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Cummulative chain fission yield

Nuclear fission Yield

⇒ This term is used to describe mass distribution b/w the fragments.

⇒ It is defined as -

$$Y(A) = \frac{\text{No. of product nuclei of mass no. (A)}}{\text{Total No. of nuclei fissioned}} \times 100$$

Nuclear fission splits a heavy nucleus such as uranium or plutonium into two lighter nuclei, which are called products. Yield refers to fraction of a fission products produced per fission. yield can be broken down by nuclei of given mass no. regardless of atomic no.

e.g. fission fragment yield as a function of mass no. in the fission of U^{235} by neutron

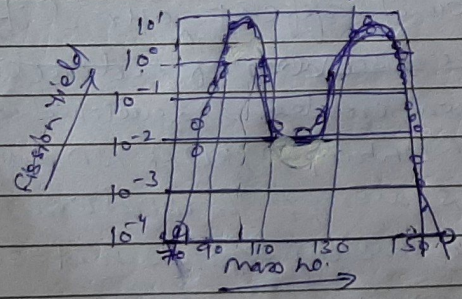

fig. 01

In above curve shows mass no & fission yields. So this mass no. of the fission fragments. So when U^{235} bombarded by neutron that U-nucleus get excited. After excitation it shows fission thus primary fission fragments are unstable, you know that they are having access neutrons, therefore undergo further β-emission, thus stable product which is a isobaric product of primary fission fragment. So β-emission takes place stable product

Now consider stable mass no A_1 & A_2 and fission yield from graph curve —

Fission yield	mass no. A_1 (lighter fragments)	mass no. A_2 (heavier fragments)
≥ 1% (10° in curve)	85 – 105	130 – 150
≥ 7%	90 – 100	134 – 144
= 0.05%	117	117

If fission yield is shown at left side in curve if it is greater than or equal to 1%, then it is means shown that 10^0 in plate (i.e $10^0 = 1$). At this mass no is lighter fragments. So range mass no. A_1 having 85 – 105. So from plate it as lighter fragment & at that same time mass no A_2 is curve show at range 130 – 150. So it is mass no of havior fragment. You can see which is as ≥ 1%. i.e 10^0. Now here of 10^0 consider as ≥ 7%. So some thing lighter fragment 90 – 100 and same time havior mass no A_2 134 – 144 and last see fission yield having

$= 0.05\%$ i.e 10^{-2} from observe graph.
observation that shows lighter fragments have mass No 117 & havior also have 117. so they have similar mass no.

observations from the plot -

① majority of fission are asymmetric i.e $A_1 \neq A_2$ → { both cases difference b/w the mass no of lighter and haviour mass no. fragments.

② The yield of symmetrical fission is lowest. (0.05%)

main observation —

Now we can say that this is true for fission by thermal or low energy neutrons.

However, as the energy of the particle
effecting fission increases, the depth of the valley b/w the two peak diminishes and two peak approach till there is a single peak of symmetric fission.
↳ e.g., fission fragment yield as a function of mass no. in the fission of ^{239}Pu by deuterons of varying energy —

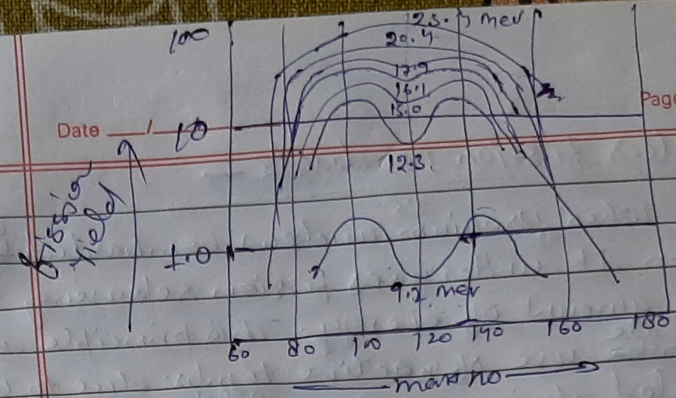

fig (2)

from above example graph b/c ~~mass no vs fission~~ yield ~~[illegible]~~ i.e. initially dipper at ~~[illegible]~~ this time energy is 9.2 mev and then it be comes 12.3 so if we increase ~~[illegible]~~ energy of valley start to depth ~~to top~~ deminishes. when it become to 15.0 mev, 16.1, 17.9, 20.4 mev like shown valley. finally it will reach at 23.5 mev, there is no valley & we get a single peak a symmetric fission. so at the high energetic radiation and ~~[illegible]~~ we have apply ~~the~~ particle of high energy ~~[illegible]~~ at same time we get take 10 fragments which having same mass no. ~~[illegible]~~

like fig (1)

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Nuclear fission products —

When $_{92}^{235}U$ nucleus bombarded with neutron it undergoes fission releasing a huge amount of energy. This principle is made use of in active bombs due to uncontroled chain reaction, All the nuclei will undergo fission in a very short interval of time, resulting in a sudden explosion with the liberation of tremendous amt. of energy. If a chain reactions of a lump of $_{92}^{235}U$ is allowed to produced without control, the in about one microsecond, there will be a release of enormous quantity of energy of the order 2×10^{13} joules. Thus uncontrolled chain reaction can cause violent explosion. By slowing down the fast moving neutrons or by absorbing unwanted ones we can control the rate of chain rxn. Any material can slow down the fast moving n, is called a moderator. Graphite blocks and heavy water are the moderators used in rxns. Metals like cadmium and Boron are efficient absorbers of neutrons.

$$_{92}^{235}U + {}_{0}^{1}n \longrightarrow {}_{56}^{141}Ba + {}_{36}^{92}Kr + 3{}_{0}^{1}n + Q$$

Reactants → Products

This is chain rxn again & again repeating of this main kind

"Happiness is when what you think, what you say, and what you do are in harmony." —Mahatma Gandhi

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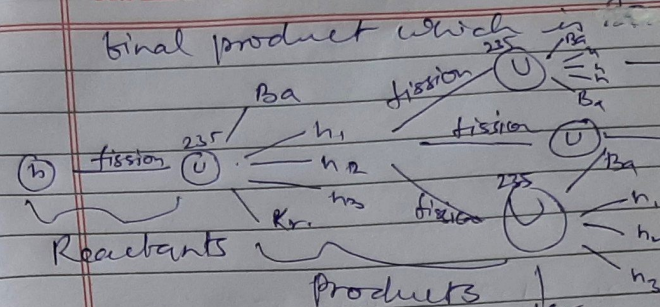
final product which is



atom bomb.

This principle is fission & product is called fission products. and energy Q always as —

$$Q = (\text{mass of reactants} - \text{mass of Products}) \times 931 \text{ mev.}$$

(1 amu = 931 Mev)

"Patience is a key element of success." —Bill Gates