

MINISTRY OF EDUCATION
SECONDARY ENGAGEMENT PROGRAMME
GRADE 11
CHEMISTRY

WEEK 12

LESSON 1

Topic: Macromolecules

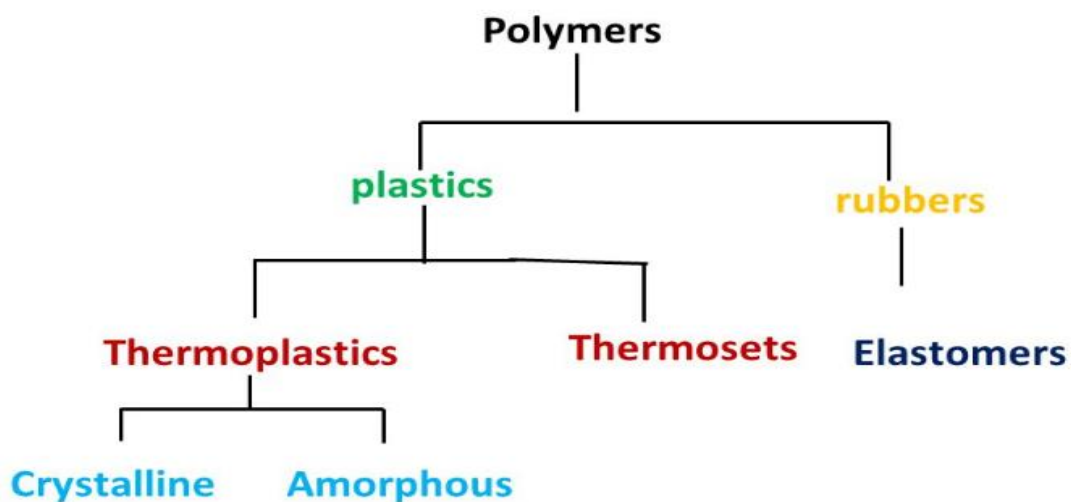
Sub-topic: Classification of Polymers

Objective: Given the information, students will at least 5 differences between thermoplastics and thermosetting plastics.

Content

Polymeric materials undergo many modifications such as the addition of stabilizers, fillers, pigments and dyes. These reduce the cost and enhance the appearance of the finished products. Plastics are classified as thermoplastics and thermosets, depending in their behavior when heated.

Classification of Polymers based on Molecular Forces



Note: You only need to know about thermoplastics and thermosets


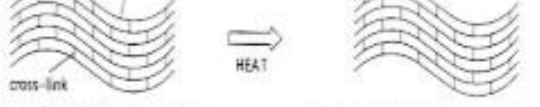
Thermoplastics

Thermoplastic polymers are long-chain polymers in which inter-molecular forces (Van der Waal's forces) hold the polymer chains together. These polymers when heated are softened (thick fluid-like) and hardened when they are allowed to cool down, forming a hard mass. They do not contain any cross bond and can easily be shaped by heating and using moulds. A common example is Polystyrene or PVC (which is used in making pipes).

iii) Thermosetting

Thermosetting plastics are polymers which are semi-fluid in nature with low molecular masses. When heated, they start cross-linking between polymer chains, hence becoming hard and infusible. They form a three-dimensional structure on the application of heat. This reaction is irreversible in nature. The most common example of a thermosetting polymer is that of Bakelite, which is used in making electrical insulation.

Differences between Thermosetting and Thermoplastics

THERMOPLASTIC	THERMOSET
<ul style="list-style-type: none">• These are made from polymers without cross-linking between their chains.• The intermolecular forces between the chains are relatively weak (compared to thermosets with covalent cross-links).• The attractive forces in the thermoplastics can be broken down by warming.• The chains are able to move over each other and the polymer can be deformed.• On cooling, the weak forces between the polymer reform and the thermoplastic holds its new shape.• Examples of thermoplastics are polythene and nylon.	<ul style="list-style-type: none">• These polymers have lots of cross-linking between the different polymer chains.• These cross-links make the chains much stronger than in thermoplastics.• The attractive forces cannot be broken by warming.• The chains cannot move relative to each other and the polymer cannot change shape.• If heated, the polymer just chars and burns. Bakelite is an example of a thermoset.
 <p>Thermoplastic: no cross-linking</p> <p>Weak forces between polymer chains easily broken by heating; polymer can be moulded into new shape.</p>	 <p>Thermoset: extensive cross-linking</p> <p>Strong covalent bonds between polymer chains cannot be easily broken; polymer keeps shape on heating.</p>

Polymers and their uses.

Polyalkenes

- 1) Polyethene -which is made from the monomer ethane- used for packaging, manufacture of toys, kitchenware, food containers, buckets, plastic film and bags.
- 2) Polyvinyl chloride- insulation for electrical wires; as building material eg guttering.
- 3) Polypropene- manufacture of ropes, food containers, washing up bowls.
- 4) Polystyrene- packaging and insulation.

Polyamide- manufacture of fibres for clothing, ropes, fishing, fishing lines.

Protein- building body cells, hair and nails, making enzymes.

Polyester- manufacture of fibres for clothing, boat, boat sails, fishing lines

Polysaccharide- stored as food reserves in living organisms eg starch in plants, glycogen in animals.

References

10. <https://www.toppr.com/guides/chemistry/polymers/classification-of-polymers/>
11. <https://slideplayer.com/slide/6019693/>
12. <https://www.bbc.co.uk/bitesize/guides/z3v4xfr/revision/6>