

<b>Title</b>	<b>Demonstrate knowledge of reaction rate and mechanisms</b>		
<b>Level</b>	<b>5</b>	<b>Credits</b>	<b>5</b>

<b>Purpose</b>	People credited with this unit standard are able to demonstrate knowledge of: reaction rate and rate law; reaction mechanism; the effect of temperature on reaction rate; and catalysis. They are also able to draw conclusions and perform calculations from rate measurements and rate laws.
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<b>Classification</b>	Science > Chemistry
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<b>Available grade</b>	Achieved
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### Guidance Information

- All work must be carried out in accordance with the quality management system, documented protocol system or Standard Operating Procedures typically acceptable in a commercial or research laboratory.
- Health and Safety practices must conform to Australian/New Zealand Standard AS/NZS 2243:2010 Set – *Safety in Laboratories*, available at <http://www.standards.co.nz> and <http://infostore.saiglobal.com/store>.
- Legislation applicable to this unit standard includes:  
Health and Safety at Work Act 2015;  
Hazardous Substances and New Organisms Act 1996.
- Glossary  
*Pseudo first order reaction* refers to second order with one reactant in large excess.

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### Outcomes and performance criteria

#### Outcome 1

Demonstrate knowledge of reaction rate and rate law.

#### Performance criteria

- Reaction is described in terms of reaction rate.
 

Range	rate includes – formation of products, rate of loss of reactants, reaction stoichiometry.
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- 1.2 Terms are defined in relation to the reaction rate.
- Range terms include – rate law, rate equation, rate constant, integrated rate law, initial rate.
- 1.3 Reaction is described in terms of ‘order of reaction’ and the order with respect to species for a given rate law.

## Outcome 2

Demonstrate knowledge of reaction mechanism.

### Performance criteria

- 2.1 Elementary reactions are defined and their rate laws are described in relation to reaction mechanism.
- Range unimolecular, bimolecular, trimolecular.
- 2.2 Complex reactions are described as a series of elementary reactions in relation to reaction mechanism.
- 2.3 Rate law is derived for a two-step reaction in relation to reaction mechanism.
- Range step 1 rate-determining, step 1 fast equilibrium – step 2 rate-determining.

## Outcome 3

Draw conclusions and perform calculations from rate measurements and rate laws.

### Performance criteria

- 3.1 Rate law is determined in terms of effect of initial concentrations on initial rates.
- 3.2 Rate law is deduced in terms of concentration time plots.
- Range first order, second order with equal initial concentration of reactants.
- 3.3 Rate constant and half-life are determined from concentration-time plots for a first order reaction or pseudo first order reaction.
- 3.4 Rate constant is calculated from a plot of inverse of concentration of a reactant or product against time for a second order reaction.
- Range rate includes –  $k[A]^2$  or  $k[A][B]$  for reaction  $A+B \rightarrow$  products with equal initial concentrations of reactants.

**Outcome 4**

Demonstrate knowledge of the effect of temperature on reaction rate.

**Performance criteria**

- 4.1 'Energy of activation' is described in relation to reaction rate.
- 4.2 An Arrhenius plot is constructed for the variation of reaction rate with temperature, and the energy of activation is determined.
- 4.3 Reaction rates at different temperatures are calculated based on the Arrhenius equation.

**Outcome 5**

Demonstrate knowledge of catalysis.

**Performance criteria**

- 5.1 Effect of a catalyst is described in terms of the reaction.  
Range effects include – rate of reaction, position of equilibrium.
- 5.2 Role of a catalyst is explained in terms of reaction mechanism.
- 5.3 Types of catalysis are described in terms of the differences.  
Range homogeneous, heterogeneous, enzymatic.

**This unit standard is expiring. Assessment against the standard must take place by the last date for assessment set out below.**

**Status information and last date for assessment for superseded versions**

Process	Version	Date	Last Date for Assessment
Registration	1	22 December 1996	31 December 2014
Revision	2	19 February 1998	31 December 2014
Revision	3	2 November 1999	31 December 2014
Review	4	18 June 2010	31 December 2022
Rollover	5	27 January 2015	31 December 2022
Rollover and Revision	6	15 June 2017	31 December 2022
Revision	7	26 October 2017	31 December 2022
Review	8	22 October 2020	31 December 2022

<b>Consent and Moderation Requirements (CMR) reference</b>	0113
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

This unit standard is expiring