Welcome students, I'm Miss Daizy Dmello, assistant professor in chemistry at Saint Joseph vaz College, Cortalim, Goa. In this session I will be dealing with the program Bachelor of Science, Third Year, subject chemistry. Semester 6 course code CHC 108 Course title physical chemistry. The name of the unit nuclear chemistry- II module name neutron emission in fission and the outline of the module.

Introduction: neutron emission in fission prompt and delayed neutrons at the end of the session . The students will be able to Understand the reason for emission of neutrons in fission. Differentiate between prompt and delayed neutrons. Explain the mechanism of delayed neutrons.

So let's begin with the module neutron emission in fission
Introduction: there is high neutron to proton ratio which leads to the instability in the fissioning nucleus.

The nucleus captures neutrons and form compound nucleus.

Further, it increases neutron to proton ratio, the compound nucleus which is formed then undergoes rupture giving rise to two fission fragments along with few number of neutrons.
The emission of neutrons in fission was experimentally demonstrated by von Halban and others.
What he did was he compared the neutron density around a neutron source.
The neutron source which is given is.
You can use a radium plus beryllium or plutonium 238 plus beryllium Or americium 241 plus beryllium.
So these are the sources which you can use. It was placed in a vessel filled with a solution of uranyl nitrate. With that when filled with the ammonium nitrate solution which was having same density, the average neutron density was greater. Then uranium was present.
This indicated more neutrons. Density is greater when you run. When uranium was present.
More neutrons were formed when fission took place. The number of neutrons emitted increases with the energy of the projectile, neutrons causing fission.
The number of neutrons released is taken as an average value, which is given as V, which is not an integer, but it should always be greater than2 from the values of thermal cross section it was found that not all the neutrons initially capture cause fission, but some captures they resulted in the emission of gamma rays that is.

Radiative capture competes with fission.The number of neutrons released.

Boron neutron absorbed in a fission of a nucleotide was given as Nita is equal to we upon one plus alpha, where alpha is the ratio of radiative capture, which is given as Sigma are cross section to the fission cross section which is given as Sigma F.That is, alpha is equal to Sigma. Are radiative capture cross section divided by Sigma If which is the fission cross section.

Next we move on to prompt neutrons and delayed neutrons.
It is said that not all the fission neutrons are released at one instant.Over 99% of the neutrons produced in fission they are emitted when an extremely short interval of time of the order of 10 raised to minus 14 seconds of the fission product.

So 99% of the neutrons are produced during a short time interval of 10 raised to minus 14 seconds, so these are called as prompt neutrons. Now the rest 1%. The rest of the fission neutrons, which is constituting less than 1% of the total they are termed as delayed neutrons. Which are emitted for some time after the actual after the actual fission process.

Sufficient number of neutrons should be provided by the reaction to have a self sustained nuclear chain reaction. Next we move on to the mechanism for the emission of delayed neutrons.

Take for example, a bromine having atomic number, which is represented as Br 35 and mass number 87.

Now to calculate the number of neutrons you have to do 87 -35. There you get your 52.

That is the number of neutrons.So how the mechanism of delayed neutron takes place first in the first step

it is Z1 and n- 1 and in the next step it is Z + 1 and north minus two,

so 35 one is going to give me my Krypton 52 - 1 is going to give me my 51.

So which is in the excited state over beta capture, takes place and then in the next step you are supposed to do one and north minus two.

So there is 35 + 136. N is 52 - 2. I get my 50 and a neutron is released.

Similar thing happens with the second example.

Take Iodine having atomic number 53 mass number 137.

Calculate the number of neutrons and beta capture take place Z1 N minus one in the first step.

I get my Xenon. Then in the next in the second step Z - 1 and North minus 2.

So 53 + 154 eighty 4 -282 neutrons are emitted and this is the mechanism of delayed neutrons.

As I have told you, the fission fragments with their protons and neutrons.

The fission fragments with z proton and neutron. They undergo beta decay. Giving rise to daughter products with Z + 1 proton and m -- 1 neutron. The beta decay energy of the fission fragment is greater than the binding energy of the last neutron in the daughter products.

In the beta decay, the daughter product nuclei may be left either in the ground state of one of the many excited state. Next we have the concept of the excitation. When does this D excitation takes place.
If the excitation energy of one of the excited state of product nuclei z, one proton and n minus one neutron is in excess of Binding energy of last neutron then the excitation takes place.
The excitation takes place with emission of neutrons, resulting in the production of nuclei of Z + 1 proton and n minus 2 neutrons.
The emission of these neutron will be delayed and it corresponds to the half life of beta decay.

So that was about neutron emission in fission these are my references,

thank you.