carbon-12 (6 protons and 6 neutrons)
carbon-13 (6 protons and 7 neutrons)
carbon-14 (6 protons and 8 neutrons)

- Carbon-12 accounts for 99% of the carbon atoms in nature. Carbon-13 makes up most of the rest while carbon-14 is found only in trace amounts.
- atomic mass = 12.01

Radioisotopes - Radioactive atoms of an element that spontaneously decay into smaller elements, subatomic particles, and energy.
- e.g. carbon-14 spontaneously decays into nitrogen-14.
- This decay occurs at a fixed rate, the time it takes for half of the atoms in a sample to decay is known as the half-life of the radioisotope.
- Uses of radioisotopes:
  - Dating - Radioisotopes are incorporated into living tissue in the same proportion as they are found in the environment up until the organism dies.
    - From this point on radioactive decay will reduce the proportion of the radioisotope. When it is half gone the time since death will be equal to the half-life of the radioisotope.
    - Approximately 5700 years for carbon-14. If only 1/4 of the C-14 is remaining 2 half-lives will have elapsed. Radiometric dating can use other radioisotopes with half-lives much longer than C-14's for very old stuff.
  - As Radioactive Tracers - As radioisotopes decay they can easily be detected by the E they give off. Molecules can be tagged with radioisotopes to determine what happens to them in chemical reactions; to uncover "biochemical pathways".
    - Melvin Calvin uncovered the complex steps of photosynthesis by tracing the flow of C-14 atoms through a variety of compounds.
  - Nuclear Medicine - imaging - e.g. The thyroid gland actively absorbs iodine, therefore, radioactive iodine-131 is administered and a device is used which forms an image of the gland. This image can be used to detect disorders. Goiter p. 385
    - treatment - The radiation given off can be used to treat some illnesses including some cancers