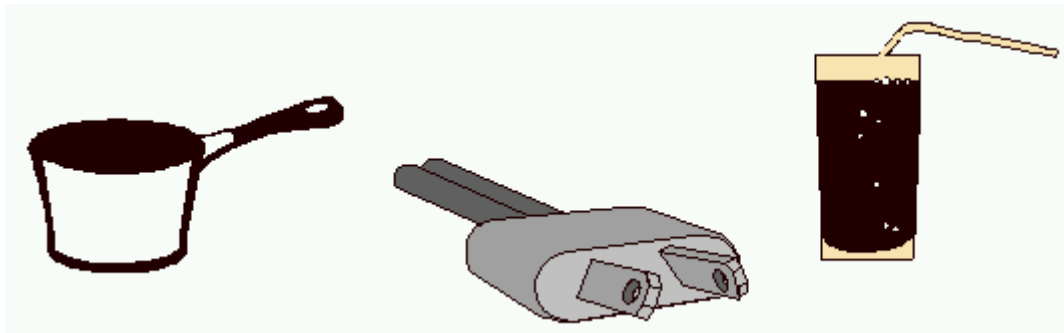


# Plastics

## ADVANTAGES AND DISADVANTAGES OF PLASTICS

<i>NAME OF PLASTIC</i>	<i>USE</i>	<i>ADVANTAGES</i>	<i>DISADVANTAGES</i>
Polyester	Clothing	Light, cheap, flexible	Flammable, easily melted, polluting due to slow decomposition
Polystyrene	Packaging foam, insulation in eskies		
Polythene	Plastic shopping bag		
PVC (polyvinyl chloride)	Plumbing pipe		
Perspex	Glass alternative		
Epoxy resin	Glue		
Bakelite	Saucepan handle, light switch		



### WHAT ARE POLYMERS AND PLASTICS?

- ◆ Polymers are long-chain molecules. They may be natural (e.g. silk, wool, protein) or synthetic (e.g. polyester).
- ◆ Plastics are flexible synthetic long – chain molecules (polymers). They are made from joining many smaller molecules (monomers) together. The raw materials for making plastics come from crude oil and the petrochemical industry.
- ◆ Examples of Plastics include bakelite, nylon, polyester and PVC (polyvinyl chloride).

### HOW ARE PLASTICS MADE?

- ◆ Polymerisation is the chemical reaction that joins repeating units called monomers together to form polymers. There are two types of polymerisation reactions.
- ◆ Two Polymerisation Reactions:
  1. *Addition Polymerisation* occurs when the double bonds of hydrocarbons called alkenes are broken, and then joined into a long – chain molecule (e.g. Many ethene molecules join to form polyethene in plastic bags).
  2. *Condensation Polymerisation* occurs when two types of monomers join to form a long – chain polymer and water is given off (e.g. Many molecules of urea and formaldehyde are joined to form glue).

### QUESTIONS

1. What are 2 natural polymers? \_\_\_\_\_

2. What are 2 synthetic or man-made polymers? \_\_\_\_\_

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3. Proteins are made of smaller units called amino acids. Which is the monomer and which is the polymer? \_\_\_\_\_

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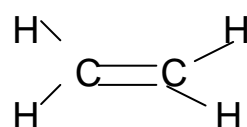
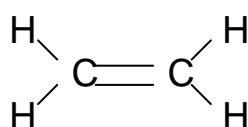
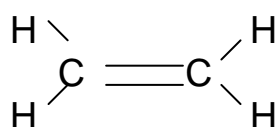
4. Polythene (actually it is polyethene) is made of many ethene molecules. Which is the monomer and which is the polymer? \_\_\_\_\_

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5. Of what smaller monomers is PVC (polyvinyl chloride) made? \_\_\_\_\_

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6. In addition polymerisation, alkenes such as ethene are joined. First, the double bonds are broken and then all the ethene molecules are joined into a very long chain. Using the monomers of ethene as a guide, draw a portion of the long-chain polymer called polythene.



SOME PLASTICS MELT AND SOME DON'T –  
WHAT ARE THE TWO TYPES OF PLASTICS ?

- ◆ Thermoplastics consist of long chains with no cross – links that allow the molecules to slide over each other when heated. This allows them to be moulded into new shapes. Common examples are polyethene in plastic bags, nylon, polyvinyl chloride (PVC), perspex and polystyrene.
- ◆ Thermosetting Plastics have cross-linking between many molecules and they cannot slide over each other. Once they are first set into a certain shape, they cannot be remoulded. If they are heated, they will not melt but will eventually burn. Common examples are bakelite in light switches and saucepan handles, polyurethanes and epoxy resins.

## WHAT ARE THE 3 WAYS OF SHAPING PLASTICS ?

Plastics can be moulded into objects in 3 main ways:

1. Injection moulding
2. Extrusion
3. Blow moulding

### Injection Moulding

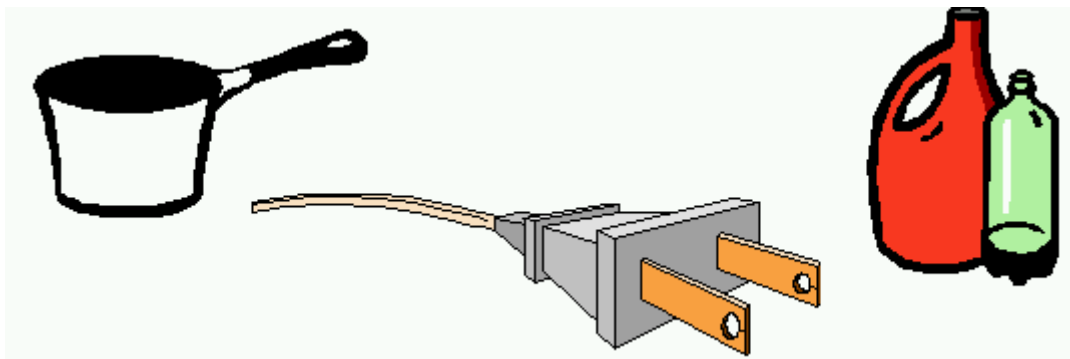
- ◆ Injection moulding consists of heating a thermoplastic and injecting it into a mould where it cools and hardens into the new object.
- ◆ This process is fast and economical for producing large numbers of objects.
- ◆ Injection moulding leaves a small line on the object where the mould splits to allow the object to be taken out.
- ◆ Examples: cups, bottle caps, dessert bowls

### Extrusion

- ◆ Softened thermoplastics are forced through an opening in a piece of metal called a die. Once through the die, the plastic cools and hardens.
- ◆ The shape of the die determines the cross-section of the object.
- ◆ Examples: pipes, tubes, straws and plastic rods

### Blow Moulding

- ◆ A small amount of thermoplastic is softened by heating, and then expanded by compressed air to fill the walls of a mould.
- ◆ Blow moulding is fast and economical for making hollow items.
- ◆ Examples: softdrink bottles



QUESTIONS

7. What type of plastic melts when heated and can be reshaped?

\_\_\_\_\_

8. What type of plastic does not melt but will eventually burn if heated sufficiently? \_\_\_\_\_

9. Which plastic type – thermoplastic or thermosetting plastic – is best for plumbing pipe, the plastic of an electric hairdryer, a haircomb and a drinking straw? \_\_\_\_\_

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10. Match the following:

- |                       |                        |
|-----------------------|------------------------|
| A. extrusion          | X. plastic milk bottle |
| B. injection moulding | Y. bathroom pipes      |
| C. blow moulding      | Z. drinking cup        |

11. At 'Fast Fred's Fabulous Feast' takeaway shop, you buy a hamburger in an enclosed polystyrene container and a Coke in polyethene plastic cup with a lid and a straw. Describe how these packaging products are made. \_\_\_\_\_

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