Title	**Compare melt flow and dimensional stability of plastics materials**		
Level	**3**	**Credits**	**7**

Purpose	People credited with this unit standard are able to demonstrate knowledge of: the polymerisation; and melt flow characteristics of plastics materials; the physical properties of thermoplastic and thermosetting plastics materials; and are able to describe the effect of cooling on plastics materials.

Classification	Plastics Processing Technology > Plastics Materials

Available grade	Achieved
Recommended skills and knowledge	Unit 23130, *Classify and name plastics materials*.

Explanatory notes

1 Definitions
Common plastics materials are:
Thermoplastic materials
polyolefins – low, linear low and high-density polyethylene
– polypropylene
styrenics – general purpose and high impact polystyrene
– acrylonitrile butadiene styrene
vinyls – polyvinyl chloride, plasticised and unplasticised
polyamides – types 6.6, 6, 12
polyacetal
polymethylmethacrylate
polycarbonate
polyesters – polyethylene terephthalate, polybutylene terephthalate
polyurethane
polyphenylene oxide
polysulphone

Thermosetting materials
polyester
epoxy
polyurethane
phenol formaldehyde

2 Descriptions of polymer molecular shape and arrangement are limited to commonly accepted diagrammatic representations.

Outcomes and evidence requirements

Outcome 1

Demonstrate knowledge of the polymerisation of plastics materials.

Evidence requirements

1.1 The principle of forming polymers from monomers is described.

Range polymers – homopolymers, copolymers, terpolymers.

1.2 The relationship between the degree of polymerisation (molecular growth) and molecular weight (molecular length) is described.

1.3 Forms of molecular shape and arrangement are described.

Range molecular shape – linear, branched, cross-linked;
molecular arrangement – crystalline, amorphous.

1.4 Plastics materials are described in terms of their molecular shape and arrangement.

Range plastics materials – low density polyethylene, general purpose polystyrene, polyamide 6, phenol formaldehyde;
molecular shape – linear, branched, cross-linked;
molecular arrangement – crystalline, amorphous.

1.5 The structure of the elements in a repeating unit of the polymer chain for plastics materials is sketched.

Range plastics materials – low density polyethylene, general purpose polystyrene, polyamide 6.

1.6 The common differences between grades of the same plastics material are described.

Range common differences – molecular weight, molecular weight distribution, additives.

1.7 Thermoplastic types of common plastics materials are classified as crystalline or amorphous.

Range evidence is required for five common plastics materials.

Outcome 2

Demonstrate knowledge of melt flow characteristics of plastics materials.

Evidence requirements

2.1 Melt flow and spiral flow test methods are explained and compared.

2.2 Thermoplastic materials' change of state during processing are described in terms of molecular movement.

Range change of state – heating, melting, cooling.

2.3 The relationship between melt flow index and molecular weight is described.

2.4 The melt flow characteristics of plastics materials are outlined.

Range melt flow characteristics – softening range, melt point, processing temperature, melt viscosity;
examples of plastics materials are – polyethylene, polystyrene, polyvinyl chloride, polyamide, polycarbonate;
evidence is required for three plastics materials.

Outcome 3

Demonstrate knowledge of the physical properties of thermoplastic and thermosetting plastics materials.

Evidence requirements

3.1 The influence of molecular weight on toughness of a thermoplastic material is described.

3.2 The effect of cross-linking on the rigidity, toughness, and mould flow of thermosetting plastics materials is described.

3.3 The dimensional stability of plastics materials is compared to one another.

Range plastics materials – amorphous, crystalline, cross-linked.

3.4 The effect of additives on the processing and application of plastics materials is described.

Range examples of additives are – anti-blocking agents, anti-oxidants, anti-static agents, fillers, flame retardants, impact modifiers, lubricating agents, nucleating agents, pigments, plasticisers, release agents, slip agents, UV stabilisers, melt strength enhancers, cross linking agents, blowing agents, heat stabilisers;
evidence is required for four additives.

Outcome 4

Describe the effect of cooling on plastics materials.

Evidence requirements

4.1 The crystallisation (molecular alignment) of polymer molecules as they cool is described.

4.2 The effect of cooling on the shrinkage of crystalline and amorphous materials is described.

4.3 The effect of annealing thermoplastic materials is described.

Replacement information	This unit standard replaced unit standard 274.

Planned review date	31 December 2021

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	24 August 2006	31 December 2019
Review	2	15 September 2016	N/A

Consent and Moderation Requirements (CMR) reference	0013

This CMR can be accessed at http://www.nzqa.govt.nz/framework/search/index.do.

Please note
Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMR). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

Comments on this unit standard

Please contact Competenz qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.