

## Achievement Standard

**Subject Reference**

Physics 2.3

**Title**

Demonstrate understanding of waves

**Level** 2

**Credits** 4

**Assessment** External

**Subfield** Science

**Domain** Physics

**Registration date** 20 October 2004

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This achievement standard involves knowledge and understanding of phenomena, concepts, principles and relationships related to waves, and the use of appropriate methods to solve related problems.

### Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
<ul style="list-style-type: none"> <li>Identify or describe aspects of phenomena, concepts or principles.</li> <li>Solve straightforward problems.</li> </ul>	<ul style="list-style-type: none"> <li>Give descriptions or explanations in terms of phenomena, concepts, principles and/or relationships.</li> <li>Solve problems.</li> </ul>	<ul style="list-style-type: none"> <li>Give concise explanations that show clear understanding, in terms of phenomena, concepts, principles and/or relationships.</li> <li>Solve complex problems.</li> </ul>

### Explanatory Notes

- This achievement standard is derived from *Physics in the New Zealand Curriculum*, Learning Media, Ministry of Education, 1994; Level 7 achievement objectives, p. 24.

2 Assessment will be limited to a selection of the following:

**Phenomena, concepts and principles:**

*Light*

Qualitative and quantitative treatment of reflection in curved mirrors, refraction through lenses, refraction, total internal reflection and 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, 2-point source interference (qualitative), properties of electromagnetic waves.

**Relationships:**

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

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

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

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

3 Real life contexts will be used whenever possible. Requisite information about the context used will be supplied.

4 The following descriptions provide guidance on the typical level of performance for achievement, achievement with merit, and achievement with excellence. Both the complexity of the situation and problem-solving process will determine the grade.

- a Statements, descriptions and explanations can be written, diagrammatic or graphical.
- Achievement will typically involve single aspects related to phenomena, concepts or principles.
  - Achievement with merit will typically involve reasons.
  - Achievement with excellence will typically have minimal irrelevancies.

- b A physics problem involves a process(es) to find a physical quantity. A process involves: recognising the relevant concept or principle; selecting the method (eg formula, graph, diagram, logical deduction); and selecting the relevant information.
- A *straightforward problem* is one involving a single process. The relevant concept or principle will be transparent, the method will be straightforward (a formula will need no more than a simple rearrangement), and the information will be directly usable.
  - A *problem* is typically one in which the relevant concept or principle may not be immediately obvious, the method may involve the use of a complex formula or rearrangement, or the information may not be directly usable or immediately obvious.
  - A *complex problem* will typically involve more than one process. The recognition of two different concepts must be involved.
- 5 Formulae listed in this achievement standard will be supplied.
- 6 Minor computational or transcription errors will not be penalised if the process used to determine the solution is clearly indicated and is valid.
- 7 Students should be aware of the appropriate use of significant figures and units. Both negative index (eg  $\text{ms}^{-2}$ ) and slash notation (eg  $\text{m/s}^2$ ) will be acceptable when writing units. Negative index notation will be used when supplying data.
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### Quality Assurance

- 1 Providers and Industry Training Organisations must be accredited by the Qualifications Authority before they can register credits from assessment against achievement standards.
- 2 Accredited providers and Industry Training Organisations assessing against achievement standards must engage with the moderation system that applies to those achievement standards.