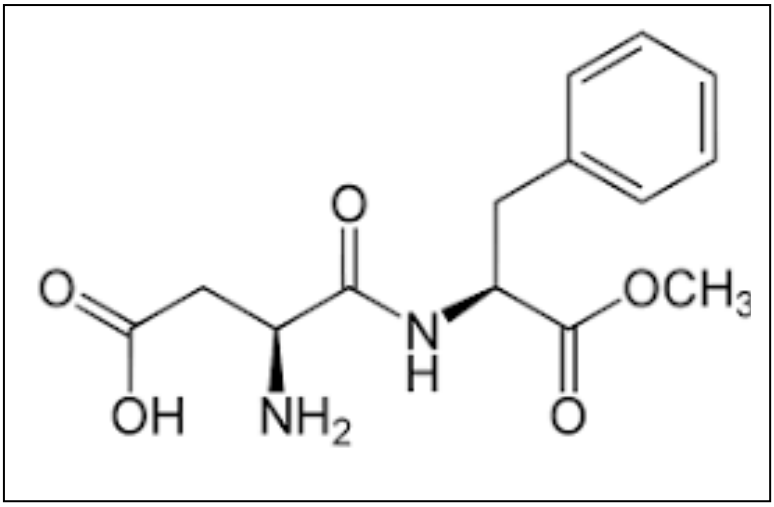
Lesson 2 – carbohydrates – artificial sweeteners.

Aspartame



Aspartame is an artificial sweetener that is, approximately, 200 times sweeter than sucrose (table sugar $C_{12}H_{22}O_{11}$).

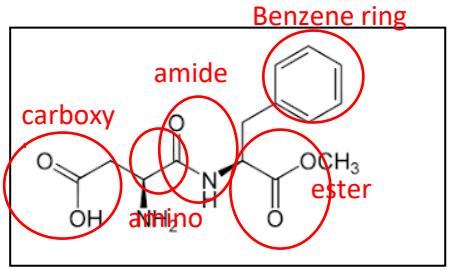
Aspartame is very stable in solutions of low pH around 4.3. Being so sweet little of the chemical compound is required in food to increase the sweet taste of the food. Hence less calories are absorbed by the body when consuming sweet foods prepared with aspartame.

The chemical structure of aspartame is shown above. It is formed in a complex chemical pathway and is said to be a dipeptide formed from two amino acids one of which is a methyl ester.

1. What type of molecule is aspartame? Circle the correct response and justify your answer.

Dipeptide ester, carbohydrate, amino acid, fatty acid, triglyceride

2. Circle and name four distinct functional groups present in the molecular structure of aspartame. *Any of the five shown*



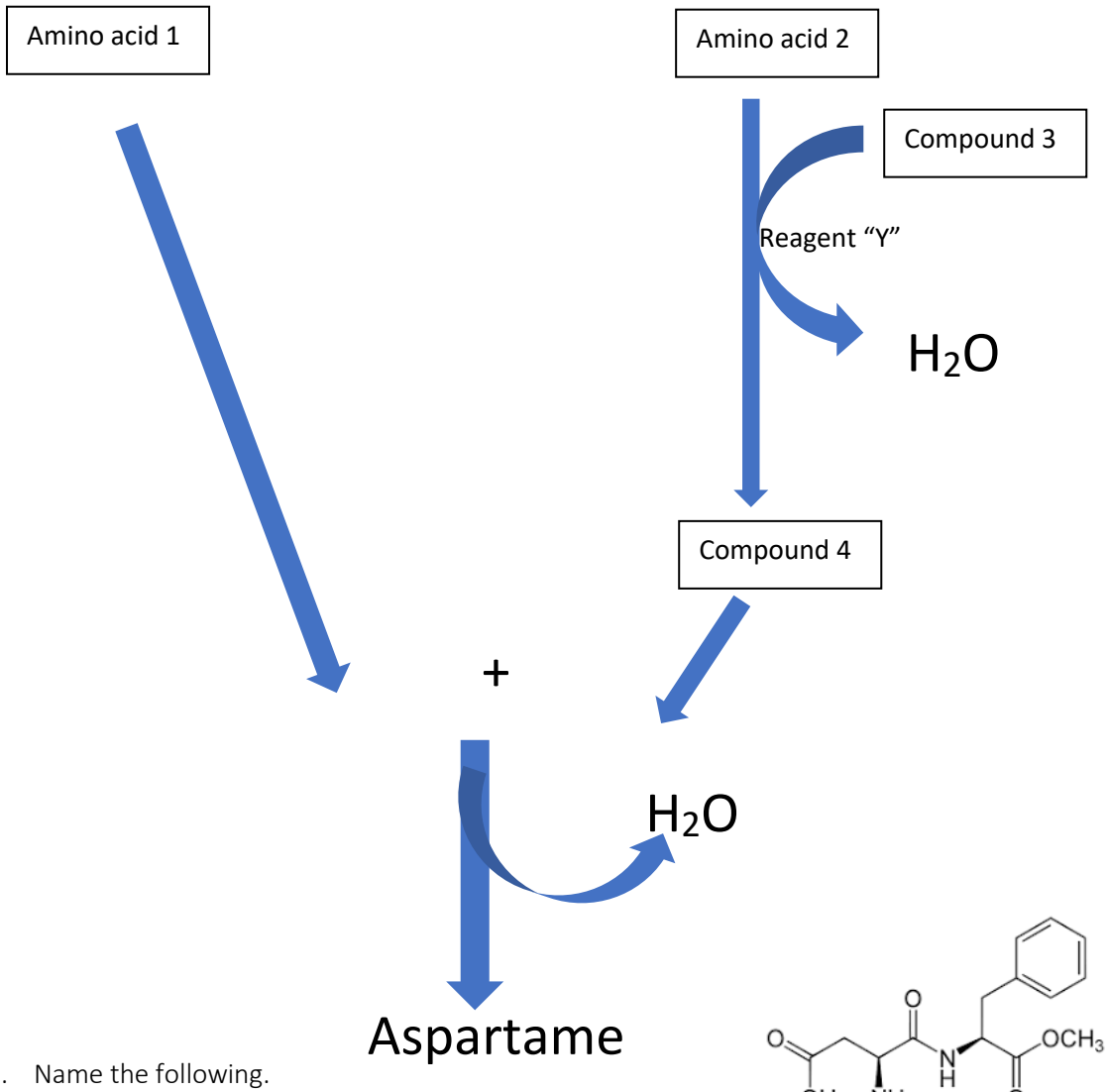
3. Explain why aspartame is preferentially used as an artificial sweetener in carbonated drinks?

   Carbonated drinks are acidic and at a pH of 4.3, according to the stem of the question, aspartame is stable.

4. When aspartame and sucrose are metabolised they each produce 17 kJ of energy per gram. Explain why aspartame is used as a low calorie sweetener?

Since aspartame is 200 times sweeter than sucrose it is used in miniscule quantities and so the energy in the food attributed to the sweetener is negligible.

Below is a simplified pathway for the formation of aspartame.



5. Name the following.
   - amino acid 1 *Aspartic acid*
   - amino acid 2 *Phenylalanine*
   - compound 3 *methanol*
   - reagent "Y" *$H_2SO_4(l)$*

6. Circle the type of reaction forming compound 4? Justify your answer.

Addition, oxidation, esterification, addition polymerisation, condensation polymerisation, hydrolysis

Phenylalanine is formed into a methyl ester when its carboxyl group reacts with methanol

7. What two functional groups directly participated in the reaction between amino acid 1 and compound 4, in the formation of aspartame .

Amino and carboxyl

8. What functional group links amino acid 1 and compound 4 to form aspartame?
   Amide