Title	**Demonstrate knowledge of physical and chemical principles used in pulp or paper manufacturing**		
Level	**4**	**Credits**	**15**

Purpose	People credited with this unit standard are able to: demonstrate knowledge of: the structure of matter, and the physical principles of electricity, the production of steam and the steam generation of electricity, and chemical principles used in pulp or paper manufacturing. People credited with this unit standard are also able to explain the physical principles of light and filtration used in pulp or paper manufacturing.

Classification	Wood Fibre Manufacturing > Pulp and Paper Technology

Available grade	Achieved

Guidance Information

1 Definition
Worksite documentation refers to organisation policies and procedures that are documented in memo, electronic, or manual format and available in the workplace, and are consistent with manufacturer's requirements. They may include but are not limited to – standard operating procedures, site specific procedures, site safety procedures, equipment operating procedures, quality assurance procedures, product quality specifications, references, approved codes of practice, housekeeping standards, environmental considerations, sustainability, on-site briefings, supervisor's instructions, and procedures to comply with legislative and local body requirements relevant to the pulp and paper industry.

2 Assessment Information
Evidence presented for assessment against this unit standard must be consistent with safe working practices and be in accordance with applicable service information, worksite documentation and legislative requirements. This includes the knowledge and use of suitable tools and equipment.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of the structure of matter.

Performance criteria

1.1 Atomic structure is explained in terms of protons, electrons, neutrons, and nucleus.

1.2 Characteristics of the periodic table of elements are described in terms of the elemental groups.

Range elemental groups – Alkali metals, Alkaline earth metals, Transition metals, Post transition metals, Metalloids, Non metals, Halogens, Noble gases

1.3 Properties of the elemental groups are described and related to the use of these in a pulp or paper manufacturing site.

Range evidence is required for five elemental groups

Outcome 2

Demonstrate knowledge of the physical principles of electricity used in pulp or paper manufacturing.

Performance criteria

2.1 Components and operations of a basic electrical circuit are explained.

Range circuit components – source of electricity, complete circuit of conducting material, switch, load.

2.2 Ohms law is explained in terms of the relationship between electrical force, the circuit current flow, and circuit resistance.

2.3 Principles of operation of an electric motor are explained in terms of magnetic fields, current, and applied force (volts).

2.4 Components of an electric motor and their purpose are explained.

Range rotor, armature, field, stator, termination box, cable.

2.5 Operation of direct online electric motor starters and its application to pulp or paper manufacturing are explained.

2.6 Purpose and operation of variable speed drive for an electric motor and its application to pulp or paper manufacturing are explained.

2.7 Purpose and operation of a variable frequency drive for an electric motor and its application to pulp or paper manufacturing are explained.

2.8 Purpose and operation of a regenerative unit in an alternating current (AC) variable frequency drive and its application to pulp or paper manufacturing are explained.

2.9 Operator checks for safe performance of electric motors are explained.

Range heat, vibration, noise, smell, moisture, corrosion, structural deterioration.

Outcome 3

Explain the physical principles of light and filtration as used in pulp or paper manufacturing.

Performance criteria

3.1 Principles of light transmission, absorption, and reflectance are explained in relation to pulp or paper manufacturing.

3.2 Principles of filtration are explained in terms of solid and liquid separation in relation to pulp or paper manufacturing.

Outcome 4

Demonstrate knowledge of the production of steam and the steam generation of electricity as used in pulp or paper manufacturing.

Performance criteria

4.1 Power boiler construction and operation are explained in terms of the components and steam and water flows.

4.2 Principles of steam distribution and condensate recovery are explained in terms of pipe and joint types, pressures and flows, heat loss, and condensate system economics.

4.3 Generation of electricity using steam turbines is explained in terms of equipment used and steam flows.

4.4 The impact of electricity generation on the economics of a pulp or paper operation is described.

Outcome 5

Demonstrate knowledge of chemical principles used in pulp or paper manufacturing.

Performance criteria

5.1 Properties of ionic, covalent, and metallic substances are explained, and examples of the application of each in pulp or paper manufacture are described.

5.2 Physical and chemical change is explained and the distinction between them is identified.

5.3 The terms ‘acid’, ‘alkali’ (base), ‘titration curve’ and ‘neutralisation’ are defined and the pH scale and its application on a pulp or paper manufacturing site are explained.

5.4 Principles of oxidation and reduction are explained in terms of electron and chemical changes applied to pulp or paper manufacturing.

5.5 Effects of temperature, pressure and catalysts on chemical reactions are explained in relation to pulp or paper manufacturing.

5.6 Differences between inorganic and organic compounds are explained in relation to pulp or paper manufacturing.

5.7 Principles of mass conservation as they relate to chemical reactions are explained.

5.8 Quantities of reagents and products required for stoichiometric reactions to take place are calculated using pulp or paper manufacturing examples.

5.9 Mass is calculated where more than one reagent reacts to form one or more products using pulp or paper manufacturing examples.

Replacement information	This unit standard replaced unit standard 17860.

Planned review date	31 December 2028

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	19 March 2015	31 December 2025
Review	2	30 November 2023	N/A

Consent and Moderation Requirements (CMR) reference	0173

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

Comments on this unit standard

Please contact Hanga-Aro-Rau Manufacturing, Engineering and Logistics Workforce Development Council qualifications@hangaarorau.nz if you wish to suggest changes to the content of this unit standard.