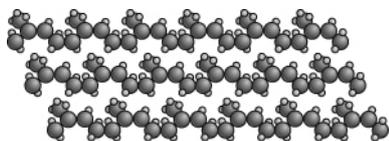


### Types of rubber

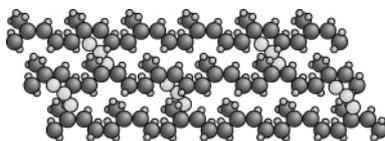
In 1839 Charles Goodyear (1800–1860) discovered that the properties of rubber could be changed by treating it with sulfur. Natural rubber is soft and flexible, but it is also easily melted. The sulfur treated (**vulcanised**) rubber was stiffer, harder-wearing and didn't melt as easily. Although harder, the vulcanised rubber was still very **elastic** and so had many more uses than the natural material.

The English inventor and entrepreneur Thomas Hancock (1786–1865) founded the rubber industry in Britain. He invented a machine that could tear up natural rubber into scraps, and stick them together in a single solid mass for remoulding into different products. He also adapted Charles Goodyear's ideas about vulcanised rubber and took out the UK patent for his process.

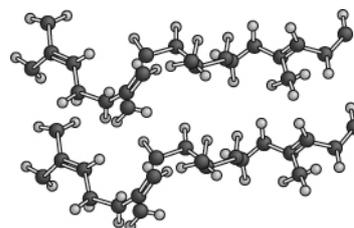
More recently a completely artificial rubber has been formed from the monomer **butadiene**. This polymer, which can be treated to have different properties, is now widely used. The bulk of the polymer is blended with natural rubber to make car tyres.



**Natural rubber molecules**



**Vulcanised rubber molecules**



**Butadiene polymer molecules**

- 1 Explain the difference between natural and synthetic materials.
- 2 What is similar about both natural and synthetic polymers?
- 3 How are most polymers formed?
- 4 Why is natural rubber not very useful for some applications?
- 5 What happens to the rubber molecules when it is vulcanised?
- 6 In what ways are the properties of vulcanised rubber different from natural rubber?
- 7 Explain why the natural rubber is soft and flexible.
- 8 Look at the structure of butadiene rubber.
  - a Would this structure make it more like natural or vulcanised rubber?
  - b Explain your answer to part a.
  - c Suggest a possible raw material source for this polymer?
  - d What would be the proper name for this polymer?
- 9 Heating is required to produce vulcanised rubber.
  - a What do you call a chemical reaction that absorbs energy?
  - b What kind of chemical reactions make the surroundings warmer?

#### I can...

- give examples of natural and synthetic polymers
- explain how the properties of a polymer depend on its structure.