(a) i) It will be able to determine if it is alpha as it will be a $^4_2$ he molecule and a beta plus decay will be ^1_0e or beta minus will be $-^0_0e$ molecule.

ii) Energy released

$= 218.00847 - 213.99941 = 4.00916$ u

$4.00916 - 4.00260 = 0.00656$ u

$1u = 931.5$ MeV

$1u = 931500$ eV $0.00656 \times 913500 = 5942.6256$ eV

$1ev = 1.602 \times 10^{-19}$ Joules

$5942.6256 \times 1.602 \times 10^{-19} =$

$\boxed{= 9.6 \times 10^{-16} \text{ joules}}$

(b) $\lambda = 0.2 \, nM = 2 \times 10^{-10}$ meters

ii) its important because 0.2nm is a very short λ. this allows it to nuetrons have no charge so they arent deflected by protons & electrons when being used to determine structure of materials

— 3 —

(c) The spectro scope allowed them to look at the spectral lines and observe what their wavelength was by looking at the colour. It allowed him to observe the hydrogen emission spectra so he could explain his model of the hydrogen atom that he said the each shell had to be an interger of a whole wavelength 1, 2, 3 -- He observed the spectral lines of the hydrogen atom.

If you require more space to answer parts (a), (b) and (c) of the question, you may ask for an extra writing booklet.

If you have used an extra writing booklet for parts (a), (b) and (c) of the question, tick here.

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(d) i) They obtained the results that the electrons striking the crystal showed diffraction. Diffraction is a property of waves that was seen in this experiments, but in this the electrons showed it

~~broad. The Rutherford Bohr model of the atom had an electron orbiting a positively charged nucleus. Bohr put the electrons in orbits in shells. This was the idea Broglie had that the matter had wave like properties as well. This experiment confirmed the wave like properties of the electron. They thought that the orbits were positioned in a way that the orbit circumference had to be an integer of λ ie 1, 2, 3 so they had the formula $n\lambda = 2\pi r$. This~~

ii) The Rutherford Bohr model of the atom had an electron orbiting a positively charged nucleus. Bohr put the orbits in shells, stating that the circumference of the orbit was an integer λ, which and the idea they were like standing waves. This experiment confirmed the idea matter had wave like properties, and supported Broglies theory of the circumferences of the orbits being an integer of λ stating $n\lambda = 2\pi r$

(e) The first advance was discovering that the protons and the nuetrons in the nucleus the were held together by a strong nuclear force. ~~They are contained by the glue~~ It was found that the sum of protons and nuetrons ↑masses added up and was slightly more than the mass of the nucleus. This is because mass is loss when they are binded together.

The discovery of the nuetrons was important as it makes up the nucleus. This discovery allowed them correctly explain atoms having electrons orbiting the nucleus, that is made of protons and nuetrons. Before this they thought the nucleus was made of protons which was not correct.

Allowed them to understand nuclear power such as reactors. These reactors were important for them as they provide a good source of power. The discovery of nuetrons and how they behaved allowed fermi and his team to create the "atomic pile" and allowed the Us Manhatten project to move foward, they ~~built that on~~ won the race in the cold war of building the first bomb. Allowed the creation of the atomic bomb.