Achievement Standard

Subject Reference	Physics 2.3				
Title	Demonstrate understanding of waves				
Level	2	**Credits**	4	**Assessment**	External
Subfield	Science				
Domain	Physics				
Status	Registered	**Status date**	17 November 2011		
Planned review date	31 December 2020	**Date version published**	20 November 2014		

This achievement standard involves demonstrating understanding of waves.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Demonstrate understanding of waves.	• Demonstrate in-depth understanding of waves.	• Demonstrate comprehensive understanding of waves.

Explanatory Notes

1 This achievement standard is derived from *The New Zealand Curriculum*, Learning Media, Ministry of Education, 2007, Level 7; and is related to the material in the *Teaching and Learning Guide for Physics*, Ministry of Education, 2010 at http://seniorsecondary.tki.org.nz/. The standard is aligned to the achievement objectives: *Physical Inquiry and Physics Concepts* in the Physical World strand and *Communicating in Science* in the Nature of Science strand.

This standard is also derived from Te Marautanga o Aotearoa. For details of Te Marautanga o Aotearoa achievement objectives to which this standard relates, see the Papa Whakaako for the relevant learning area.

2 *Demonstrate understanding* involves writing statements that show an awareness of how simple facets of phenomena, concepts or principles relate to a described situation.

Demonstrate in-depth understanding involves writing statements that give reasons why phenomena, concepts or principles relate to a described situation. For mathematical solutions, the information may not be directly usable or immediately obvious.

Demonstrate comprehensive understanding involves writing statements that demonstrate understanding of connections between concepts.

3 Written statements include mathematical solutions and/or descriptions. Descriptions may include graphs or diagrams.

4 Assessment is limited to a selection from the following:

Light:
- reflection in curved mirrors
- refraction through lenses
- refraction
- total internal reflection
- critical angle at a plane boundary.

Waves:
- reflection and refraction at a plane boundary including phase and wave parameter changes if applicable
- superposition of pulses
- diffraction through a slit
- 2-point source interference (qualitative).

Relationships:

$\frac{1}{f}=\frac{1}{d_o}+\frac{1}{d_i}$ or $s_i s_o = f^2$

$m=\frac{d_i}{d_o}=\frac{h_i}{h_o}$ or $m=\frac{f}{s_o}=\frac{s_i}{f}$

$n_1 \sin\theta_1 = n_2 \sin\theta_2$ $\frac{n_1}{n_2}=\frac{v_2}{v_1}=\frac{\lambda_2}{\lambda_1}$

$v=f\lambda$ $f=\frac{1}{T}$ $v=\frac{d}{t}$

5 Assessment Specifications for this achievement standard can be accessed through the Physics Resources page found at http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/ncea-subject-resources/.

Replacement Information
This achievement standard replaced AS90254, unit standard 6382, and unit standard 8768.

Quality Assurance

1 Providers and Industry Training Organisations must have been granted consent to assess by NZQA before they can register credits from assessment against achievement standards.

2 Organisations with consent to assess and Industry Training Organisations assessing against achievement standards must engage with the moderation system that applies to those achievement standards.

Consent and Moderation Requirements (CMR) reference 0233