

7.3 Nuclear Reactions

Science 10 Notes

Nuclear Reactions vs Chemical Reactions

Chemical reactions:

- Mass is conserved, and energy changes are small
- There are no nuclear changes in chemical reactions
- Electrons can be lost gained or shared

Nuclear reactions (<https://goo.gl/bGyBav>):

- The nucleus of the atom is changed
- Protons, neutrons, electrons and /or gamma rays can be lost or gained
- There are small changes in mass
- The mass is converted to huge amounts of energy.

$$E = mc^2$$

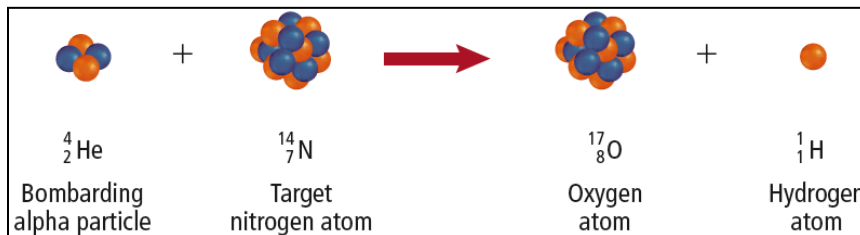
energy mass speed of light (300 000 000 m/s)

1g of Uranium-235 produces the same energy as burning 2000 kg of coal.

- All nuclear power plants use a process called fission.

Nuclear Fission

- Occurs when a heavy nucleus splits into two smaller nuclei. A little bit of mass is lost and large amounts of energy are produced.
- Nuclear fission is an induced nuclear reaction. This means that scientists start the nuclear reaction by shooting unstable nuclei with alpha, beta, gamma radiation, or other subatomic particles

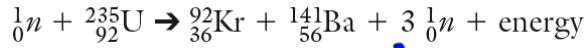


the $\alpha + \text{N}$ form ${}^{18}_9\text{F}$ which immediately decays

+ energy.

Nuclear Fission of U-235

- It is easiest to shoot a neutron into a nucleus than a proton.
- Most nuclear fission reactors and bombs use this to start a nuclear reaction.
- A neutron crashes into an atom of uranium 235 to create uranium-236 which undergoes radioactive decay



three neutrons can start more reactions.

- The extra neutrons can crash into other, nearby nuclei and cause those to decay and release energy as well.
- Once this nuclear reaction has started, it can get quickly out of control.
- Reactors have special materials to absorb neutrons
- Nuclear bombs operate on the principle of letting the reaction get out of control

most reactors don't use "critical mass" of fuel. (U-235)

when these fail the core overheats and melts "meltdown"

CanDu Reactors <https://goo.gl/xMTeP1>

Canada Deuterium Uranium

- _____ reactors
- Produce heat to generate steam, which drives a turbine to produce electricity

Nuclear fission is dirty, meaning that it produces nuclear waste

Some waste products can be reused (fuel rods)

Other products are very radioactive and must be stored far from living things.

Most of this waste is buried or stored in concrete.

It takes 20 half lives (thousands of years) before the material is safe.

