into a proton and an high energy electron
- Mass of atom does not change
- Has a negative charge
- Thin sheet of metal can protect



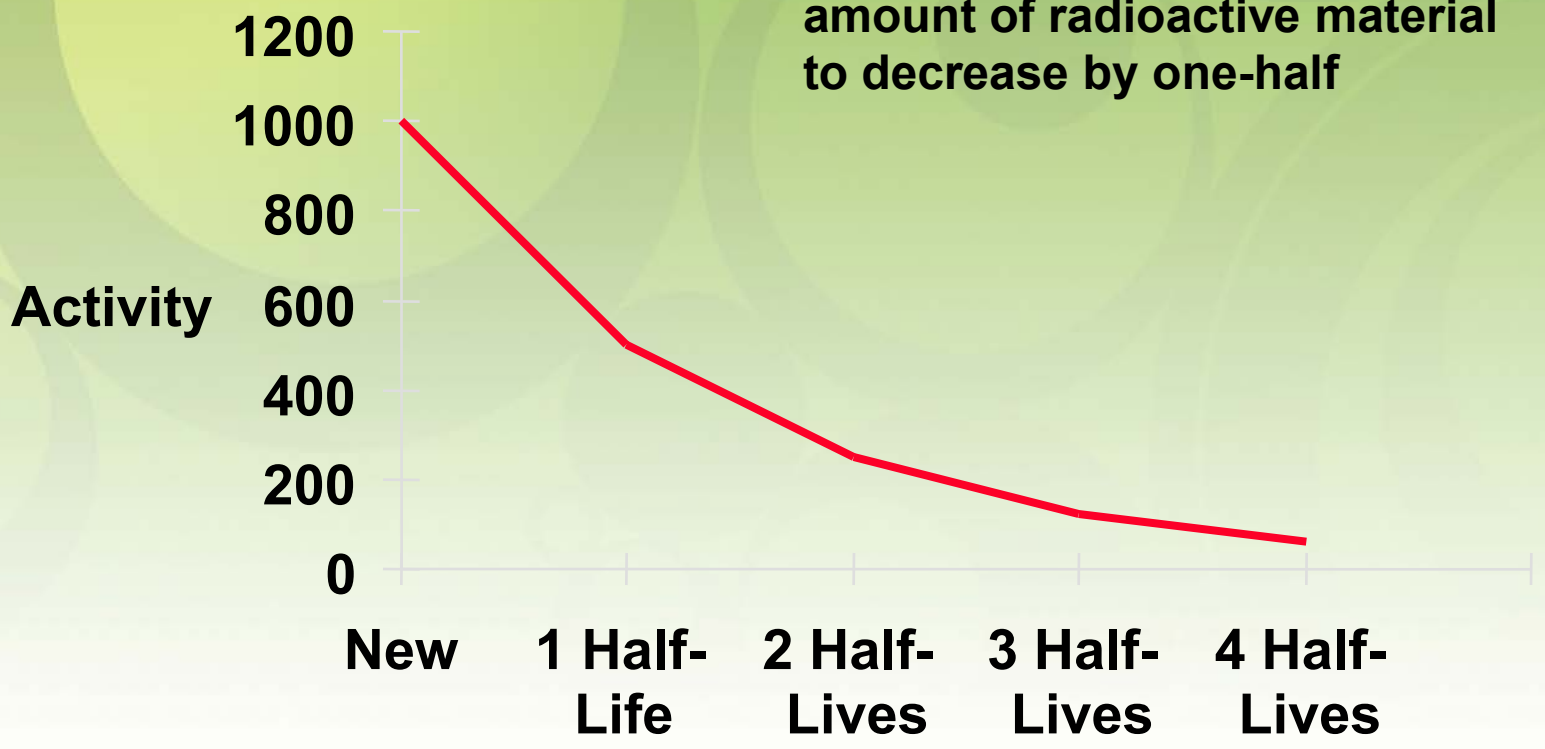
GAMMA RAYS

- Excess energy release from unstable radioactive nuclei
- Has no mass or charge
- Easily pass through the human body
- Several inches of lead will stop gamma rays



Half-Life

The time required for the amount of radioactive material to decrease by one-half



Dangerous Fission Fragments from U-235

- Iodine 131 – short half life (8 ½ days) can accumulate in the thyroid
- Cesium 137 – half life about 30 years – will replace potassium in living organisms
- Strontium- 90 half life about 30 years – will replace calcium in the bones of organisms.

Decay of Uranium 235 and 238

- U-235 → α + Th -231 → β + Pa-231 → α + Ac-227 → α + Fr-223 → β + Ra-223 → α + Rn-219 → α + Po-215 → α + Pb-211 → β + Bi-211 → α+ Tl-207 → β + Pb207
- U-238 → α + Th-234 → β + Pa-234 → β + U-234 →α + Th230 → α+ Ra-226 → α + Rn-222 → α + Po-218 → α + Pb-214 → β + Bi-214 → β + Po-214 → α + Pb-210 → β + Bi-210 → β + Po-210 → α + Pb-206