**433**

**Polymers – Shaping and Joining**

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**Acknowledgement**

Mr John Gibson is a highly regarded educator and engineer. John taught Industrial Arts at a number of high schools before taking a position at Sydney Teachers’ College, then University of Sydney. He had an engineering education consultancy and has extensive experiencing working with NESA on Engineering Studies syllabus development and the HSC examination committee. The STEM Industry School Partnerships (SISP) Program asked John for his responses to the iTeachSTEM topic discussion questions. SISP is grateful to John for submitting these example discussion responses.

# Why is the process used to shape a polymer dependent on the type of polymer?

Each polymeric material has its own characteristic set of properties; to successfully produce items from the material, the process must operate within some of those characteristic properties. Example: a polymer that softens at 120° will not survive in a process that heats the polymer to 350°.

1. **List ways to shape thermo-softening polymers.**

* blow moulding
* injection moulding
* drape moulding
* extrusion
* calendaring

1. **List ways to shape thermosetting polymers.**

* hot compression moulding
* transfer moulding
* jet moulding
* FRP hand layup

1. **List ways to join thermosoftening polymers.**

* using a liquid ‘glue’ based on a chemical that dissolves the polymer
* using heat to soften the polymer
* ‘weld’ parts together

1. **List ways to join thermosetting polymers.**

* mechanical fasteners
* thermosetting glues – Araldite

1. **Describe examples of a biomedical application for a polymer that has significantly improved the performance of the body part.**

Biochemical materials include a wide range of composite materials incorporating metals, ceramics, glasses and polymers.

Some examples include:

* pure titanium
* titanium/aluminium/iron
* titanium/molybdenite alloys

1. **What would distinguish the microstructure drawings of a thermosetting polymer from a thermosoftening polymer?**

Polymers, in general, are non-crystalline materials and, therefore tend to behave as liquids in the solid state. When heated and then allowed to solidify, polymers do not transform to become crystalline forms. Therefore, under the microscope, the amorphous state will not show up a structure. It would, however, show up any embedded form within the resin.