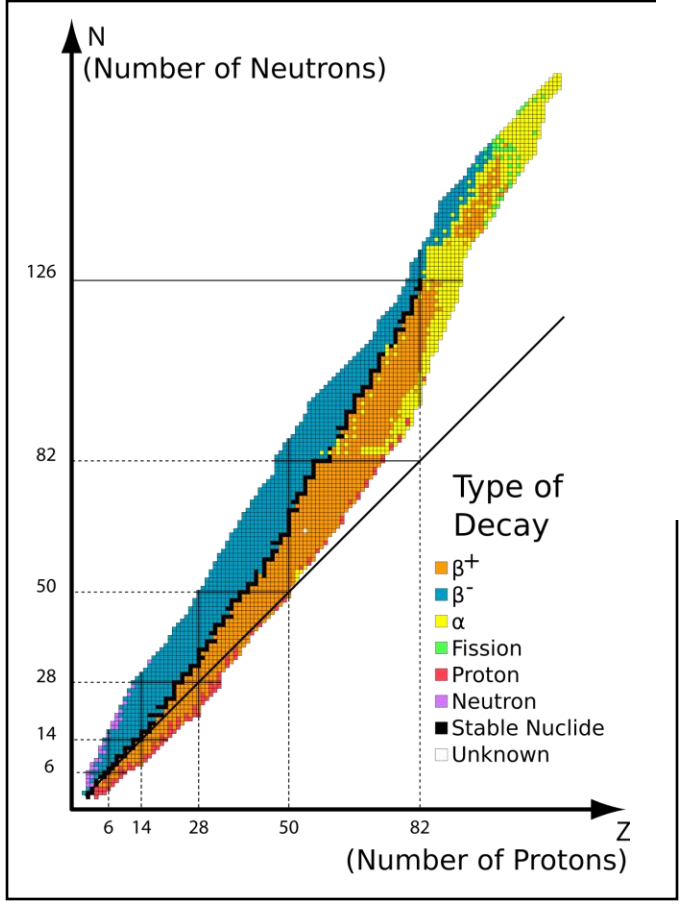
Nuclear physics

Big idea: Forces

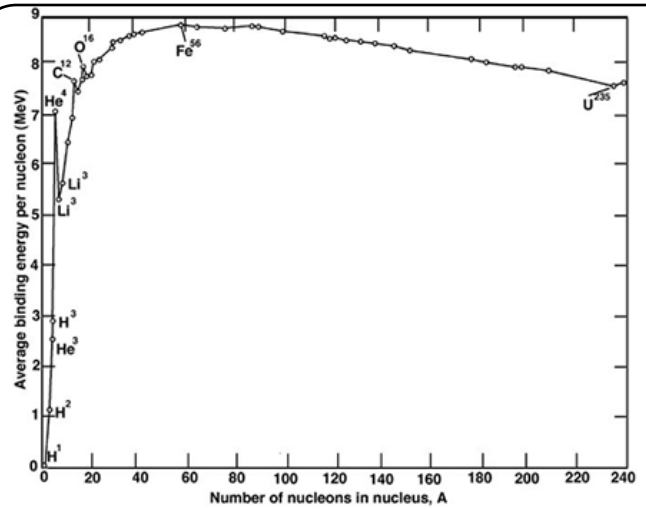
Key vocabulary	
Atomic mass unit	1/12th the mass of a carbon 12 atom. 1u = 1.66043 x10^-27 kg
Binding energy	The energy needed to separate all nucleons in nucleus
Nuclear fusion	The joining of smaller nuclei into a larger nuclei
Nuclear fission	The splitting of a large nuclei into smaller nuclei
Critical mass	The mass of a fissile material which will allow for a self sustaining chain reaction
Thermal neutron	Slow moving neutron which can be captured by a fissile nucleus



Type	Nuclear equation	Representation	Change in mass/atomic numbers
Alpha decay	${}^{A}_{Z}X \rightarrow {}^{4}_{2}He + {}^{A-4}_{Z-2}Y$		A: decrease by 4 Z: decrease by 2
Beta decay	${}^{A}_{Z}X \rightarrow {}^{0}_{-1}e + {}^{A}_{Z+1}Y$		A: unchanged Z: increase by 1
Gamma decay	${}^{A}_{Z}X \rightarrow {}^{0}_{0}\gamma + {}^{A}_{Z}Y$	Excited nuclear state → γ	A: unchanged Z: unchanged
Positron emission	${}^{A}_{Z}X \rightarrow {}^{0}_{+1}e + {}^{A}_{Y-1}Y$		A: unchanged Z: decrease by 1
Electron capture	${}^{A}_{Z}X + {}^{0}_{-1}e \rightarrow {}^{A}_{Y-1}Y$	X-ray	A: unchanged Z: decrease by 1

A nuclear PowerStation uses a moderator (e.g. water) to slow the fast neutrons to make them easier to absorb.

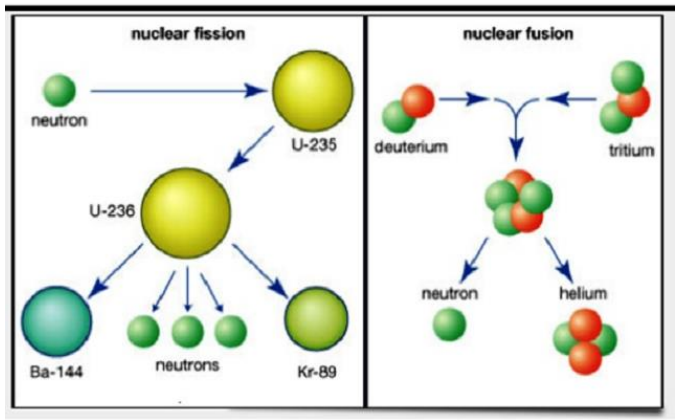
Control rods are used to absorb neutrons to reduce the number of fissions occurring and slow the reaction#



Binding energy

Elements to the left of Iron -56 will release energy through fusion and take energy to spilt through fission
Elements to the right of iron -56 will release energy through fission but will take energy to fuse.
The greater the change between the binding energy of the input and output elements, the greater the energy released.

Nuclear Fission and Nuclear Fusion



Nuclear Power Process