Week 6 question: (NZIC 2005)

An organic compound, **A**, has the molecular formula C3H7OBr.

**A** can be hydrolysed to **B**, C3H8O2.

Careful oxidation of **A** yields compounds **C**, C3H5OBr, and **D**, C3H5O2Br.

**D** can be hydrolysed to **E**, C3H6O3.

On oxidation, **E** yields **F**, C3H4O3 and **G**, C3H4O4.

(a) Write structural formulae for each of the compounds **A** – **G**.

(b) Describe, with reference to physical and chemical properties, how the two products **C** and **D** can both be isolated from the oxidation of **A,** and then identified.

(c) Show how compound **A** can be used as the starting material for the polymer



Week 6 answer: (NZIC 2005)

**A** Br-CH2-CH2-CH2-OH (3-bromo propan-1-ol)

**B** HO-CH2-CH2CH2-OH (propan-1,3-diol)

**C** Br-CH2-CH2-CHO (3-bromopropanal)

**D** Br-CH2-CH2-COOH (3-bromopropanoic acid)

**E** HO-CH2-CH2-COOH (3- hydroxypropanoic acid)

**F** OHC-CH2-COOH

**G** HOOC-CH2-COOH

**C** and **D** will have different boiling points and different solubilities in water. It would be expected that **C** would be less soluble in water because of the aldehyde group which will form less H-bonds with the water molecules.

**D** would be expected to have a higher boiling point because it is a heavier molecule so will have more electrons available and hence more temporary dipoles between molecules. It can also form H-bonds between the –COOH ends of the molecules. These two factors will increase the forces of attraction between the molecules and give them a higher boiling point than **C**. Separate with distillation.

**D** can be identified with litmus (blue litmus turns red) or NaHCO3 which will bubble when added to the acid.

**C** can be identified by its reaction with Fehlings (turns blue to red-brown when warmed) or Tollen’s reagent (turns silver mirror when warmed)

Week 7 question: (NZIC 2011)

See over:

**QUESTION FIVE (8 marks)**

a) Compound **A** has the formula C9H15O2Cl

When **A** is refluxed with dilute acid it forms **B**, C5H9O2Cl, and **C**, C4H8O.

Treating **B** with alcoholic NaOH produces **D** and **E**, both with the formula C5H8O2, neither of which have geometric isomers.

Reacting **C** with acidified dichromate produces **F**, C4H6O2, which cannot be oxidised further.

Reacting **C** with acidified permanganate produces first **G**, C4H10O3, and then **H**, C4H6O5. Neither **G** nor **H** exists as enantiomers (optical isomers), nor do they react with Tollens’ reagent.

Draw the structural formulae for Compounds **A** – **H** that are consistent with the information given above and justify your answers.

b) The following method is from a 1975 chemistry textbook describing how to prepare butan-2-ol from butan-1-ol.

“Add 98% sulfuric acid to the butan-1-ol. Reflux for 30 minutes. Cool the resulting mixture and then add excess 75% sulfuric acid. Stopper the flask, shake for several hours and pour the contents into water. Distill the resulting misture; butan-2-ol distills over with the steam and can be recovered from the condensate by adding anhydrous sodium sulfate”

Explain how each step aids in the eventual maximum yield of butan-2-ol.

(c) Discuss the effect of water on the following organic molecules

* ethanol
* ethanoyl chloride
* chloroethane
* ethanamide
* aminoethane