(a) i) A Wilson Cloud Chamber ~~is~~ is used to track the paths created by the emitted radiation. The radiation causes the gases in the cloud chamber to ionise ~~and~~ which acts as a center for condesation thus the tracks can be seen. Alpha particles ionises the gases significantly more than beta particles therefore the thicker tracks is alpha decay ~~particles~~ and beta decay is the thin tracks.

ii). Mass defect.

$218.00897 - (213.99991 + 4.002600)$

$= 0.006929$

Energy released. ~~of Mass~~

0.00629×931.5

$= 5.86$ MeV

(b) i) $\lambda = \frac{h}{mv}$

$mv\lambda = h$

$v = \frac{h}{m\lambda}$

$\therefore v = \frac{6.626 \times 10^{-34}}{1.675 \times 10^{-27} \times 0.2 \times 10^{-9}}$

$v = 1977.91 \text{ m/s}$

ii) Neutrons are useful in determining the structure of materials by using their wave properities. When the neutron hits the target it material it scatters and thus the wavelenghts produced will vary and cause an interference pattern. Using ~~spfe~~ diffractometers and spectrometers to detect the interference pattern the structure of the material can be determined. Neutrons are used because they are a neutral particle and thus will be uneffected by protons and electrons. Also neutrons are more penetrating than electron microscope and x-rays ~~so~~ which means that using neutrons results in better and clear understanding of the structure of materials.

(c) A spectroscope was important in the development of the Bohr model of the atom since it was used to observe the hydrogen spectrum.

Bohr realised that ~~by excited~~ hydrogen in a excited state emitted ~~a~~ electromagnetic radiation of specific frequencies which was observed using a ~~spectrum~~spectroscope.

Bohr noticed that the frequencies emitted where of characteristic amounts and never amounts inbetween. this lead Bohr to conclude that the emission of EMR when a electron moved from a higher energy shell to lower energy shell was of fixed distances from each other. ~~This feat~~ Thus Bohr concluded that electrons can only revolve around the nucleus in specific metastable orbits and all other orbits were unstable. ~~Also Bohr was able to~~

Bohr also stated that the energy absorbtion and emission of EMR caused by electrons moving to higher or lower states was given by the equation $E=hf$. Thus the Spectroscope ~~played~~ allowed Bohr to develop ~~th~~ his model of the 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. ☐

(d) i) Davisson and Germer noticed that when electrons were fired at a crystal of nickel the electrons where scattered and diffracted. But scattering and diffraction is a wave property thus they concluded that electrons also exhibit wave properties.

ii) Davisson and Germer provided experimental evidence to de Broglie's ~~hypoth~~ theory that ~~et~~ particles ~~such exhibit both wave and p~~ could behave as both wave and a particles Thus de Broglie stated that electrons behaved as standing waves that wraped around the nucleus in integral number. de Broglie ~~stated~~ stated the ~~electron is only~~ orbit is only stable if an integral number of wavelenghts fit on the circumference ~~thus this lead to a~~ and since standing ~~no~~ waves don't propagate and emit energy the orbits are stable. Thus this lead to a modification of the Rutherford-Bohr model to include standing waves of electrons as well as provide a theoritical explanation for why only certain orbits are stable and others ~~often~~ are not.

(e) there have been many advance in the understanding of the nucleus through out history that lead to our current understanding today.

The first advancement was by Rutherford. ~~Rutherford performed the gold foil experiment~~ and concept of a nucleus was provided by Rutherford. Rutherford performed the gold foil experiment where he fired alpha ~~parp~~ particles at a piece of gold foil and noticed that 1 in 8000 would scatter or bounce back. this ~~we~~ result was uncharacteristic of the Thompson ~~re~~ plum-pudding model ~~and thus~~ where all of the particles should have passed through. Thus Rutherford concluded that the atom consisted of a ~~dens~~ small dense positive nucleus with electrons orbiting around it. Thus he ~~fus~~ was the first scientist to propose the existence of a ~~nucleus in an atom~~ atomic nucleus.

Chadwick later discovered the neutron by firing alpha particles at beryllium which resulted in the emission of an unknown radiation which was difficult to detect since it didn't ionise

any gases. thus a paraffin block was placed behind ~~the~~ beryllium which is rich in hydrogen atoms. ~~that~~ this resulted in protons being ejected by the unknown radiation. Using the law of conservation and energy Chadwick stated that the protons were ejected by a ~~deutrat~~ particle of around the same mass and since it ~~dud~~ doesn't ionise it must be neutral hence Chadwick had discovered the existence of neutrons ~~et~~ in an atomic nucleus.

An increased understanding in forces lead scientists to discover strong nuclear forces. the ~~atom~~ ~~ex~~ nucleus experiences a strong ~~electrostat~~ repulsive electrostatic force due to the interaction between the positively charged protons. the nucleus also experiences a gravitational force but since the mass is small it is ~~ne~~negible. thus a force is needed to overcome the repulsive electrostatic force which ~~is~~ ~~is~~ is strong nuclear force which was an attractive force that keeps the nucleus together through the exchange of mesons.

Thus over time our understanding of particles and forces in the atomic nucleus has ~~ev~~ evolved over time.

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

If you have used an extra writing booklet for parts (d) and (e) of the question, tick here. ☐