(a) i. A wilson cloud chamber can distinguish between alpha and beta by the fact that alpha particles are highly ionising and would therefore be much more clearly seen in a cloud chamber than beta decay.

ii. $^{218}_{84}Po \longrightarrow ^{214}_{82}Pb + ^{4}_{2}$[illegible]

(alpha decay is a helium nucleus)

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

0.0000002

1m = 100000 nm

1nm = 0.00001m

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

$= \frac{6.626 \times 10^{-34} \times 0.000002}{1.675 \times 10^{-27}}$

$= 7.9116 \times 10^{-13}\ ms^{-1}$

ii. Beams of neutrons are useful in determining the structure of materials because they have no charge, meaning that when they enter a structure they can't be deflected by attractive or repulsive forces due to charged particles. They will only be reflected if they physically hit a section of the structure allowing for accurate determination of the size and shape of structure. This is why neutrons are useful in determining the structure of materials.

(c) The spectroscope showed the seperate wavelengths and emission lines of a hydrogen atom. This showed Bohr that when electrons jumped from different energies (shells) they either absorbed or emitted light (when moving closer to nucleus, absorption lines are observed, when moving away from nucleus, emission lines are observed). This allowed Bohr to create a model of an atom that had shells that electrons jumped to and from. Without the observation of wavelengths / emission lines ~~[illegible]~~ through the spectro-scope, Bohr wouldn't have figured out the existence of shells and that electrons jump ~~[illegible]~~ between them, therefore the spectroscope was vital in the development of Bohr's 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's experiment resulted in the recrystallisation of nickel due to a crack in the vacuum tube. This resulted in a diffraction pattern. They concluded that electrons have varrying densities and energies.

ii. This experiment was significant to the Rutheford - Bohr model of the atom as it described the characteristics and properties of the electron allowing Rutherford/ Bohr to understand how electrons behaved within the shells of an element allowing for the production of a more accurate model.

(e) Scientists understanding of the atomic nucleus grew due to the discovery of gravitational, electrostatic and strong nuclear forces exerted on the nucleons within the atomic nucleus.

The gravitational force is the attractiveness of one object to another. Although it does attract nucleons together, it is not as strong as electrostatic (repulls-ion) forces. Electrostatic forces is the concept that like charges (mainly protons within the nucleus as nuetrons have no charge) repel eachother. To truly understand why the nucleus was still in tact, scientists continued to investigate resulting in the discovery of strong nuclear forces that hold the nucleus together and the force is strong enough to overcome repulsion forces. Strong nuclear forces work ove a small distance otherwise it would bind multiple nuclei's together.

Without the fundamental ~~[illegible]~~ knowledge ~~[illegible]~~ and discovery of the ~~[illegible]~~ three previously mentioned forces, Scientists wouldn't have such a detailed understanding of the atomic nucleus and how it works. Therefor the advances in knowledge of the before stated forces greatly increased the understanding of the atomic nucleus.

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. ☐