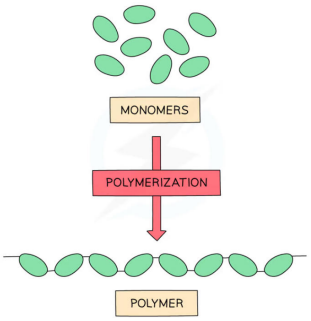
Polymers

Polymers: A polymer is a large molecule built up from many smaller molecules (Monomers).



Natural polymers

Proteins
Starch
Natural rubber
Silk

Synthetic polymers

Poly(Ethene)
Poly(Propene)
Pollyvinylchloride(PVC)
Nylon

Polymer

Addition polymerisation

Addition polymerisation occurs when unsaturated polymers join together.

Same type of monomers join together

Condensation polymerisation

Condensation polymerisation occurs when monomers combine to form a polymer by the elimination of small molecules.

Different types of monomers join together

There are two types of polymerisation, addition and condensation.

(a) Explain the difference between these two types of polymerisation.

.....

.....

..... [2]

addition: polymer is the only product / only one product; [1]
condensation: polymer and water formed / small molecule formed; [1]

Drawback of using Plastics:

Most plastics are non -biodegradable that is they can not be broken down by bacteria.

1. landfill sites fill up very quickly which could be used for agriculture or housing.
2. It damages wild life .
3. When we burn plastics they produce toxic gases like HCl.

Advantages of using plastics

1. Plastics are durable.
2. They are light weight.
3. They are resistant to corrosion.

Storage tanks for cold water are now made from polymers because they are cheaper than metal tanks. Suggest **two** other advantages of making cold water tanks from polymers.

.....

..... [2]

Any **two** from: [2]
resistant to corrosion / unreactive to water / more durable (1)

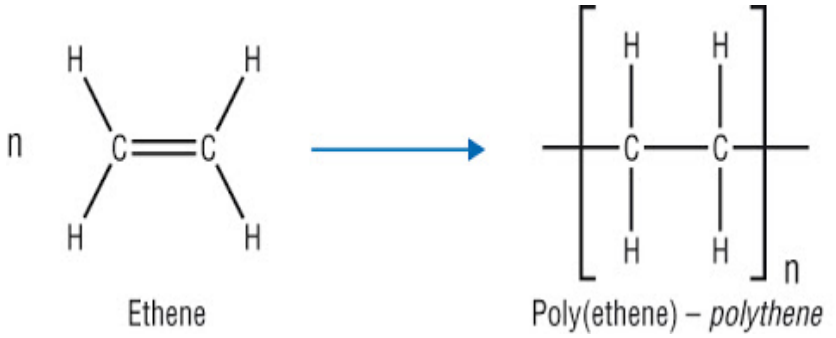
lighter / less dense (1)

easier to manufacture / can be moulded (1)

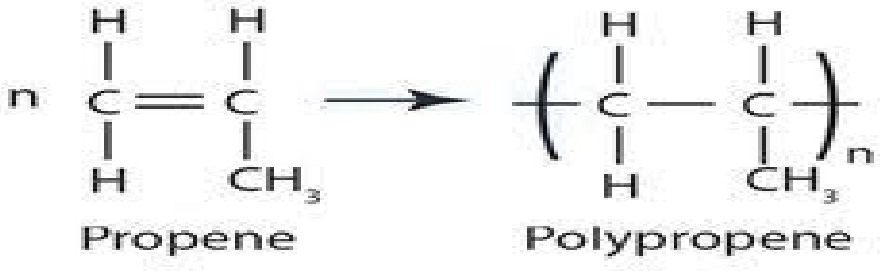
good insulator / keeps the water cold (1)

Addition polymerisation:

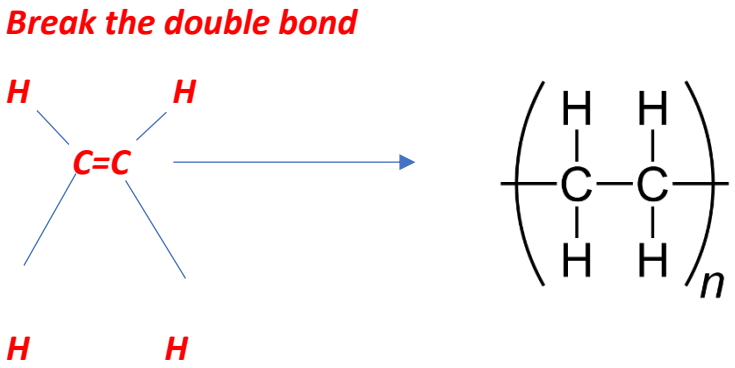
Addition polymerization : ***Formation of successive links between small units called monomer molecules containing a C=C double bond to form a long unchained macromolecule named polymer.***



Ethene — Poly(ethene) – *polythene*



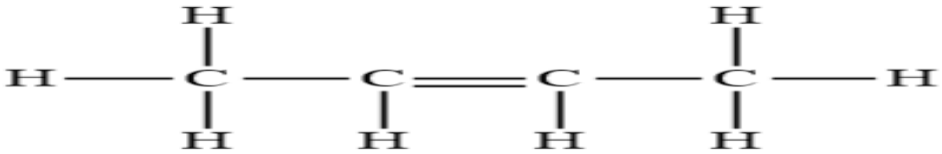
Propene — Polypropene



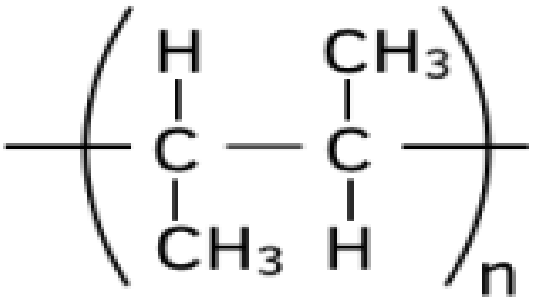
Drawing the polymer unit from the monomer

- ***Break the double bond***
- ***The unit should be put in brackets with "n" to show repetition***
- ***Atoms bonded to carbon should be put in 12'o clock and 6'o clock position(straight up and down)***
- ***All atoms bond to C=C should be collected to be put over the carbons in the double bond 12'oclock and 6'o clock position.***
- ***Place the structure inside brackets with the lines from the carbon atoms going through the brackets to show that the structure is continuing in both directions***

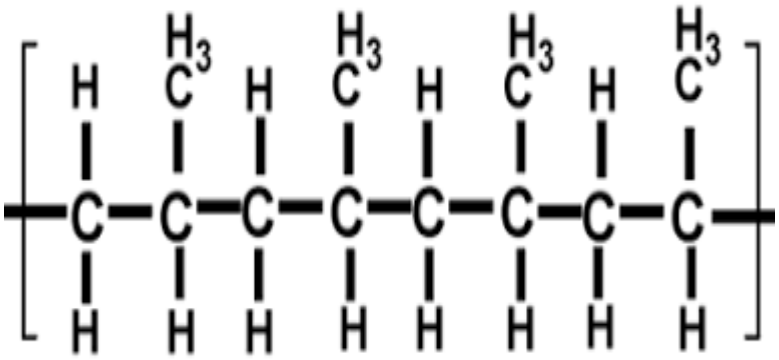
Example: but-2-ene

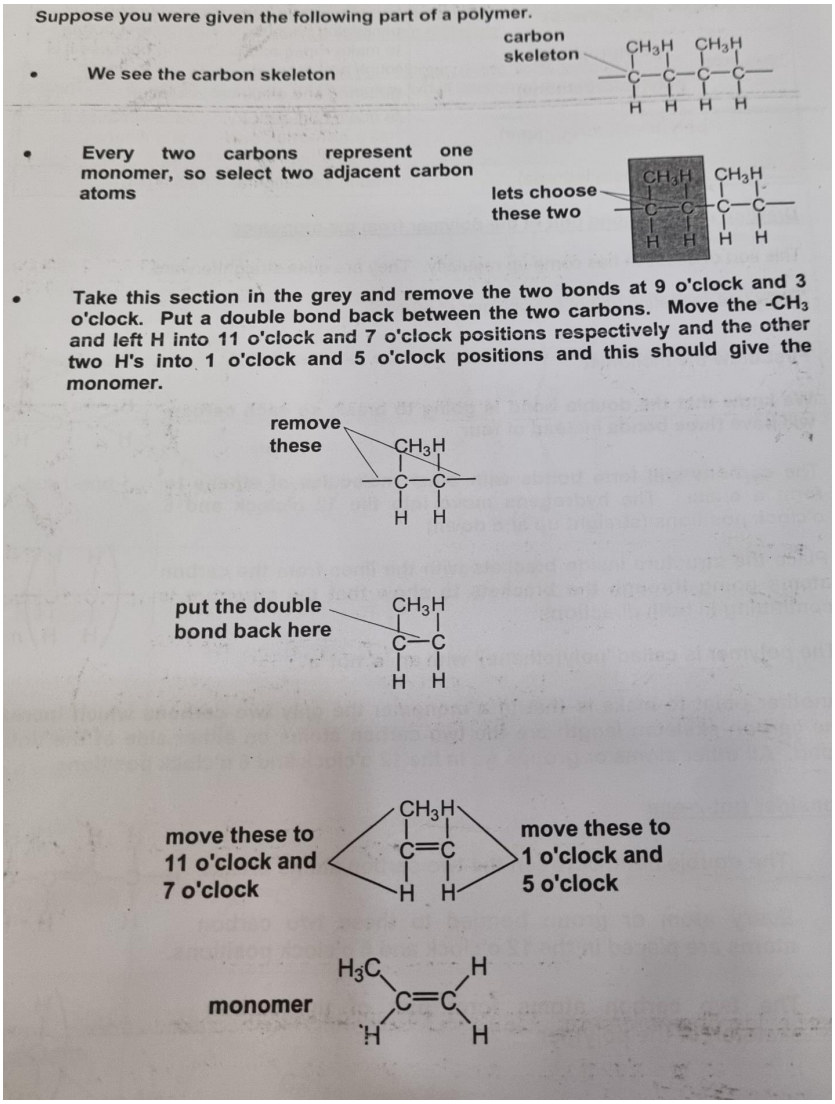


1) ***Break the double bond***
2) ***Every atom or group of atoms being bonded to carbon in the double bond are placed in the 12 o clock and 6 o clock position***
3) ***The 2 carbon atoms form part of the carbon skeleton of the polymer***

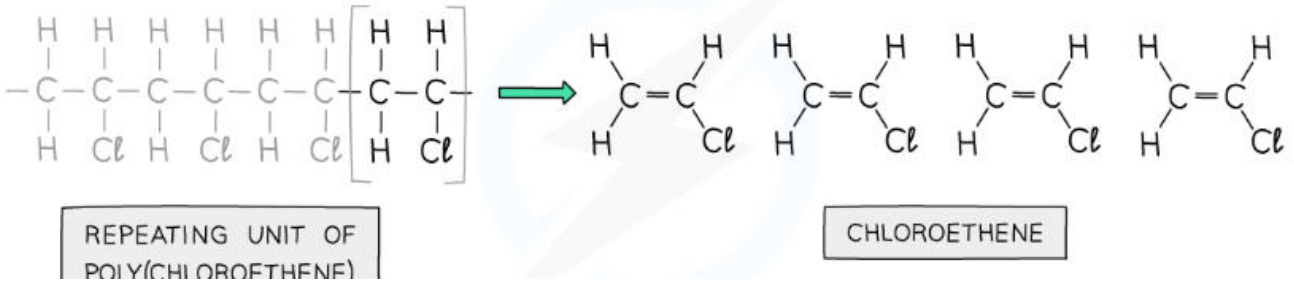


Drawing the monomer from the polymer





Note: The mass of monomer will be same as polymer as nothing is eliminated.



Condensation polymerisation:

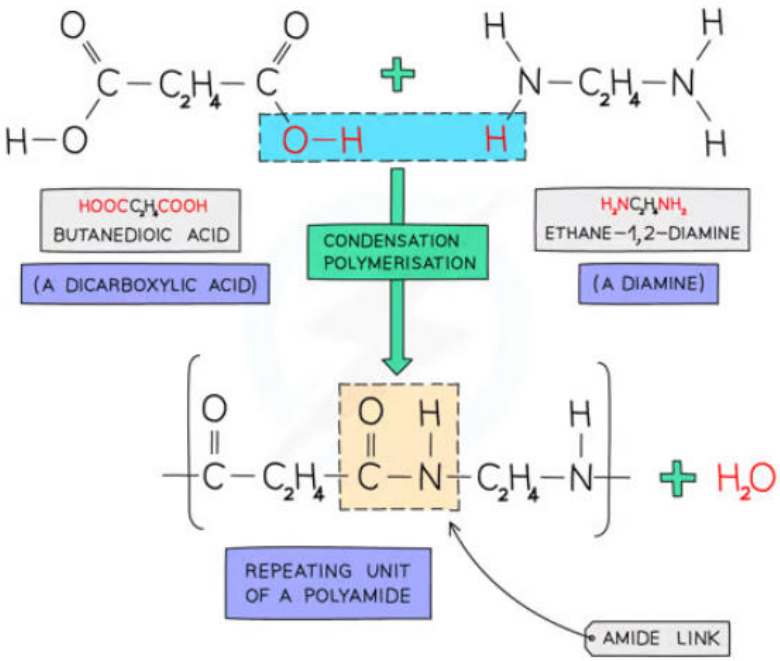
Nylon: Synthetic polyamide

Monomers: Dicarboxylic acid

Diamine

Forming Nylon

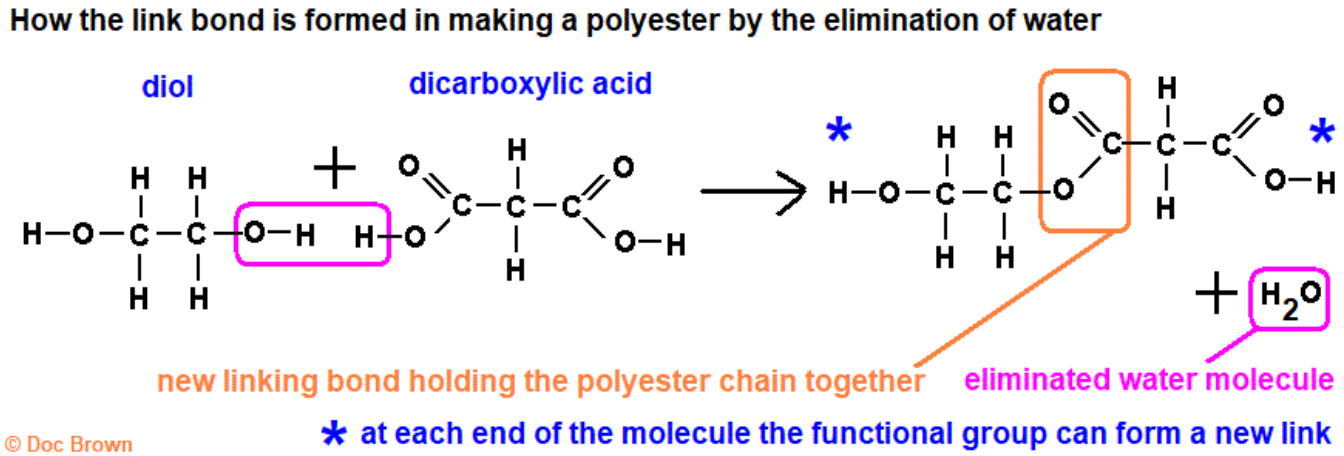
- Nylon is a polyamide made from **dicarboxylic** acid monomers (a carboxylic with a -COOH group at **either** end) and **diamines** (an amine with an -NH_2 group at **either** end)
- Each -COOH group reacts with another -NH_2 group on another monomer
- An amide linkage is formed with the subsequent loss of **one** water molecule per link

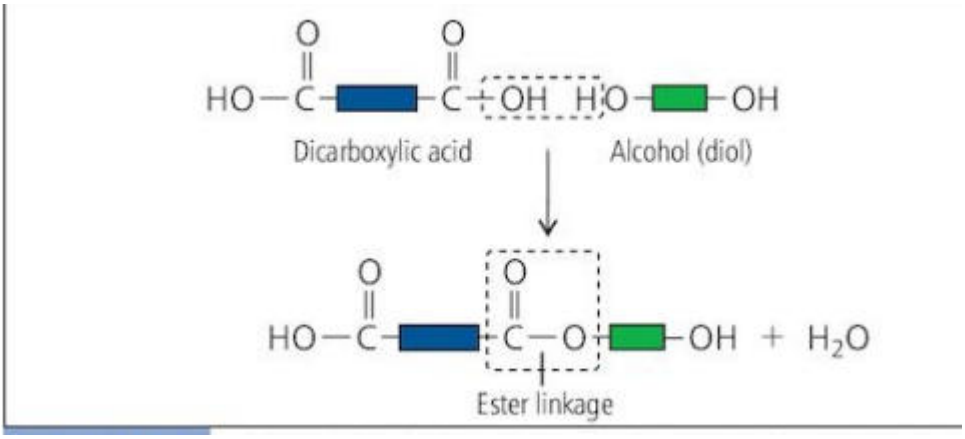


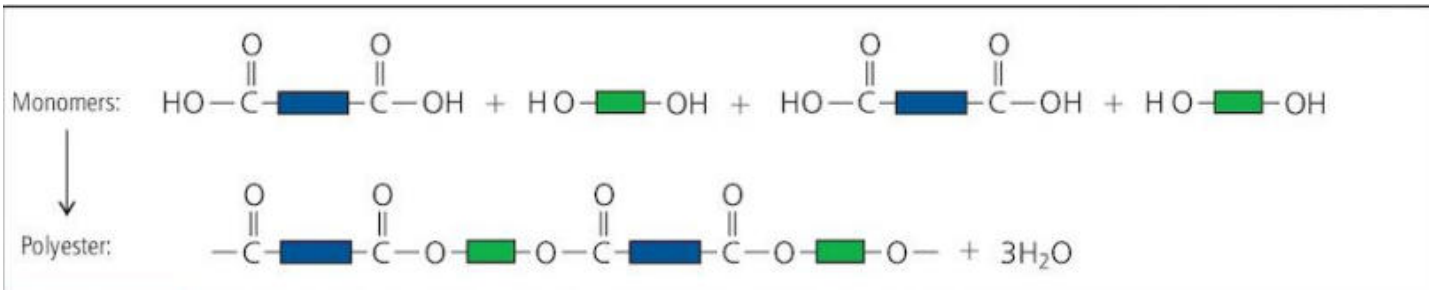
PET : Synthetic Polyester.(PET is also known as Terylene.

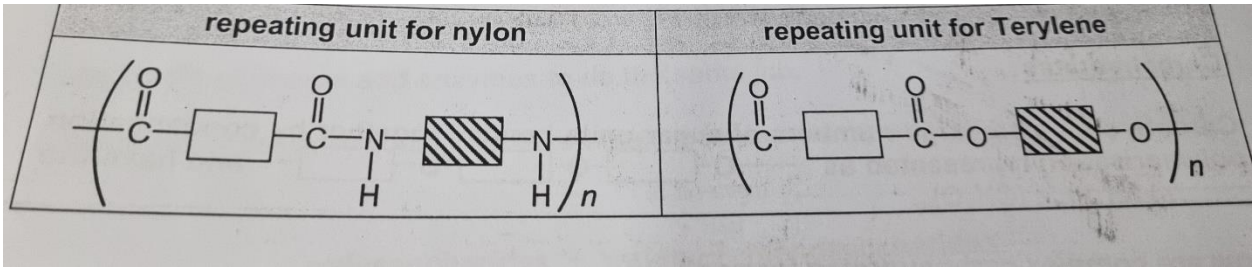
Monomers: Dicarboxylic acid

Diol









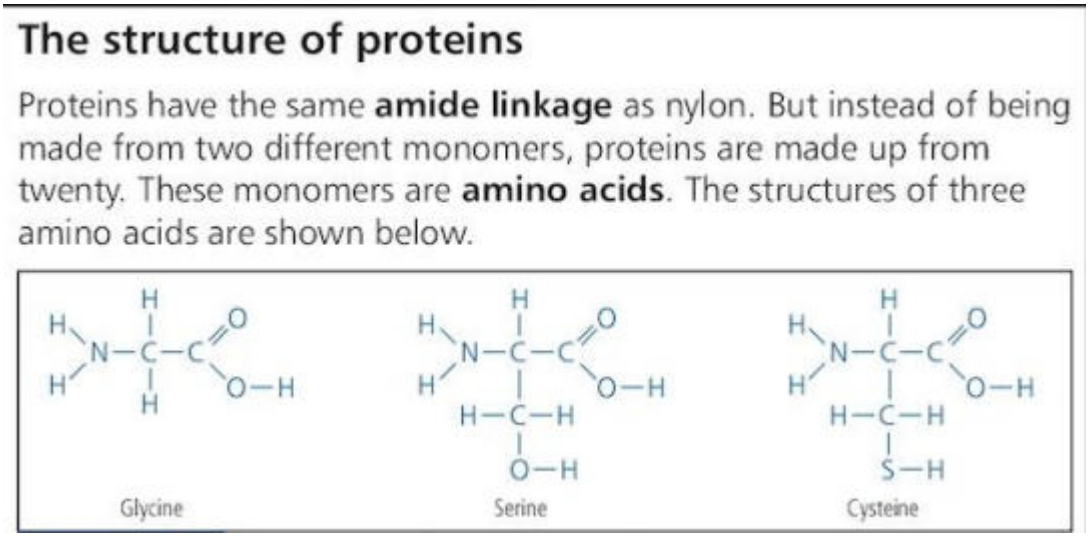
Nylon and PET are synthetic fibres. Clothes made from synthetic fibres are shrink proof and crease proof.

They are easier to wash and dry.

PET depolymerisation: (Plastic Recycling) Treatment of PET in heat to produce monomers for recycling.

Natural polymers ：Examples are proteins, Carbohydrates and Fats.

Proteins: Proteins are formed by condensation polymerisation.



The amide linkage in protein often called as peptide linkage Hence proteins are also called as polypeptides.