

2 3 1 c Polymers

Preparation

- Read pages 36 - 39

Resources

- Examples of the various plastics and the products from which they are made
- Styrofoam off cuts of different sections
- Files and garnet paper to shape styrofoam
- Acrylic off cuts
- Files, wet and dry paper and polishing equipment
- Scribers to scratch the surface

Key Points Polymers in Commercial Packaging		
Suggest teacher finds an image of PET recycling code 1 polyethylene terephthalate	Suggest teacher finds an image of a person drinking from a PET drinks bottle	<input type="checkbox"/> Thermoplastics are widely used in commercial packaging <input type="checkbox"/> Heated to a plastic state and moulded using blow moulding, injection moulding ... <input type="checkbox"/> Thermoplastics can be re-heated, re-formed ... recycled <input type="checkbox"/> Lightweight <input type="checkbox"/> Versatile <input type="checkbox"/> Strong <input type="checkbox"/> Tough <input type="checkbox"/> Rigid <input type="checkbox"/> Durable <input type="checkbox"/> Impact and water resistant <input type="checkbox"/> Easily formed and moulded <input type="checkbox"/> Easily printed on <input type="checkbox"/> Inexpensive <input type="checkbox"/> Easily recycled
Suggest teacher finds an image of HDPE recycling code 2 high density polyethylene	Suggest teacher finds an image of washing up and bleach bottles	
Suggest teacher finds an image of PVC recycling code 3 polyvinyl chloride	Suggest teacher finds an image of a garden hose	
Suggest teacher finds an image of LDPE recycling code 4 low density polyethylene	Suggest teacher finds an image of carrier bags	
Suggest teacher finds an image of PP recycling code 5 polypropylene	Suggest teacher finds an image of a lunch box	
Suggest teacher finds an image of Ps recycling code 6 polystyrene	Suggest teacher finds an image of a yoghurt pot	

Key Points Styrofoam™ for Block modelling

styrofoam

Suggest teacher finds a cartoon about styrofoam - [suggested source](#)

- Blue or pink
- Extruded polystyrene foam
 - Produces uniform, small, closed cells
 - Rigid
 - High compressive strength
 - Easily cut and shaped with hand tools
 - Smooth to a finish
- Range of thicknesses
- Glue with PVA
- Paint with acrylic paint
- For a high quality finish:
 - Coat the styrofoam in plaster
 - Smooth down
 - Spray paint
- Weak*
- Surface breaks away easily*
- The surface can be dented by filing or ripped when sanding*
- Unsuitable for fine detail*
- For insulating buildings

Key Points Acrylic for shop and point of sale displays

acrylic

Suggest teacher finds an image
of acrylic toys

- Polymethyl methacrylate (PMMA)
Plexiglas or Perspex
- Sheet, rod and tube cross section
- Self finishing

Performance requirements for
architectural grade acrylic for shop fronts

- withstand extreme weather conditions
- chemical resistant
- durable to resist long term stresses
- easy to fabricate
- excellent aesthetic properties

Point of sale displays

- Clear or frosted acrylic often used
- Illuminated signage
- As an alternative to glass

- Brittle – take great care!
- Cracks form easily and spread
- Low scratch resistance

Key Points Environmental concerns and recycling

- Oil is the raw material*
- Finite resource*
- High energy processing*
- Blow moulding to produce packaging is also high energy*
- Slow degradation in land fill*
- Burning polymers releases toxic fumes*

Recycling

- Sorted by ID code – slow and labour intensive*
- There are a few mechanical sorting systems*
- Contamination: products typically contain more than one polymer*
- Recycling polystyrene is not cost effective*

Wider study

- Table 2.5 Common thermoplastic polymers (page 37)
- Commercial D&T programme Focus Resistant Materials/Plastics
- All about plastics <http://www.technologystudent.com/designpro/plastic1.htm>
<http://www.designandtech.com/resistantmaterials>
- Manufacturers of Perspex[®] and related products
<http://www.lucitesolutions.com>
- Manufacturers of Plexiglass[®] and related products
<http://www.plexiglas.com>
- Test procedure to identify plastics
<http://www.btinternet.com/~hognozesam/gcse/page50.html>

Assignment

- Around the home, look for and collect examples of thermoplastics with the recycling codes
- Think back to your experiences of working with acrylic in the school workshop

Homework

- As above

Revision questions

1. Explain the properties of
 - PET
 - PPand give their applications

2. State what polymers are used for
 - Detergent bottles
 - Yoghurt pots
 - Crisp bags and sweet wrappersand justify your answers

Specification and Learning Objectives

Aesthetic, functional and mechanical properties, application and advantages/disadvantages of the following thermoplastics in the production of graphic products and commercial packaging:

- polythene
- polyethylene
 - high density polyethylene (HDPE)
 - low density polyethylene (LDPE)
 - polyethylene terephthalate (PET)
- polyvinyl chloride (PVC)
- polypropylene (PP)
- polystyrene (PS), rigid (high density polystyrene) and expanded
- styrofoam™ for block modelling
- acrylic

Solutions to revision questions

Next page

1. Explain the properties of

- PET
- PP

and give their applications

PET

Property

- Very tough
- High tensile strength
- Impact resistant
- Good chemical/temperature resistance
- Alcohol and oil resistant
- Transparent
- Good optical qualities
- Recyclable

End use

- Mineral water/soft drinks bottles
- Food containers
- Microwaveable food trays etc

Polypropylene (PP)

Property

- Lightweight
- Rigid
- Excellent chemical resistance
- Low moisture absorption
- Good impact resistance

End use

- Yoghurt/margarine pots, sweet and snack wrappers, stationery – folders etc

1 mark for a property and 1 mark for an end use for each of the two properties

2. State what polymers are used for

- Detergent bottles
- Yoghurt pots
- Crisp bags and sweet wrappers

and justify your answers

Detergent bottles

Accept:

- HDPE
- High density polyethylene (polythene)

- PET

Yoghurt pots

Accept:

- PS
- Polystyrene
- PP
- Polypropylene

Crisp bags and sweet wrappes

Accept:

- PP

Polypropylene