

## CHEM 101 Day 2

Copper metal has 2 naturally occurring isotopes: copper-63 (69.17%, mass = 62.94 amu) and copper-65 (30.83%, mass = 64.93 amu). Calculate the atomic weight of copper.

$$((64.93 \times 0.3083) + (62.94 \times 0.6917)) / 2 = 63.55 \text{ amu}$$

### Nuclear Reactions

Involve a change of the atoms nucleus, the result of **radioactive decay** (spontaneous emission of a small sub-nuclear particle or radioactive energy from the nucleus).

#### Alpha radiation (Gold-Foil experiment)

Consist of 2 protons and 2 neutrons (relatively heavy, helium nucleus).  ${}^4_2\text{He}$ .

Uranium-238 spontaneously emits alpha radiation.  ${}^{238}_{92}\text{U} \rightarrow {}^4_2\text{He} + {}^{234}_{90}\text{Th}$ . Parent nucleus  $\rightarrow$  alpha particle + daughter nucleus.

#### Beta radiation

Stream of fast moving electrons ( ${}^0_{-1}\text{e}$ ) (think of 1 neutron changing into 1 proton and 1 electron and the electron is ejected).

Iodine-131 releases beta radiation.  ${}^{131}_{53}\text{I} \rightarrow {}^0_{-1}\text{e} + {}^{131}_{54}\text{Xe}$ .

#### Gamma Radiation

High energy electromagnetic radiation (no mass).

What type of radiation is given off?  ${}^{234}_{90}\text{Th} \rightarrow {}^{234}_{91}\text{Pa} + \underline{\hspace{1cm}}$ .

Beta radiation is given off ( ${}^0_{-1}\text{e}$ ).

${}^{209}_{83}\text{Bi} \rightarrow {}^{205}_{81}\text{Tl} + \underline{\hspace{1cm}}$ .

Alpha radiation is given off ( ${}^4_2\text{He}$ ).

Cesium-137 (Cs-137) is a beta emitter. Write the complete nuclear equation.



Radium-228 (Ra-228) is produced by alpha emission from a parent nucleus. Write the complete nuclear equation.



Alpha particles are the most damaging but least penetrating (heavy, can't penetrate skin). Beta radiation is more penetrating (can penetrate skin and paper but can't reach organs). Gamma radiation is the highest energy and the most penetrating (more so than x-rays, can pass straight through you).