Question 38 **(14 marks)**

A hydrolysis reaction is one that involves water being consumed as a reactant. Hydrolysis reactions can be represented by the following general equation.

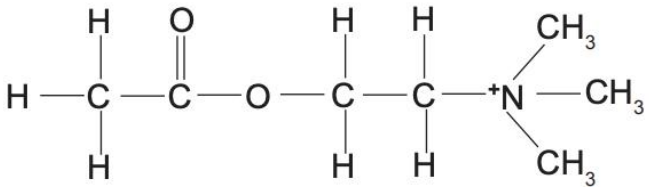
$$A — B + H_2O \rightarrow A — OH + H — B$$

Many processes within the human body involve hydrolysis reactions. These hydrolysis reactions usually require a catalyst; in living organisms that catalyst is an enzyme.

(a) What type of organic compound is an enzyme? (1 mark)

Acetylcholinesterase is an enzyme that is used in the hydrolysis of acetylcholine, a neurotransmitter in the brain.

The structure of acetylcholine is drawn below.



(b) Two products are formed when acetylcholine undergoes hydrolysis in the presence of the enzyme acetylcholinesterase; one of these is a charged molecule called choline and the other is a carboxylic acid. Draw structures of these **two** products. (2 marks)

A catalyst is said to be **active** if it is working to form the desired products. To ensure the acetylcholinesterase is **active** and so catalysing the hydrolysis of acetylcholine, the charged compound found in the reacting vessel is separated and analysed using a combustion reaction to determine its empirical formula.

A 4.270 g sample was combusted in the presence of pure oxygen until no solid remained. 9.020 g of carbon dioxide, 5.169 g of water and 1.886 g of nitrogen dioxide were produced.

(c) Calculate the empirical formula of the combusted sample. (9 marks)

(d) Use your calculated empirical formula to demonstrate that the enzyme is **active**.

(2 marks)