

## Polymers

Plastics are one of the most widely used manmade materials. They can be easily shaped when heated and formed quickly to cool products with many desirable properties. Plastic is light, fairly strong, tough and durable. Plastic does not conduct electricity making it highly suitable for the casing of many electrical appliances.

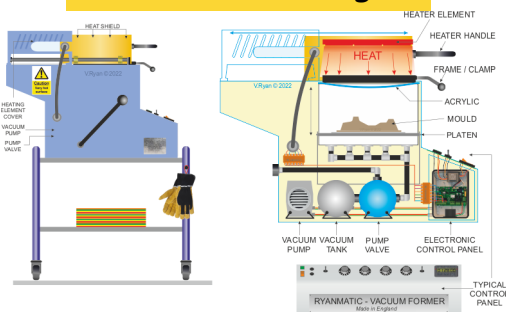
## Thermoforming Polymers

Thermoplastics / Thermoforming : Thermoplastics can be recycled and reshaped. They have an excellent surface finish and can be recycled. Common thermoplastics include acrylic, polystyrene and ABS.

## Thermosetting Polymers

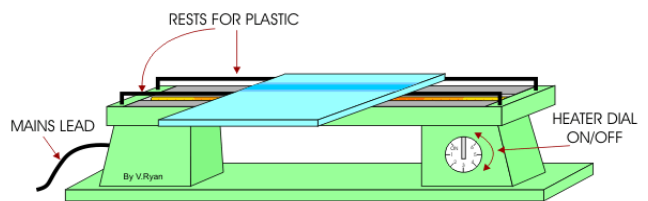
Thermoset plastics can only be shaped and heated once. They can be difficult to finish and cannot be recycled however they are more heat resistant making them ideal for high-heat applications. Common thermoset plastics include epoxy resin and urea formaldehyde.

### Vacuum Forming



Vacuum forming is a technique that is used to shape a variety of plastics. In school it is used to form/shape thin plastic, usually plastics such as polythene and perspex. Vacuum forming is used when an unusual shape like a 'dish' or a box-like shape is needed. Below you can see the stages involved in vacuum forming.

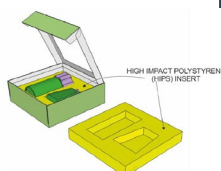
### Strip Heater/Line Bender



Plastics such as acrylic can be formed (shaped) in different ways. One of the most popular methods of shaping plastic materials like acrylic is to fold (bend) it on a 'strip heater', at different angles. An example of a strip heater is shown below. A heating element extends along the length of the strip heater and gives off intense heat when it is turned on.

### High Impact Polystyrene (HIPS)

High Impact Polystyrene (HIPS) is available in a range of colours and transparent form and can be moulded accurately, to the shape of the insert. HIPS can be recycled relatively easily, if disposed of in the relevant recycling bin.



### Acrylic

This is the most common plastic in a school workshop. It is purchased usually in the form of sheets and comes in a range of colours. It is resistant to most acids and weather conditions.



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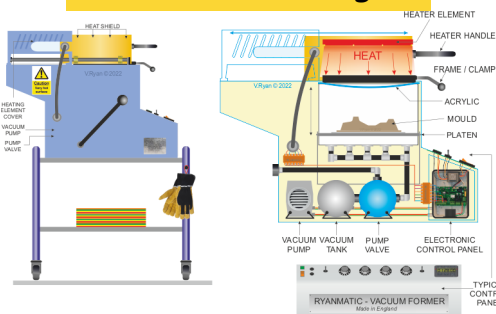
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**Thermosetting Polymers**

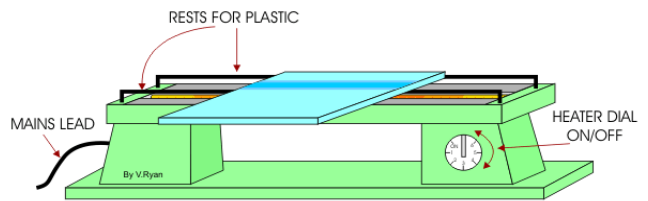
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**Vacuum Forming**



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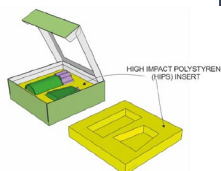
**Strip Heater/Line Bender**



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## Health & Safety

List 2 potential hazards that need to be considered when using the strip heater.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

List 2 potential hazards that need to be considered when using the vacuum former.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

## Smart material: processes

Explain the polymorph process, using full sentences with adjectives and connectives, the technique for carrying out the process.

1.



POLYMORPH GRANULES

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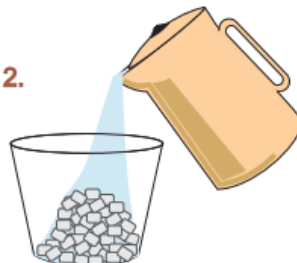


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2.



ADD HOT WATER

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3.



GRANULES SLOWLY JOIN TOGETHER

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4.



MASS OF POLYMORPH

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5.



REMOVE POLYMORPH

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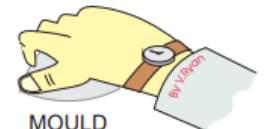


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6.



MOULD POLYMORPH GRANULES

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## Orthographic Projection



TOP

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FRONT

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RIGHT SIDE

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**Properties**

Read the boxes at the bottom of the table carefully. Re-write them into the correct box on the table below to describe the properties

Metal	Properties
HDPE - High Density Polythene Which Is Rigid And Hard. Less Flexible Than LDPE.	
Polypropylene (PP) Is A Thermoplastic Often Formed Into Products Through Injection And Blow Moulding.	
Polyvinyl Chloride. Better Known As PVC.	
LDPE - Low Density Polythene Is Tough And Flexible. Softer Than HDPE.	
High Impact Polystyrene (hips).	
Nylon	

A tough material, purchased as either a hard (inflexible) material or alternatively a flexible form. It can be extruded, welded or bonded with an adhesive.

Machine parts, bowls and crates are generally made from high density polystyrene.

Can be moulded into almost any form. Flexible, comes in range of colours.

Light material and yet strong. Available in a range of colours. Can be vacuum formed. Thinner HIPS is quite flexible.

Is used in engineering to make gears and bearings. It's oily nature means that friction is reduced between moving parts made from nylon.

It is robust, strong, flexible and supplied in a range of colours. Food containers, chairs, packaging and storage units.