(a) i) alpha particles can leave the chamber whilst the beta particles are trapped inside.

ii) 218.00897 − 213.99981 = 4.00916

∴ 4.00916 − 4.00260 = 0.00656

∴ Energy released is equal to 0.00656 u

(b) i) Data:

$\lambda = 0.2\,nm$

$= 2\times10^{-9}\,m$

$h = 6.626\times10^{-34}$

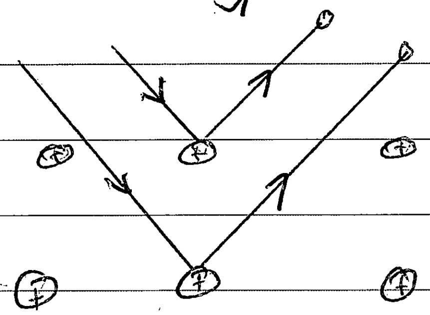
$m_n = 1.675\times10^{-27}\,kg$

$\lambda = \frac{h}{mv}$ ~~$\frac{h}{\lambda} = mv$~~

$2\times10^{-9} = \frac{6.626\times10^{-34}}{1.675\times10^{-27}\,v}$

$v = 197.7910448$

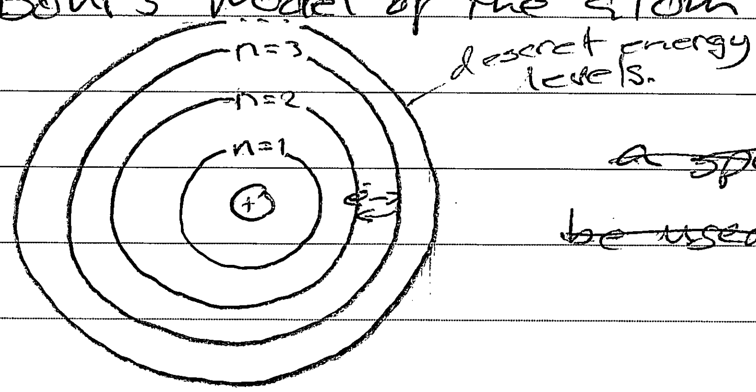
$V = 197.8\,m\,s^{-1}$ (1.d.p)

ii) 

~~the neutrons beam~~ the neutrons hit and "bonce off" the different atoms in the latice and so reflect at different angles as shown in the diagram above thus hitting the detector screen at different points, creating a pattern from which the structure of the material can be determined.

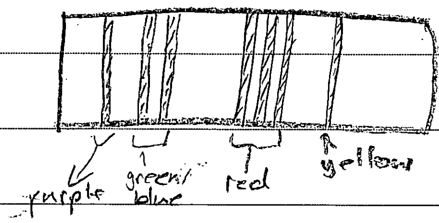
- Neutrons are ideal for this experiment as they have a zero charge and so will not distort or manipulate the lattice.

(c) Bohr's model of the atom



~~a spectroscope can be used to see~~

e⁻ can move up an energy level and then be re-radiated back down, as it does this it gives off a packet of energy (photon)
a spectroscope can be used to see the different energy levels. eg. hydrogen
↳ by seeing the light/photons.

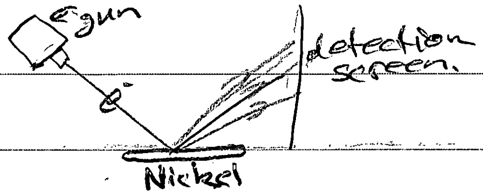


Bohrs created his model to account for the spectral lines seen through the spetroscope that could not be explained in previous models.

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)



e⁻ has a wave-like property as it reflected off of the crystal Nickels lattice.

ii) showed there was limitations to the Rutherford-Bohr model of the atom.
- e⁻ had a wave-like property

(e) • small nuclear forces } hold the nucleus together
& larger nuclear forces } overcoming force of repulsion

further research needed. ↙ ↓ gluons.

• Quarks → nucleus → (u)(u)(d) } given scientists further understanding to the main parts that make up the nucleus however leads to more questions
↳ proton → (u)(u)(d) }

• Pauli's nutrino → accounts for mass defect in the ~~nucleus~~ ~~[illegible]~~ nucleus.