

# Plastics Module

Polymer technology explained using text and animations

# ***Plastics Technology***

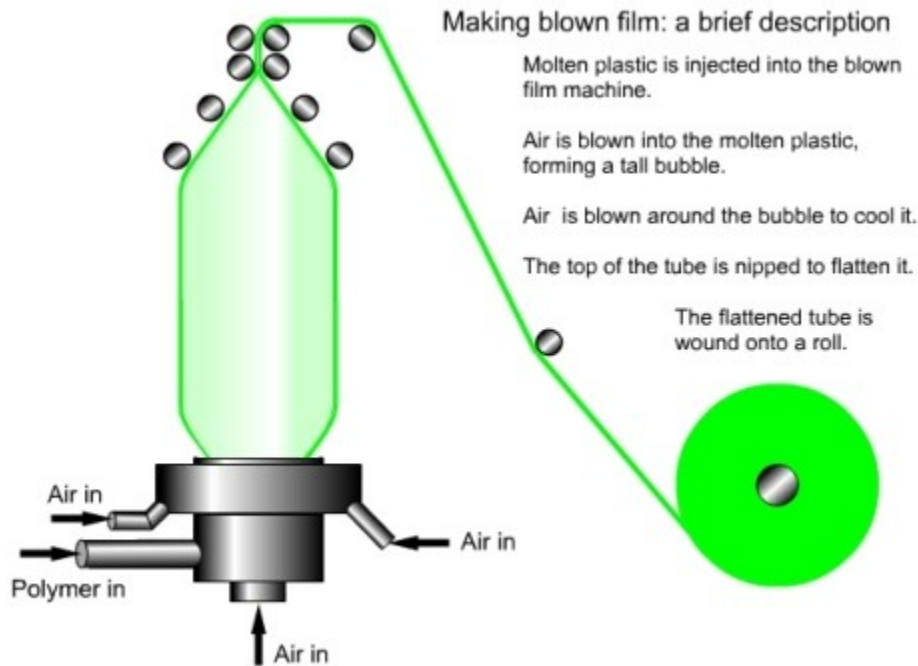
***This “Plastics Module” covers the plastics technology specifications for KS3 and GCSE courses, including:***

- ***Structure, composition and properties of polymers***
- ***Polymer composites***
- ***Formulae of common polymers***
- ***Hazards – polymers leaching chemicals***
- ***Sustainability***
- ***Recycling***
- ***Abbreviations of polymers***

# ***Animations of Processes***

- ***Blown film***
- ***Calendering***
- ***Compression moulding DMC***
- ***Compression moulding SMC***
- ***Compression moulding thermoplastics***
- ***Expanded polystyrene***
- ***Extrusion blow moulding***
- ***Filament Winding***
- ***Glass reinforced plastic GRP***
- ***Hot wire cutting***
- ***Injection moulding***
- ***Injection blow moulding***
- ***Injection moulding - gas assisted***
- ***Line bending introduction***
  - ***line bending animation***
  - ***line benders***
  - ***jigs for line bending***
  - ***plastics used for line bending***
- ***Plastic Memory***
- ***Plastic coating***
- ***Pultrusion process***
- ***Resin casting and encapsulation***
- ***Resin transfer moulding***
- ***Rotational moulding***
- ***Vacuum forming***

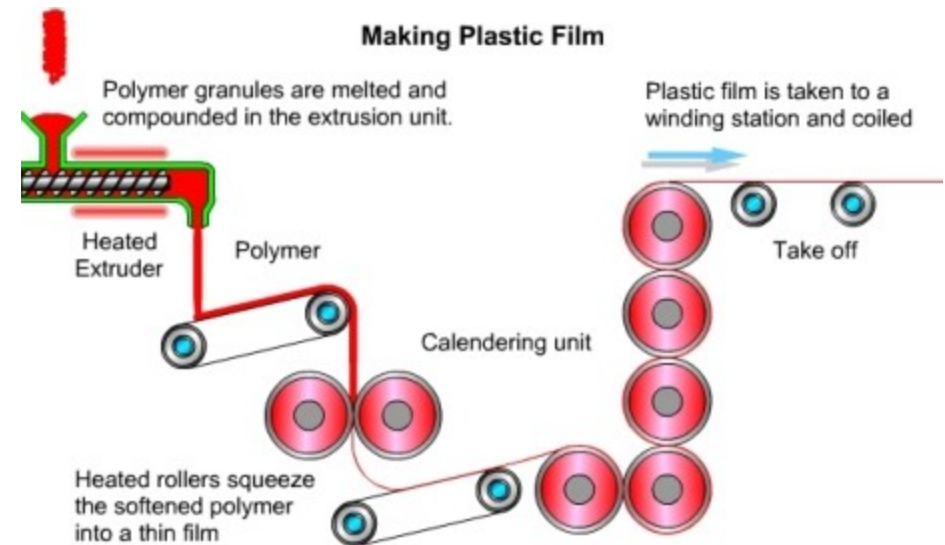
## ***Blown Film***



### ***Blown film process –***

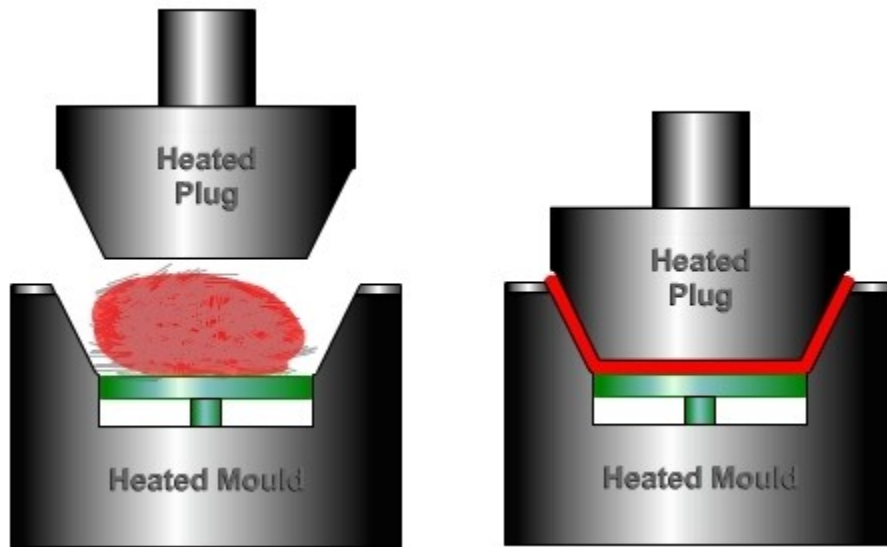
***clear notes and animations  
are used to explain how  
blown film is made***

## ***Calendering***



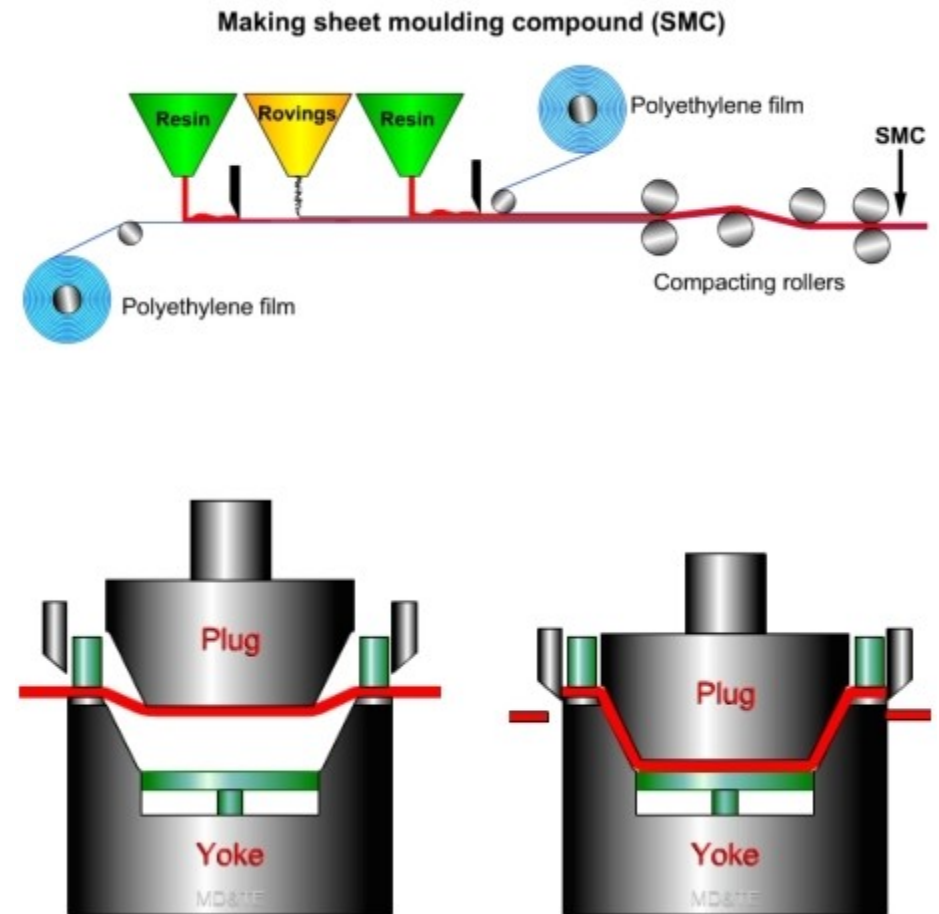
***Notes and animations are used  
to show how calendering  
processes are used on sheet  
materials to reduce thickness  
and to produce various finishes***

## *Compression Moulding DMC*



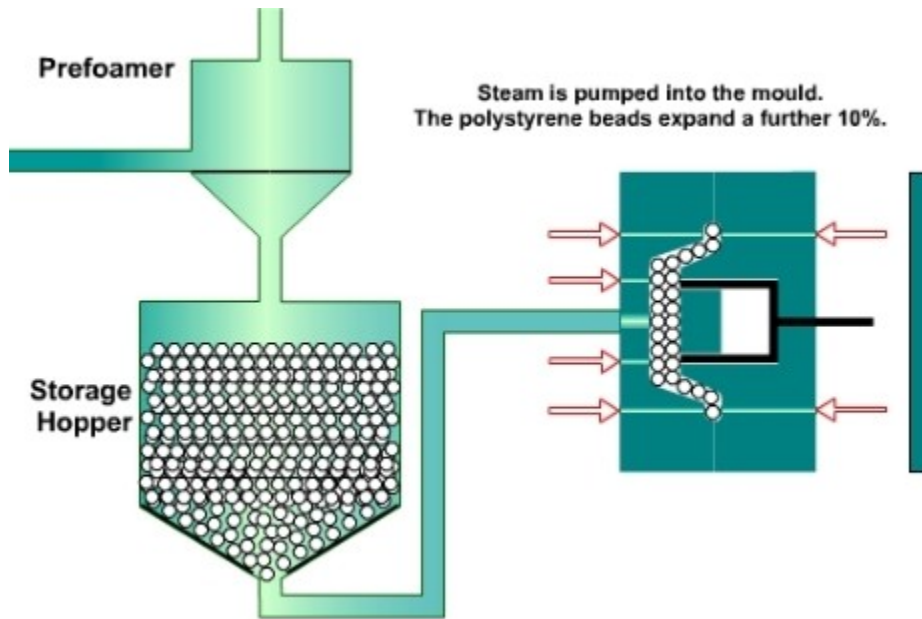
*Compression moulding of dough moulding compound (DMC) explained using notes and animations*

## *Compression Moulding SMC*



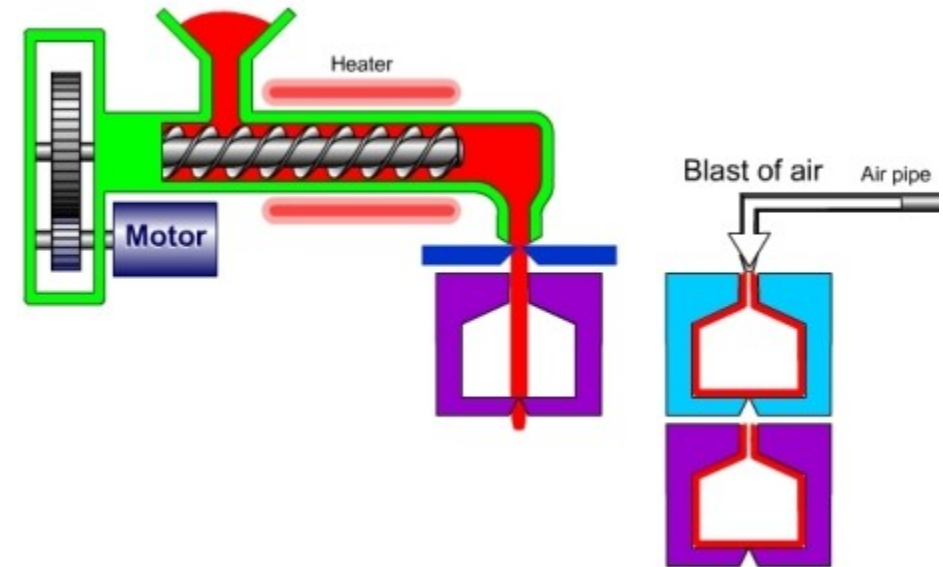
*Making and moulding sheet moulding compound (SMC)*

## ***Expanded Polystyrene***



***Animation illustrates how expanded polystyrene products are made from expandable polystyrene beads***

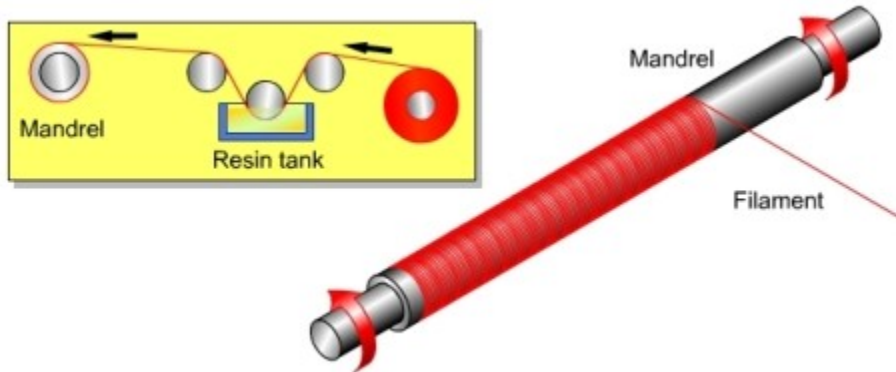
## ***Extrusion Blow Moulding***



***Extrusion blow moulding process made easy to understand***

***Technology made easy to learn***

## ***Filament Winding***

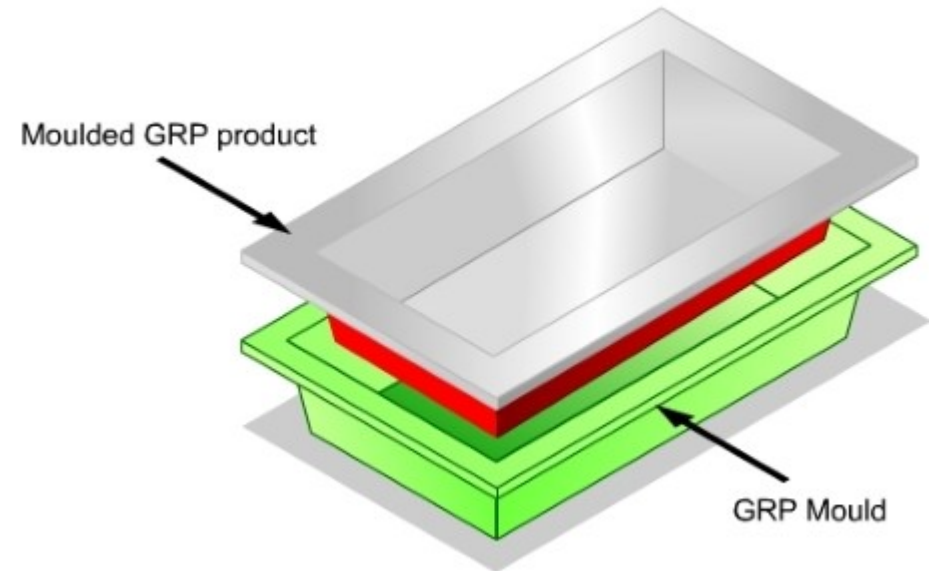


### ***Plastics Module:***

***Students given information  
in a way they understand.***

***Polymer composite hollow  
products produced by the  
filament winding process***

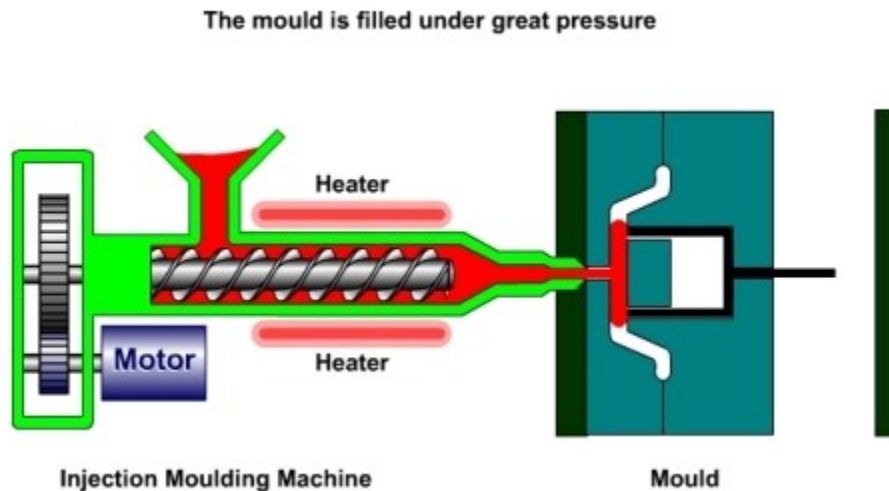
## ***Hand Layup of GRP***



***Step by step animation and  
PDF diagrams of the process  
of making GRP products***

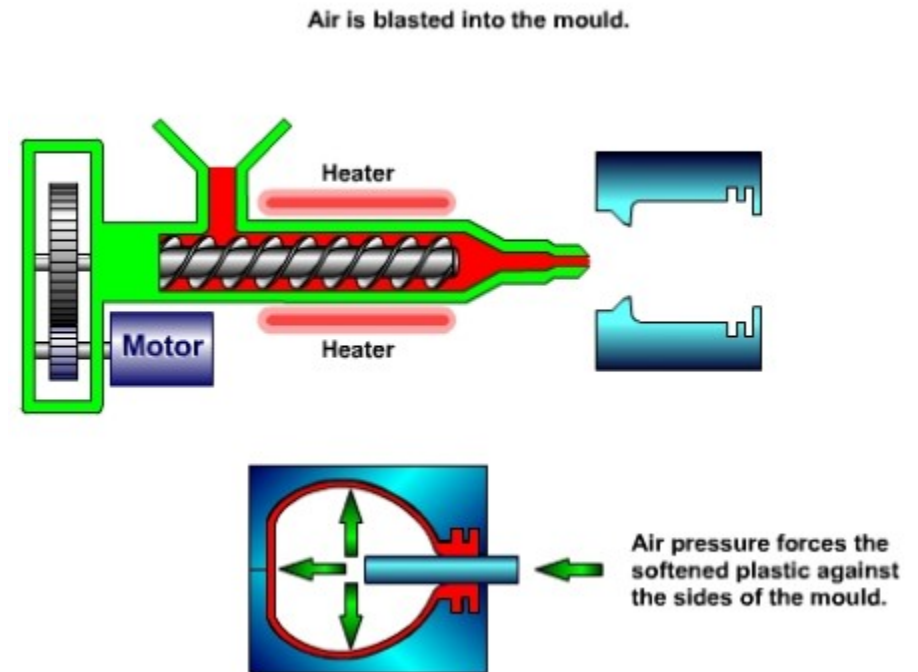


## *Injection Moulding*



*Injection moulding:  
animation of stages  
of moulding a product*

## *Injection Blow Moulding*

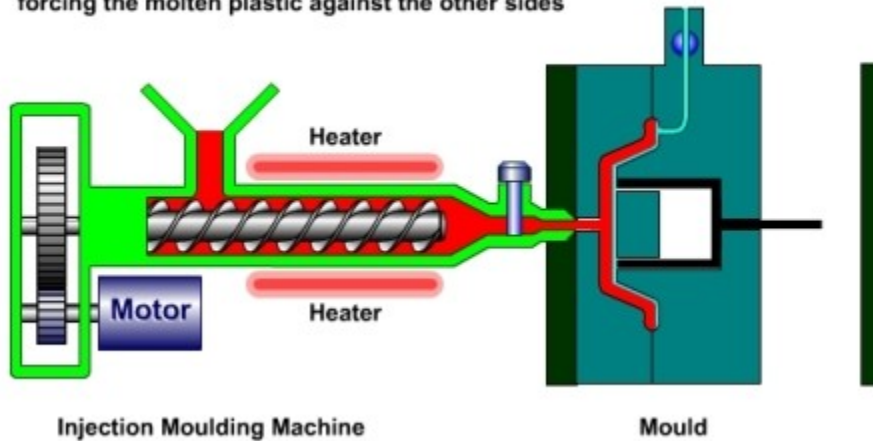


*Making hollow plastic products  
using the injection blow  
moulding process*

***The “Plastics Module” covers all plastics technology specs for KS3 & GCSE***

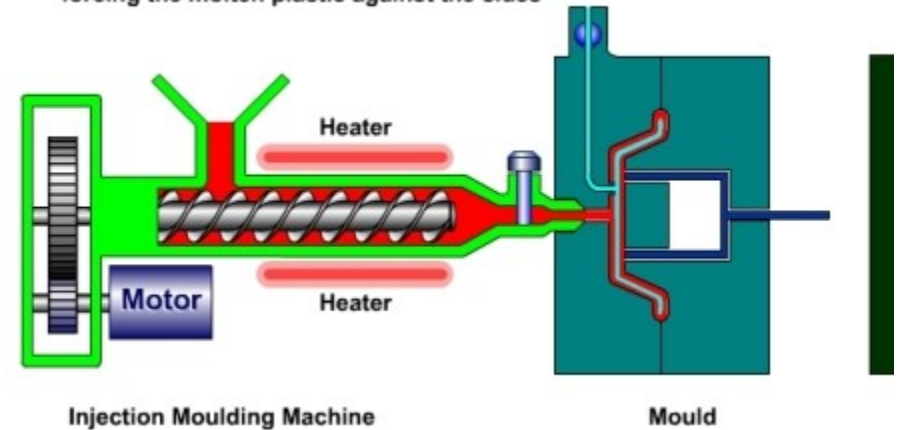
## ***Gas Assisted Injection Moulding (External method)***

Nitrogen gas is pumped into one side of the mould, forcing the molten plastic against the other sides

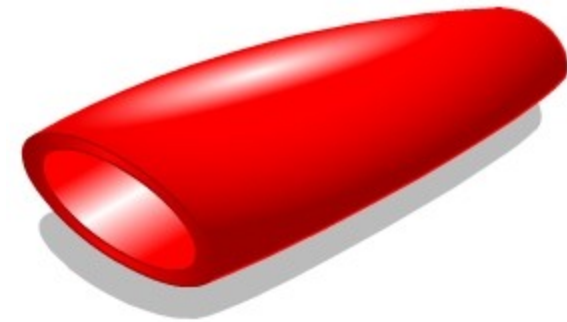


## ***Gas Assisted Injection Moulding (Internal method)***

Nitrogen gas is pumped into the mould, forcing the molten plastic against the sides



***Animations illustrates how  
gas is used to force molten  
polymer against the internal  
sides of moulds in gas assisted  
injection moulding***

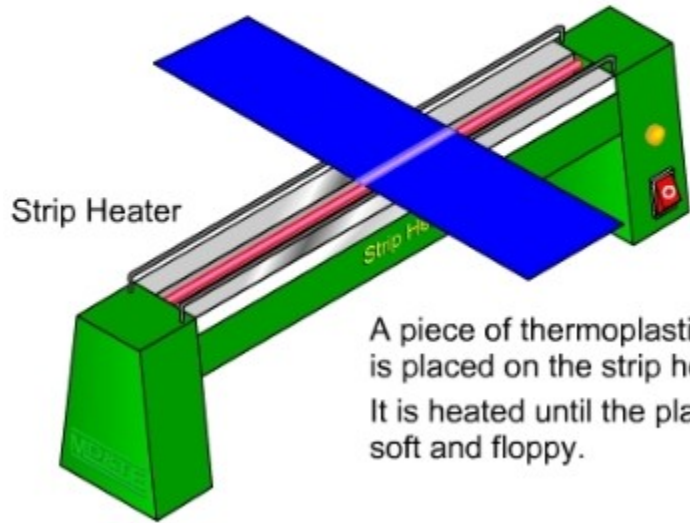


***Hollow plastic products made  
by this moulding process***

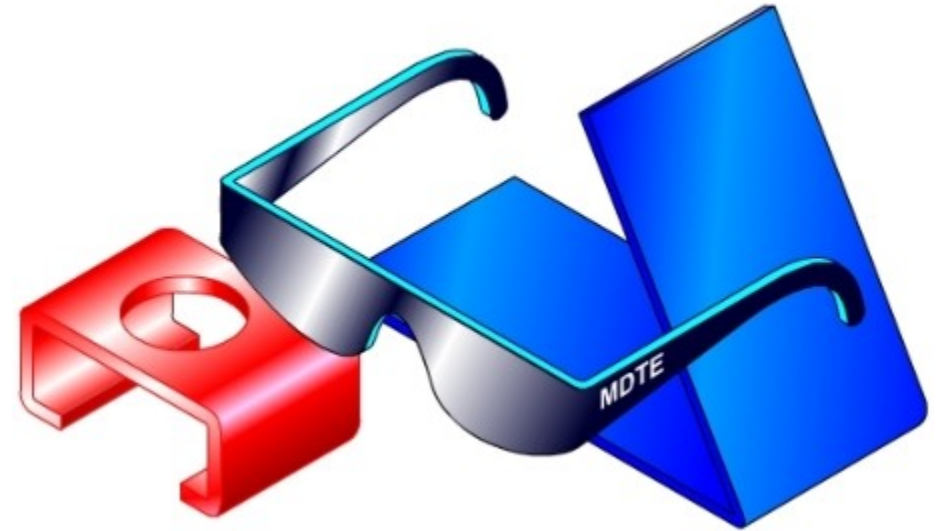


# ***Line Bending***

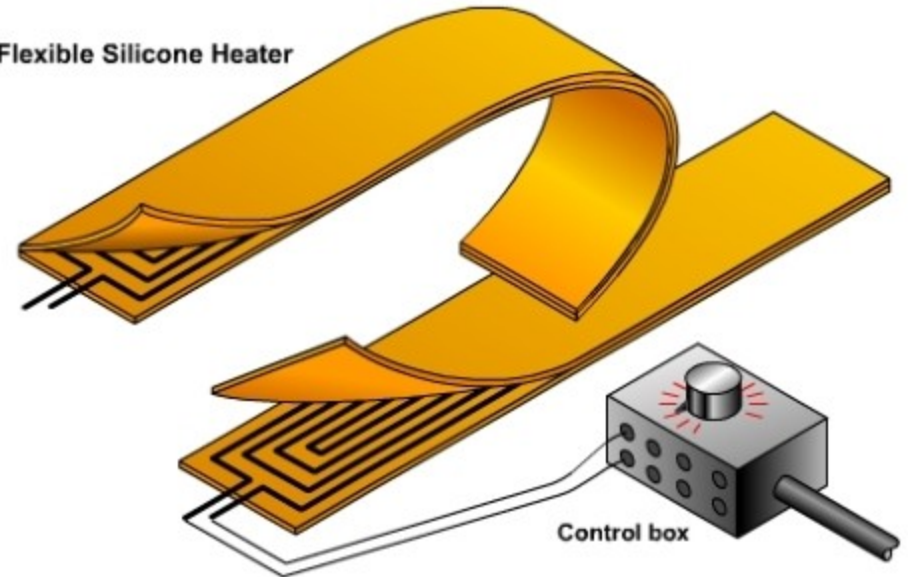
Heat until soft → Bend → Hold until cool



A piece of thermoplastic sheet material is placed on the strip heater. It is heated until the plastic becomes soft and floppy.

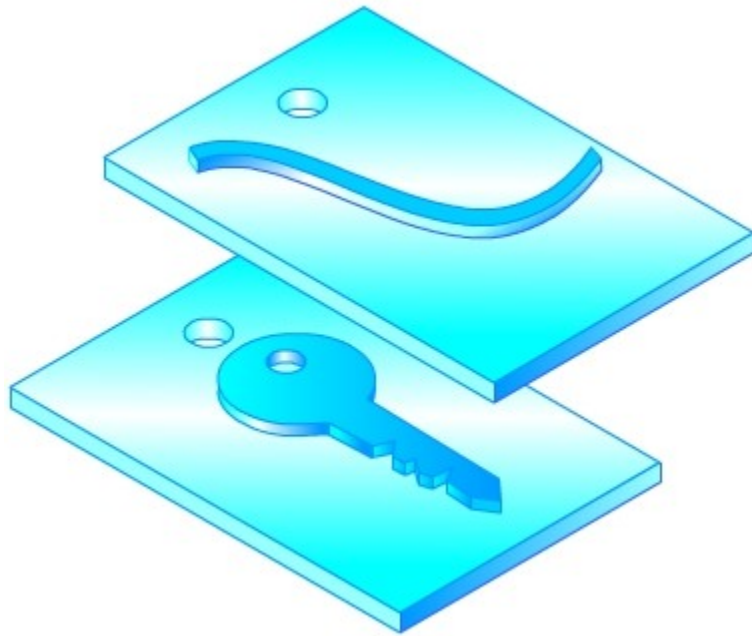


**Flexible Silicone Heater**



***Line bending is clearly explained using notes and sketches and Flash animations***

## ***Plastic Memory***



### ***Plastics Memory –***

***what it is and  
how it can be used***

## ***Plastic Coating***

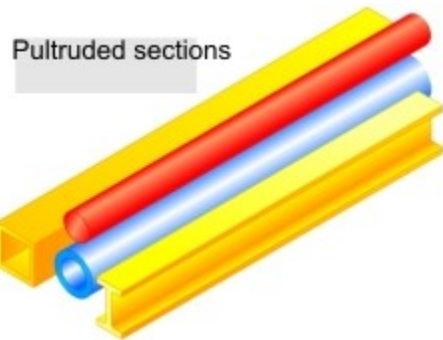
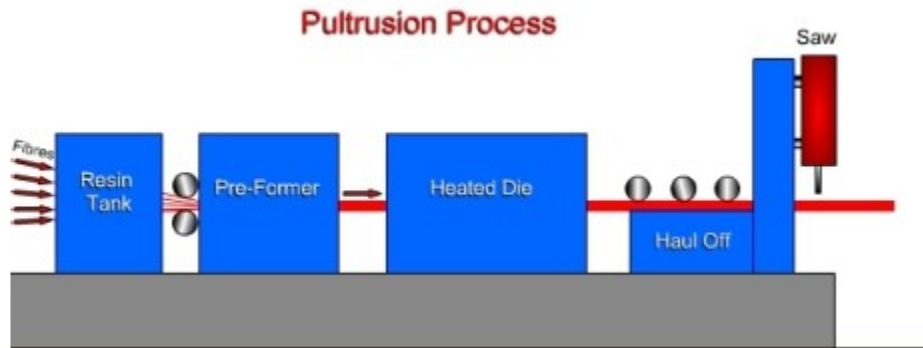


### ***Plastic coating using:***

- ***fluidised polymer powder***
- ***Plastisol***

***Plastics Module:  
Focused practical tasks & design and make assignments***

## ***Pultrusion***



***Students learn how polymer composites are made using the pultrusion process***

## ***Resin Casting***

***Casting process***

***Cast products***



***Moulds***

***Resins***

***Additives***

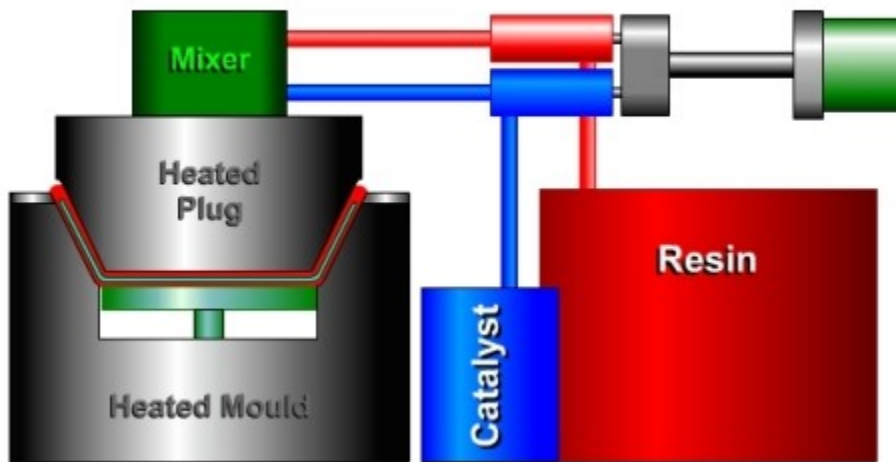
***Encapsulation***



***Plastics Module: software, PDF notes and exercises***

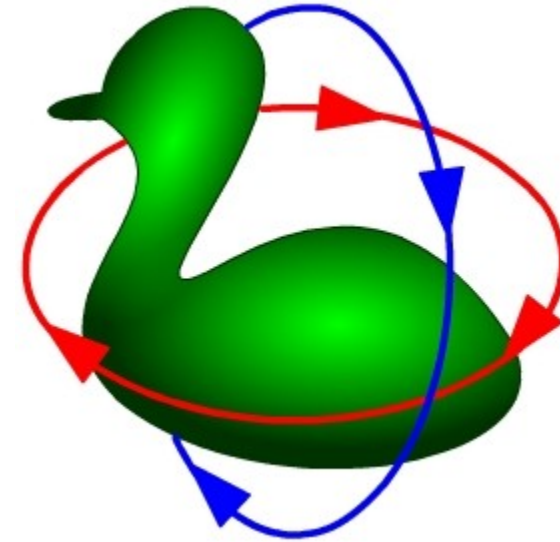
## ***Resin Transfer***

Making a moulded glass reinforced plastic (GRP) product



***Resin transfer moulding  
with and without fibre  
reinforcement explained***

## ***Rotational Moulding***

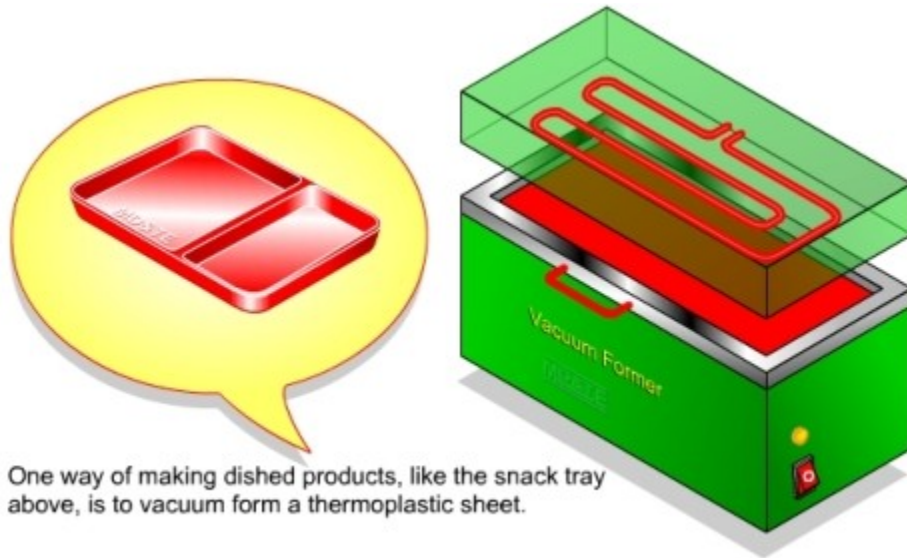


***Rotational moulding of  
thermoplastics and thermosets  
explained using D&T notes  
and animations***

***Our animations make technology easier to learn***



## ***Vacuum Forming***



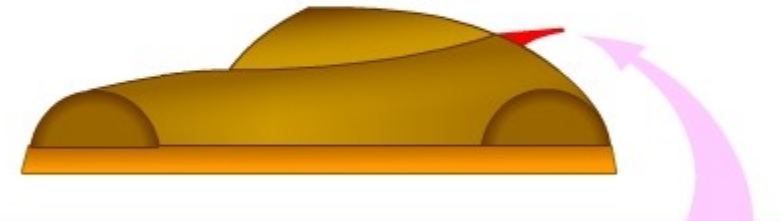
One way of making dished products, like the snack tray above, is to vacuum form a thermoplastic sheet.

***Stages of vacuum forming thermoplastic sheet materials explained using animations and easily printed A4 PDFs.***

## ***Using clay or resistant material moulds***

... model irregular shapes in clay on an MDF base.

Vacuum form over the pattern while the clay is still soft enough to be scraped from the vacuum formed plastic.



Beware of making shapes that would stretch the vacuum formed plastic too much and cause wrinkling.

***Students guided step by step through the stages of vacuum forming***


## 21 Exercises in digital and PDF format

**NOTE** Plastic Memory Pendant

Pendants and key fobs with a raised design (called a relief) can be made using a characteristic of acrylic called "plastic memory".

The process involves pressing a metal shape into a piece of acrylic that has been softened by heating.

1. Choose a metal shape.
2. Heat a piece of 6mm. thick acrylic until it is soft and floppy.



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**Brief**

Make an acrylic pendant or key fob that has a raised design (relief).

**Specification**

The pendant/key fob must:

- be made from 6mm thick acrylic sheet
- have a raised design (relief), created using plastic memory.

**Resources required**

- A pendant/key fob sized piece of 6 mm thick acrylic
- An oven to heat the acrylic
- A selection of wires, e.g. brazing rod, welding rod.
- A jig to hold the acrylic while it is being abraded.
- An abrading tool, e.g. a sander and whole sheets of glass paper or wet and dry paper for finishing the machine abraded acrylic face.
- Wire for jump rings.

**What you must do**

1. Heat a your pendant/key fob sized piece of acrylic until it is soft and floppy.
2. Make an interesting shape in steel or brass wire, or choose a flat product e.g. a key.
3. Place the wire shape on the heated and softened acrylic and sandwich it between two MDF pads.
4. Squeeze the pads together in a vice or in a press so that the wire shape is forced into the acrylic.
5. Hold the pads tightly until the acrylic is cold.
6. Remove the wire.
7. Remove the surface layer of the acrylic to the depth of the groove formed by the wire.
8. Reheat the acrylic.
9. File the edges of the pendant until they are smooth, drill a hole for a jump ring.
10. Evaluate the final product, e.g.:
  1. how good the design looks
  2. how well the design works
  3. discover what others think about your product.
11. Work safely and complete the assignment on time.

**CLEAPSS**

Please refer to CLEAPSS, Model Risk Assessments for Design and Technology in Secondary Schools and Colleges, Part 1 653 COSHH Regulations.

**with stated learning objectives and success criteria**

## Plastics Module Exercises

- **Line bending DMA - Toothbrush rack**
- **Line bending DMA - Picture holder**
- **Line bending DMA - Egg holder**
- **Line bending DMA - CD rack**
- **Line bending DMA - Display stand**
- **Line bending DMA - Leaflet stand**
- **Line bending DMA - Desk tidy**
- **Line bending DMA - Sticky tape holder**
- **Line bending DMA - Sun glasses**
- **Vac forming DMA - Remote controlled car**
- **Vacuum forming DMA - Snack tray**
- **Vac. forming DMA - Bedroom door buzzer**
- **DMA - New design for a tong or clip**
- **Compression Moulding - focused p.t.**
- **Plastic memory pendant - focused p.t.**
- **Dip coating - focused practical task**
- **Hot wire cutting DMA - Polystyrene sign**
- **Funny face festive decoration**
- **Making plastic bottles - questions**
- **Children's plastic tableware - questions**
- **Plastics crossword**



## Funny Face Festive Decoration

### Objectives

Students will develop a design that satisfies the requirements of the brief.

By the end of the assignment, students should be able to:

- symmetrical design
- thermoplastic sheet materials
- vacuum forming
- line bending
- patterns for vacuum forming
- patterns for line bending
- plastics sheet materials
- hot parts of a circuit
- research materials
- Crocodile Clips
- circuits are safe
- components

### Success criteria

Each student:

- knows how to use thermoplastic sheet materials
- has designed a festive decoration
- has used vacuum forming and/or line bending processes
- knows that a flashing lamp circuit can be switched on and off
- knows that either:
  - have a circuit holder that encloses and hides the circuit or
  - the circuit should be visible and should be a feature of the decoration
- knows that the decoration must be safe to use
- knows that the decoration must fall apart in use
- knows that the decoration must be dangerous to use
- has made a festive decoration
- has used vacuum forming and/or line bending processes
- has assessed the risks of the design
- has researched materials
- has used Crocodile Clips
- has made a circuit
- shows evidence of research

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## A Polystyrene Sign

### Funny Face Festive Decoration

#### Situation

Shops, public areas and homes are often decorated during festive occasions.

#### Design brief

Design and make a festive decoration that includes:

- a funny face
- a flashing lamp or flashing LED



#### Specification

The funny face flashing lamp decoration must:

- be made from thermoplastic sheet materials
- must be made using vacuum forming and/or line bending processes
- include a flashing lamp circuit that can be switched on and off
- either:
  - have a circuit holder that encloses and hides the circuit or
  - the circuit should be visible and should be a feature of the decoration
- be safe to use.

The funny face flashing lamp decoration must not:

- fall apart in use
- be dangerous to use.

#### What you must do

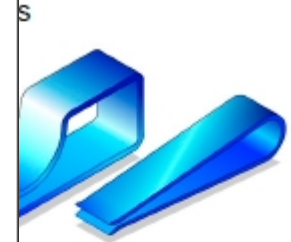
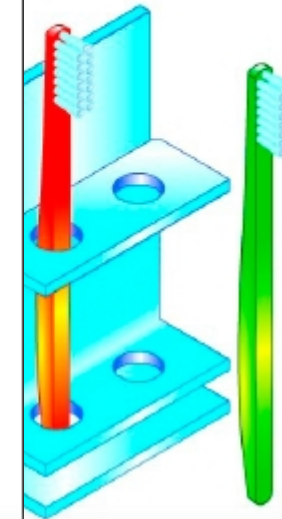
1. Analyse the design brief and specification and pick out the essential requirements.
2. Plan the design of the decoration.
3. Record your designs using notes and sketches and any other appropriate media.
4. Make the funny face part of the design by vacuum forming and/or cutting out a shape and line bending thermoplastic sheet material.
5. Model a flashing lamp/flashing LED circuit using "Crocodile Clips" or similar software.
6. Decide whether the flashing lamp/LED circuit will be hidden or exposed.
7. Build your flashing lamp/flashing LED circuit.
8. If your circuit will be hidden, make your circuit box.
9. Assemble the circuit, circuit box and funny face.
10. Evaluate the final product, e.g.:
  1. how good the design looks
  2. how well the design works
  3. discover what others think about your product.
11. Prepare a Risk Assessment of the hazards involved with making and using your product.
12. Work safely and complete the assignment on time.

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storing tooth brushes is in a rack.



from an acid bath, lifting circuit boards

from Technology lessons, clipping

to show how it was made, how it works,

to show a special tong or clip.

to show a chosen situation.

to show a tong or clip to the panel of experts (your

to show the competition

to show not break easily

to show the essential requirements.

to show the requirements of

to show that the product should have sufficient detail so that it

to show that the product should be made to meet the requirements.

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# Digital worksheets for computers

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## Plastic tableware for children

### Children's Tableware

In this exercise, you will be looking at the design of children's tableware.

You will have to consider the needs of young children, their likes and dislikes and their ability to handle cutlery and dishes.

You will have to consider the design of individual items of children's tableware and the properties of the materials that will be used to make them.



Back Next

Write your name in the box

Give three reasons why plastic is a suitable material for children's tableware

Name a suitable polymer for children's tableware

State whether your chosen polymer is a thermoplastic or a thermoset

Name a polymer that leeches harmful chemicals and so should not be used for children's tableware

Name a machine that melts polymer pellets and is used to inject molten polymer into a mould

Name a mechanism that is often used to force molten polymer into a mould

State how a moulded product is removed from a mould

Explain why bright colours are used for children's products

State why plastic products rarely have to be painted

Explain why children's cutlery is sometimes made "chunky"

Give three safety specifications for children's tableware

What is the difference between one-off production, batch production and mass production?

Explain why plastic products are often inexpensive to buy, yet the machinery used to make the products is very expensive

Briefly explain why the material in plastic products should be recycled after the product is no longer required

# Complete the worksheet on a computer, then press the "Print Page" button

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## Making Plastic Bottles

### Your assignment

In this exercise, you will investigate how plastic bottles are manufactured and then describe the manufacturing process.

You may research information in the plastics technology notes and animations section of this software package.

Answer the questions in the boxes below, then arrange the arrows in the correct order.



Write your name in the box

Name the class of plastics that soften when they are heated

Name two polymers that are used to manufacture plastic bottles

Name a manufacturing process that is used to mould polymers into bottles

Name a machine that melts polymer pellets and forms the melted polymer into long cylinders, tubes or other sections

What is the name of a short length of plasticised polymer tube that will be formed into plastic bottles?

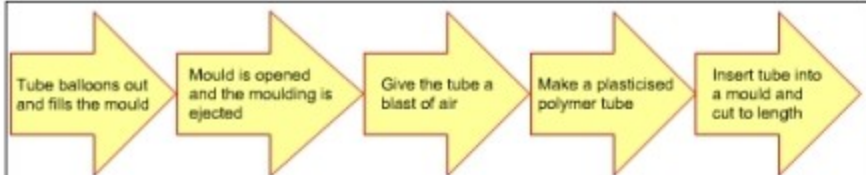
What forces the plasticised polymer tube against the sides of a mould?

State how the plasticised polymer is hardened before it is removed from the mould

State how a moulded product is removed from a mould

Explain how a finished bottle can be tested for leaks without using liquids

Name a polymer that leeches dangerous chemicals and so should not be used for food containers



```

graph LR
    A[Tube balloons out and fills the mould] --> B[Mould is opened and the moulding is ejected]
    B --> C[Give the tube a blast of air]
    C --> D[Make a plasticised polymer tube]
    D --> E[Insert tube into a mould and cut to length]
  
```

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