(a) (i)

A wilson cloud chamber or similar device could be used to distinguish between alpha decay and beta decay as it detects the subatomic particles emitted from the decay.
For example in an alpha decay, it will emit a helium nucleus.
In a beta decay like a beta minus decay will release a antineutrino, electron and neutron. In a beta plus decay it will release a positron, electronneutrino.

(ii)

1.661×10^{-27} kg amu
931.5 MeV/c^2

polonium-218 — 218.00897 (mass).
lead-214 — 213.99981 (mass).
alpha particle — 4.00260 (mass).

= mass of products — mass of alpha
= 436.01138 — 436.0026.
= 0.00878. $\times$ 1.661×10^{-27}
m_{defect} = 1.458358×10^{-29} amu
$E = mc^2$ $E = (m_{defect} \times 931.5) \times 3.00 \times 10^8$
$E = 4.075 \times 10^{-12}$ J.

(b) (i)

$\lambda = 0.2\text{nm} \times \frac{1}{10^9}$ $\quad p = mv$

$v = ?$

$h = 6.626 \times 10^{-34}$ $\quad \lambda = \frac{h}{mv}$

$m = 1.675 \times 10^{-27}\text{ kg}$ $\quad mv = \frac{h}{\lambda}$

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

$v = \frac{6.626 \times 10^{-34}}{\frac{0.2 \times 1}{10^9}}$

1.675×10^{-27}

$v = 1977.91\ ms^{-1}$

or

(ii) A beam of neutrons is useful in determining the structure of materials as they have a neutral charge. This means that they can penetrate deeper into nuclei and become unaffected by protons as neutrons they have no charge. They are also much bigger atoms, meaning that they can distinguish subatomic or smaller particles. The Neutrons are not affected or do not affected by electric and magnetic fields, so they can discover more about magnetic fields in the nucleus.

(c) Bohr developed a model of the atom stating that electrons were placed in 'stationary states', however could not explain why. However the spectroscope is an important equipment that is able to determine the wavelength of a particular light source. For example the a spectroscope looking at visible light will measure a wavelength of $\times 10^{-7}$ nm and show a colour green, indicating that the light source is visible light. This equipment is useful through the development of Bohr's model of atom.

De broglie was able to publicised a theory of particle wave duality theory and how electrons can behave as waves. Determining the wavelength of electron was able to explain Bohr's model of 'stationary states'. The circumference of the electrons orbit is the same of whole multiple number of electron is an orbit. Therefore, determining wavelength through spectroscope, come to development of atom and 'stationary states'.

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 is an experiment by firing electrons at a crystal of nickel and observed how electrons were scattered. Through the results and observations, the results of wavelength of electron as it collided with nickel, has similar properties to the nature of waves. The results of how electrons were interfered and produced a ~~wavelength~~ wavelength, stating that electrons could be ~~can also be supported~~ thus supported De Broglie's theory of wave/particle wave; ~~can also be supported through~~ duality theory of electrons.

(ii)

Rutherford's model of the atom sticks how there is a nucleus with protons and how electrons orbited around it. But could not explain why.

Bohr's model of the atom is more specific in which he stated that the electrons were placed in 'stationary states', but could not explain why.

With Davisson's and Germer's experiment it proves that electrons have wave properties, which then helps with ~~the model of~~ Bohr's model of atom.

(e)

There are major advances in knowledge about particles and forces on the understanding of the atomic nucleus. Understanding the forces in the nucleus such as repulsive force (~~electromagnetic force~~ electrostatic) between protons in the nucleus. As well as the strong force ~~that is greater than repulsive force.~~ between the neutrons is greater than repulsive force and that helps keep the protons from repulsion, therefore making the nucleus stable - stable radio isotope. This contributes to the theory of atomic nucleus through the understanding of stability and radio isotopes.

Secondly, the understanding of particles such as discovering neutrons help understand the atomic nucleus, as neutrons have no charge (neutral). Therefore are able to penetrate deeper into a nuclei, unaffected by protons. Therefore when studying atomic nucleus and nuclear reactions, neutrons are used to collide in the nucleus with protons, to release energy. This contributes to the concept of atomic nucleus

by discovering the properties of a nuclei and how a nuclear reaction can occur.

Lastly, the discovery of mass defect and relates to particles where the sum of products of nucleus (protons, neutrons, electron) have a greater mass than the actual atomic mass. This contributed to nuclear decay and how energy is released are to binding energy within the nucleus. This helps understand the atomic nucleus by proposing the concepts of radioactive decay and binding energy. that related relates with the theory of 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. ☑

Start here.

The circumference ~~explaining why~~ of the electrons orbit is proportional to the ~~same~~ whole multiple number of electrons in their shells. Therefore explaining that electron are in 'stationary states' due to the quantised energy.