Student 4: High Achieved

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This report is to outline the science behind nuclear Fusion, the benefits and disadvantages of fusion and whether nuclear fusion could be used in New Zealand.

(1) Nuclear fusion is the process of releasing and harnessing the energy emitted when two nuclei collide and fuse. Nuclear fusion occurs when two nuclei, usually Deuterium, tritium and/or Helium, moving at very high speeds collide. The process needs a lot of energy but when the new nucleus is created it is unstable and a neutron is ejected with a huge amount of energy. The nuclei must be travelling fast enough to overcome the Coulombic repulsion between the two nuclei. This is the attractive force that makes an electron orbit the nucleus, where an electron is negative and the nucleus are positive. This means that two nuclei would repel each other, like two magnets facing north to north however when the nuclei are moving fast enough, they can overcome this repulsion, collide and fuse. The repulsion can be overcome and the nuclei can be forced together and held by the strong nuclear force which works when the nuclei are very very close to each other. The way to overcome it is the give the nuclei enough kinetic energy to give really strong collisions and lots of the collisions which can be provided by extreme heat of around 1million degrees.

(2) When the nuclei fuse, a small amount of mass is converted into a large amount of energy. This converted mass is the mass deficit, or the change in mass, worked out by subtracting the mass of the sum of the two nuclei by the mass of the final nuclei. The Laws of Thermodynamics state matter or energy cannot be destroyed or created, only converted. This proves that the mass deficit is converted to energy during fusion. The famous physicist and scientist Albert Einstein discovered the relationship $E=mc^2$, used to calculate the amount of energy released during fusion. The energy released is equal to the mass deficit (m or Δm) multiplied by the speed of light squared (c^2). Despite the mass deficit being such a tiny amount, the speed of light squared is so great that it produces a large amount of energy.