

- i) Describe how the process of respiration release chemical energy from a molecule of glucose

Respiration involves the breakdown of glucose in gradual steps and the energy is used to create ATP. It is in four stages; glycolysis, link reaction, krebs cycle and electron transport chain.

Glycolysis takes place in the cytoplasm. First, glucose (6C) is phosphorylated to hexose biphosphate which requires two ATP molecules. This is then broken down into two triose phosphates which are 3 carbon molecules. This is converted into two pyruvates which creates 4 ATPs and 2NADHs. The net gain of glycolysis is 2ATP molecules and 2NADHs.

Next is the link reaction where pyruvate diffuses from the cytoplasm into the mitochondrial matrix. Two pyruvates is broken down into two acetates, producing 2CO₂. This is then converted acetyl CoA, and the net gain of this process is 2NADH.

Then it continues to the krebs cycle, where carbon bonds are broken to produce energy to synthesise ATP and produce reduced NAD. This releases CO₂. Firstly, acetyl CoA combines with a 4 carbon compound to form a 6 carbon compound. The CoA is regenerated. The 6C compound undergoes a series of reactions involving dehydrogenation which produces reduced NAD and FADH₂, and decarboxylation which produces CO₂. The 4C residue then undergoes a series of reactions converting it back to the 4C compound that combines with acetyl CoA. The reduced NAD and FAD deliver the hydrogen to the electron transport chain. For one molecule of glucose the krebs cycle turns twice.

In the electron transport chain, reduced NAD moves to the inner membrane where there are three pumps and two carrier molecule which make up the chain. NAD becomes oxidised losing its hydrogen to the pump. The hydrogen splits to form H⁺ and e⁻. The electron is passed to a carrier at a lower energy level. The energy released powers the pump to pump H⁺ into the inter membrane space. The e⁻ passes down the chain of carriers to lower energy levels each time releasing energy for each pump to pump H⁺ into the inter membrane space. The H⁺ ions build up in the inter membrane space creating an electrochemical gradient.