**Radioactivity and Nuclear Energy**

**Radioactive Atoms**

* the nuclei of some U atoms are unstable (Becquerel and Curies)
* unstable nuclei "decay" and emit particles and/or energy = \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_
* the nuclei have an unstable ratio of p+ to n0 = too many neutrons make the nucleus unstable
* they can be made in the lab but also occur naturally
* can be very dangerous but also beneficial
* are called radionuclides
* have half lives = the amount of time before half of a radioactive sample disappears

 e.g.

**Applications of Radioactive Isotopes of Elements (radionuclides)**

**Hydrogen**

 H-1 = 99.9 % of all H atoms

 H-2 = deuterium

 H-3 = tritium = radioactive = used in controlled nuclear fusions

**Carbon**

 C-11 for PET scans for brain disorders

 C-14 for carbon dating of the age of organic material

**Cobalt**

 C-60

* for aiming at a tumour
* for sterilizing insects
* for destroying parasites in pork and chicken
* for irradiation of strawberries

**Iodine**

 I-131 = killing cancerous thyroid cells

**Radiotracers**

* tag a molecule with a radioactive atom and follow the radioactivity e.g. blockages in water pipes

**Nuclear Reactors for Energy Production**

**Advantages**

* no GHGs = methane and carbon dioxide

**Disadvantages**

* disposal of radioactive waste
* cracking of waste containers
* half lives are long therefore stick around for a long time!

**2 Types of Nuclear Reactions**

* in a nuclear reaction **1 type of element** is changed into **another type of element**

**Fusion**

* 2 smaller (lighter) nuclei combine to form a larger more stable nucleus
* huge amount of energy given off = 1 x 106 x a chemical reaction



**Fission**

* bombard a large nucleus with high energy neutrons and split it
* U-235 and Pu-239
* additional neutrons are produced and keep the rxn going = chain rxn
* require a critical mass of material

