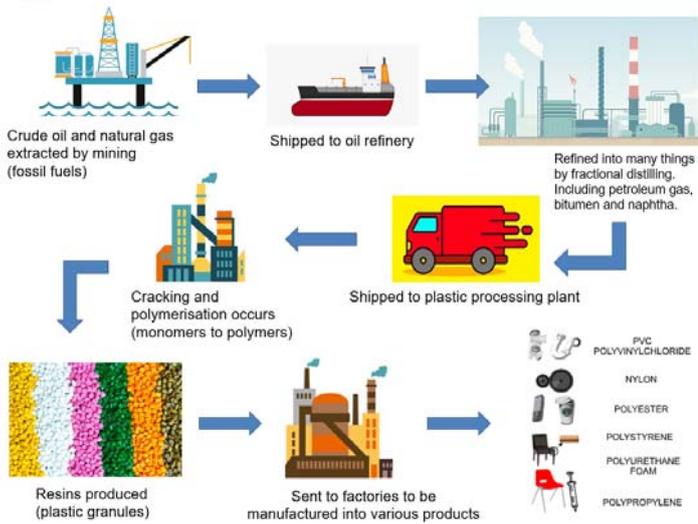


# Knowledge Organiser Year 10 Practical Skills: Polymers

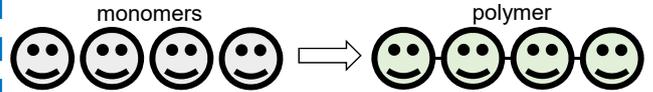
## How it's made



## Polymerisation

Poly means **many**  
Mer means **part** → "Many monomers make a polymer"

Polymerisation- happens when monomers join together to make long chains of molecules- called polymers.



## Thermofforming Polymers-

can be heated and shaped many times



Low density polythene



High density polythene



High impact polystyrene (HIPS)



Acrylic

Lack of links means it's more flexible and allows movement.

The bond between the molecules is weak and becomes weaker when heated.



## Thermosetting Polymers-

can be heated and shaped only once  
Links mean no movement. The bond between the molecules is very strong.



Polyester resins



Urea formaldehyde

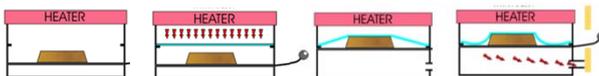


Melamine formaldehyde

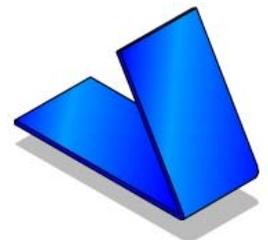


## The five steps of vacuum forming:

1. An accurate mould is made with draft angles and round edges with appropriate 'air holes' so that air can be sucked out.
2. The mould is placed at the bottom of the vacuum former and the thermofforming polymer sheet is heated up until it softens.
3. The mould is raised into the heated sheet and the air is sucked out.
4. The polymer sheet is allowed to cool, so that it becomes rigid again.
5. The mould is lowered and the plastic impression is removed so that the 'flashing' or excess material can be cut off.



Line bending is a process used to bend thermoplastics in a straight line. The line bending process involves heating a thermoplastic sheet over a strip heater until it becomes soft and then bending it to any desired angle. The plastic sheet is then held still until it cools and stays in the bent shape.



Heat the plastic sheet until it is soft and bends easily

Bend the softened plastic

Hold the plastic until it cools and remains in the bent shape



TinkerCAD is an amazingly powerful easy-to-use tool for creating digital designs that are ready to be 3D printed into super-cool physical objects.

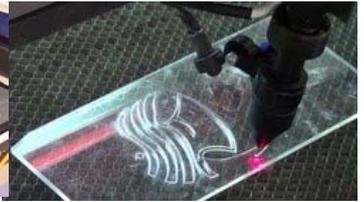
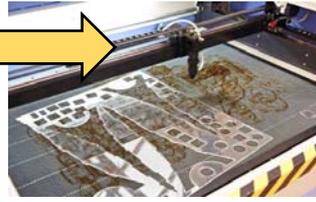


**Serif Draw** is a computer programme & graphics editor software used to create digital drawings of pretty much anything you want – this programme can be used to cut things out using the laser cutter & creating all kinds of different product throughout this project.

# Knowledge Organiser Year 10 Practical Skills: Polymers

## CAM equipment

A **laser cutter** uses a high-powered laser to cut, etch or engrave a material. Typically polymers or timbers, but can vary.

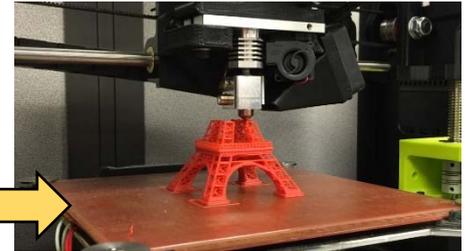


These examples shows etching & cutting on acrylic.



A **3D printer** prints thin layers of your design – one on top of the other - by extruding heated plastic, which cools quickly. It starts printing at the bottom and works its way up, printing the top layer last.

This example shows a model half way through the process.



## Tools



flat file

A flat file is used to smooth edges of the plastic – leaving no sharp edges.



**solvent cement** - designed to gluing acrylic to acrylic. It is applied to one surface using a brush & the other piece is held in place while it sets.



A coping saw is used to cut shapes out of timber and plastics for example. The saw is so called because of its ability to cope around curves.



wet & dry paper

Wet & dry paper is ideal for removing fine scratches and creating a satin smooth finish on paint, metal & plastic.

## Accuracy & quality control

How accurate a product needs to be is described as the **tolerance**.

**Tolerance** describes how inaccurate a product can be and is measured in +/- mm.

keyword	definition
measure	to determine the size, of something by using an instrument or device marked in standard units
accuracy	to do/make something precisely & without mistakes
polymer	a substance made from molecules, commonly known as plastics
CAD	Computer Aided Design
CAM	Computer Aided Manufacture
manufacture	the making of goods or objects by manual labour or by machinery