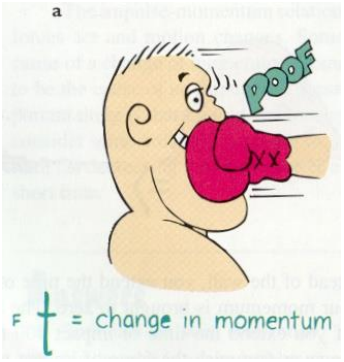
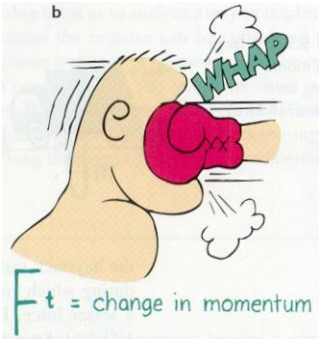


Year 12 PHYSICS
NCEA Level 2
2021



This course is based on the Physics in New Zealand Curriculum Document and is structured around 3 units of work. The textbooks used are: Year 12 Physics Study Guide, NCEA Level 2, by David Housden, published by ESA Publications (NZ) Ltd and sciPAD Level 2 Physics Workbook.

Mechanics

- **2.4.1** **Motion**
  Vectors and Scalars, Kinematic Equations, Projectile Motion
- **2.4.2** **Forces**
  Newton's Laws, Circular Motion, Equilibrium
- **2.4.3** **Energy and Momentum**
  Energy, Momentum

Electricity and Electromagnetism

- **2.6.1** **Electrostatics**
  Electric Field Strength
- **2.6.2** **DC Current**
  Current, Voltage, Resistance, Power
- **2.6.3** **Electromagnetism**
  Current and Magnetism, Lorentz Forces, Electromagnetic Induction

---

Wave Phenomena

- **2.3.1** **Light**
  Reflection from curved mirrors, Mirror ray diagrams, Refraction, Total internal reflection, Refraction through lenses, Lens ray diagrams.
- **2.3.2** **Mechanical waves**
  Reflection of wave fronts, Refraction of waves, Diffraction of waves, Wave interference

---

The Course offered is NCEA level 2 Physics.
HIBS is offering five Achievement Standards.

Unit	Achievement Standard	Description	Internal /External Examination	Credits
2.1	AS91168	Carry out a practical physics investigation that leads to a non-linear mathematical relationship	Internal	4
2.3	AS91170	Demonstrate understanding of waves	External	4
2.4	AS91171	Demonstrate understanding of mechanics	External	6
2.5	AS91172	Demonstrate understanding of atomic and nuclear physics	Internal	3
2.6	AS91173	Demonstrate understanding of electricity and electromagnetism	External	6

Year 12 Timeline

The following units will have an internal, (non-credit), end of unit examination which will take place at the conclusion of each unit of work, and an external end of year examination.

Achievement Standard	Sub topic	Week	Internal/ External Examination
2.3 Demonstrate understanding of waves	2.3.1 2.3.2	Term 3 week 3 – Term 3 week 7	External
2.4 Demonstrate understanding of mechanics	2.4.1 2.4.2 2.4.3	Term 1 week 10 – Term 2 week 7	External
2.6 Demonstrate understanding of electricity and electro-magnetism	2.6.1 2.6.2 2.6.3	Term 1 week 1 – Term 1 week 9	External

The internal component of the subject will be assessed as follows:

Term	Achievement Standard	Internal/External Examination	Assessment	Date
Term 3	**2.1** Carry out a practical physics investigation that leads to a non-linear mathematical relationship	Internal	3 Hour Practical Examination	**Week 2, Friday, 6th August** **NO REASSESSMENT**
Term 3	**2.5** Demonstrate understanding of atomic and nuclear physics	Internal	Exam	**Week 10, Wednesday, 29th September** **NO REASSESSMENT**

2021 Term/Week Planner and Calendar

W	Month	Date	Topic	Assessment	Assessment/Notes
1	February	1-5	Start 2.6		Thurs th February – Year 7 & 13 Friday 1st February Full School
2	February	9-12			Waitangi Day Monday 8th
3	February	15-19			
4	February	22-26			
5	March	1-5			
6	March	9-12			
7	March	15-19			
8	March	22-26			
9	March/April	29-1		2.6 Topic Test	
10	April	7-9	Start 2.4		
11	April	12-16			Good Friday 10th April
	April	19-23			
	April	26-30			Anzac Day holiday 27th April
1	May	3-7			
2	May	10-14			
3	May	17-21			ToD 11th May
4	May	24-28			
5	May/June	31-4			
6	June	8-11			Queen's Birthday 7th June
7	June	14-18		2.4 Topic Test	
8	June	21-25	Start 2.1		
9	July	28-2			
10	July	5-9			
	July	12-16			
	July	19-23			
1	July	26-30			
2	August	2-6		2.1 Int Assessment	ToD 5 th August
3	August	9-13	Start 2.3		
4	August	16-20			
5	August	23-27			
6	August/September	30-3			
7	September	6-11		2.3 Topic Test	Tournament week
8	September	13-17	Start 2.5		
9	September	20-24			
10	September/October	27-1		2.5 Int Assessment	
	October	4-8			
	October	11-15			
1	October	18-22			IEE
2	October	26-29			Labour Day 25th Oct
3	November	1-5			
4	November	8-12			
5	November	15-19			
6	November	22-26			
7	November/December	29-3			ToD 1st December
8	December	6-10			

Number	AS91168	**Version**	2

Achievement Standard

Subject Reference	Physics 2.1				
Title	Carry out a practical physics investigation that leads to a non-linear mathematical relationship				
Level	2	**Credits**	4	**Assessment**	Internal
Subfield	Science				
Domain	Physics				
Status	Registered	**Status date**	17 November 2011		
Planned review date	31 December 2018	**Date version published**	20 November 2014		

This achievement standard involves carrying out a practical physics investigation that leads to a non-linear mathematical relationship.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Carry out a practical physics investigation that leads to a non-linear mathematical relationship.	• Carry out an in-depth practical physics investigation that leads to a non-linear mathematical relationship.	• Carry out a comprehensive practical physics investigation that leads to a non-linear mathematical relationship.

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 *Investigating 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 *Carry out a practical physics investigation* involves:

- collecting data relevant to the aim based on the manipulation of the independent variable over a reasonable range and number of values
- drawing a graph that shows the relationship between the independent and dependent variables
- writing a conclusion which describes the type of mathematical relationship that exists between the variables.

Carry out an in-depth practical physics investigation involves:

- controlling the variable(s) that could have a significant effect on the results
- using technique(s) that increase the accuracy of the measured values of the dependent (and independent, if appropriate) variable
- writing a conclusion that describes the mathematical relationship obtained from the experimental data.

Carry out a comprehensive practical physics investigation involves writing a discussion that addresses critical issues such as:

- a reason why there is a limit to either end of the value chosen for the independent variable
- a justification for why a variable needs to be controlled
- a description of any difficulties encountered when making measurements and how these difficulties were overcome
- the relationship between the findings and physics ideas
- a description of any unexpected results and a suggestion of how they could have been caused and/or the effect they had on the validity of the conclusion.

3 *A practical physics investigation* is an activity that includes gathering, processing and interpreting data.

4 Conditions of Assessment related to this achievement standard can be found at http://ncea.tki.org.nz/Resources-for-Internally-Assessed-Achievement-Standards.

.

Number	AS91170	**Version**	2

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 2018	**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:

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

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

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

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

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/.

Number	AS91171	**Version**	2

Achievement Standard

Subject Reference		Physics 2.4			
Title		Demonstrate understanding of mechanics			
Level	2	**Credits**	6	**Assessment**	External
Subfield	Science				
Domain	Physics				
Status	Registered	**Status date**	17 November 2011		
Planned review date	31 December 2018	**Date version published**	20 November 2014		

This achievement standard involves demonstrating understanding of mechanics.

Achievement Criteria

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

Explanatory Notes

6. 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.

7. *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.

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

9. Assessment is limited to a selection from the following:

   Motion:
   - constant acceleration in a straight line
   - free fall under gravity
   - projectile motion
   - circular motion (constant speed with one force only providing centripetal force).

   Force:
   - force components
   - vector addition of forces
   - unbalanced force and acceleration
   - equilibrium (balanced forces and torques)
   - centripetal force
   - force and extension of a spring.

   Momentum and Energy:
   - momentum
   - change in momentum in one dimension and impulse
   - impulse and force
   - conservation of momentum in one dimension
   - work
   - power and conservation of energy
   - elastic potential energy.

Relationships:

$v = \frac{\Delta d}{\Delta t}$ $\quad a = \frac{\Delta v}{\Delta t}$

$v_f = v_i + at$ $\quad d = v_i t + \frac{1}{2} at^2$

$d = \frac{v_i + v_f}{2} t$ $\quad v_f^2 = v_i^2 + 2ad$

$a_c = \frac{v^2}{r}$

$p = mv$ $\quad \Delta p = F \Delta t$

$E_p = \frac{1}{2} kx^2$ $\quad E_k = \frac{1}{2} mv^2$ $\quad \Delta E_p = mg \Delta h$

$W = Fd$ $\quad P = \frac{W}{t}$

$F = ma$ $\quad \tau = Fd$

$F = - kx$ $\quad F_c = \frac{mv^2}{r}$

10. 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/.

Number	AS91172	**Version**	2

Achievement Standard

Subject Reference		Physics 2.5			
Title		Demonstrate understanding of atomic and nuclear physics			
Level	2	**Credits**	3	**Assessment**	Internal
Subfield	Science				
Domain	Physics				
Status	Registered	**Status date**	17 November 2011		
Planned review date	31 December 2018	**Date version published**	20 November 2014		

This achievement standard involves demonstrating understanding of atomic and nuclear physics.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Demonstrate understanding of atomic and nuclear physics.	• Demonstrate in-depth understanding of atomic and nuclear physics.	• Demonstrate comprehensive understanding of atomic and nuclear physics.

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 typically includes:

- models of the atom (Thomson and Rutherford), gold foil experiment
- nuclear transformations: radioactive decay (half life), fission and fusion reactions
- conservation of atomic and mass number
- products of nuclear transformation: power generation, $E = mc^2$, $P = E/t$, properties of nuclear emissions (ionising ability, penetration ability).

5 Conditions of Assessment related to this achievement standard can be found at http://ncea.tki.org.nz/Resources-for-Internally-Assessed-Achievement-Standards.

Number	AS91173	**Version**	2

Achievement Standard

Subject Reference		Physics 2.6			
Title		Demonstrate understanding of electricity and electromagnetism			
Level	2	**Credits**	6	**Assessment**	External
Subfield	Science				
Domain	Physics				
Status	Registered	**Status date**	17 November 2011		
Planned review date	31 December 2018	**Date version published**	20 November 2014		

This achievement standard involves demonstrating understanding of electricity and electromagnetism.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Demonstrate understanding of electricity and electromagnetism.	• Demonstrate in-depth understanding of electricity and electromagnetism.	• Demonstrate comprehensive understanding of electricity and electromagnetism.

Explanatory Notes

2. 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:

Static Electricity:
- uniform electric field
- electric field strength
- force on a charge in an electric field
- electric potential energy
- work done on a charge moving in an electric field.

DC Electricity:
- parallel circuits with resistive component(s) in series with the source
- circuit diagrams
- voltage
- current
- resistance
- energy
- power.

Electromagnetism:
- force on a current carrying conductor in a magnetic field
- force on charged particles moving in a magnetic field
- induced voltage generated across a straight conductor moving in a uniform magnetic field.

Relationships:

$E = \frac{V}{d}$ $F = Eq$ $\Delta E_p = Eqd$ $E_k = \frac{1}{2}mv^2$

$F = BIL$ $F = Bqv$ $V = BvL$

$I = \frac{q}{t}$ $V = \frac{\Delta E}{q}$ $V = IR$ $P = IV$ $P = \frac{\Delta E}{t}$

$R_T = R_1 + R_2 + \ldots$ $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

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/.