Kāpiti College

Physics 301 Ahupūngao 301

Level 3 Physics Course Information

2016

Kāpiti College Physics 301 Assessment Scheme

Course Aim / Description

To provide an interesting course that will provide content knowledge leading to future studies at tertiary level.

In Physics 301 we will be offering 26 Credits from the Physics domain at NCEA level 3 (with an optional 3 more by a further internally assessed research project).

Course entry requirements: 14 Level 2 Physics credits. Entry without these requirements may be approved on a case by case basis.

Internal Assessments:

91527 v1 (3.7) Use physics knowledge to develop an informed response to a socio-scientific issue. 3 Credits
(assessed by research project, due week 8 term 1)

91521 v1 (3.1) Carry out practical investigation to test a physics theory relating two variables in a non-linear relationship. 4 Credits
(assessed by practical)

91525 v1 (3.5) Demonstrate understanding of Modern Physics 3 Credits
(assessed by class test)

Total Internal 10 Credits

External Assessments: (assessed in end of year exam)

91523 v1 (3.3) Demonstrate understanding of Wave Systems 4 Credits
91524 v1 (3.4) Demonstrate understanding of Mechanical Systems 6 Credits
91526 v1 (3.6) Demonstrate understanding of Electrical Systems 6 Credits

Total External 16 Credits

Optional Internal Assessment:

91525 v1 (3.2) Demonstrate understanding of the application of physics to a selected context (assessed by research project, due week 23 Sept) 3 Credits

Physics 301 Year Plan 2016

Term 1	Term 2	Term 3	Term 4
1 **91524 (3.4) E** **Topic One**	1 **91521 (3.1) I** **Topic Five** Practical	1 AC Circuits cont.	1 Waves
2 Translational Motion (**91527 (3.7) I** handed out)	2 Physics	2 *3.6 Test*	2 cont. *Test 3.3*
3	3 *3.1 Practical Assessment*	**91525 (3.5) I**	3 Revision
Topic Two	**91526 (3.6) E**	3 **Topic Nine** Mod Phys	4 Revision
4 Circular Motion	4 **Topic Six** Resistors &	Exam Revision	
5 *Trans & Circ Motion Test*	5 Capacitors in DC Circuits	4 **Exams** **3.4 Mechanics &** **3.6 Electricity**	
Topic Three	6 **Topic Seven** Inductors	5 Exam Recap	
6 (3.7 *Proj due 08 Mar*) Rotational	7 in DC Circuits	**Topic Nine**	
7 Motion	8	6 Modern Physics	
8	**Topic Eight**	7 *3.5 Assessment*	
Topic Four	9 AC Circuits	**91523 (3.3) E**	
9 Simple	10	8 **Topic Ten** Waves	
10 Harmonic Motion		9	
11 *3.4 Test*		91522 (3.2) I optional "Physics in context" – due 21 Sep	

Topics

(see www.nzqa.govt.nz/NCEA for more details on Achievement Standards in this course)

For the purposes of fulfilling NZQA requirements the domain for all standards addressed in Physics 301 is **PHYSICS**!!!!!

91524 Physics 3.4 v2, External, 6 Credits

Demonstrate understanding of **mechanical systems (4 topics)**

1. Translational Motion

- Centre of mass (1 and 2 dimensions)
- conservation of momentum and impulse (2 dimensions only).

Relationships:

$F = ma$ $\quad p = mv$ $\quad \Delta p = F\Delta t$ $\quad \Delta E_p = mg\Delta h$

$W = Fd$ $\quad E_{K(LIN)} = \frac{1}{2}mv^2$ $\quad x_{COM} = \frac{m_1x_1 + m_2x_2}{m_1 + m_2}$

91527 Physics 3.7 v1, Internal, 3 Credits

Use physics knowledge to develop an informed response to a socio-scientific issue

2. Physics in a Socio-scientific Context

You will carry out a research project in parallel with topics 1 and 3. This will take the form of answering a question – Should New Zealand remain nuclear power free?

Students will produce an informed response, having processed knowledge from a range of sources, selecting relevant ideas and integrated them to produce an article.

3. Circular Motion

- Velocity & acceleration of, and resultant force on, objects moving in a circle under the influence of 2 or more forces, eg banked corners, vertical circles etc
- Newton's Law of gravitation, satellite motion.

Relationships: $F_g = \frac{GMm}{r^2}$ $F_C = \frac{mv^2}{r}$

91524 Physics 3.4 v2, Mechanical systems continued

4. Rotational Motion

- Rotational motion with constant angular speed and with constant angular acceleration
- torque
- rotational inertia
- angular momentum
- rotational kinetic energy
- conservation of angular momentum
- conservation of energy.

Relationships:

$d = r\theta$ $v = r\omega$ $a = r\alpha$ $\omega = \frac{\Delta\theta}{\Delta t}$

$\alpha = \frac{\Delta\omega}{\Delta t}$ $\omega = 2\pi f$ $E_{K(ROT)} = \frac{1}{2}I\omega^2$

$\omega_f = \omega_i + \alpha t$ $\theta = \frac{(\omega_i + \omega_f)}{2}t$ $\omega_f{}^2 = \omega_i{}^2 + 2\alpha\theta$ $\theta = \omega_i t + \frac{1}{2}\alpha t^2$

$\tau = I\alpha$ $L = mvr$ $L = I\omega$

5. Simple Harmonic Motion

- Displacement
- velocity
- acceleration
- time and frequency of a particle undergoing SHM
- forced SHM; resonance; the reference circle
- phasors
- conservation of energy.

Relationships:

$a = -\omega^2 y$ $\quad F = -ky$ $\quad T = 2\pi\sqrt{\frac{l}{g}}$

$T = 2\pi\sqrt{\frac{m}{k}}$ $\quad E = \frac{1}{2}ky^2$

$y = A\sin\omega t$ $\quad v = A\omega\cos\omega t$ $\quad a = -A\omega^2 \sin\omega t$

$y = A\cos\omega t$ $\quad v = -A\omega\sin\omega t$ $\quad a = -A\omega^2 \cos\omega t$

91521 Physics 3.1 v1, Internal, 4 Credits

Carry out a practical physics investigation to test two variables that leads to a non-linear relationship

6. Practical Investigation

You will carry out a practical physics investigation that requires the graphical identification and mathematical analysis of a relationship that is non-linear. Students will gather, process and analyse data, and interpret the results.
Assessment will take the form of an internal field trip – a 4 hour practical assessment. **One further assessment opportunity will be offered.**

91526 Physics 3.6 v2, External, 6 Credits

Demonstrate understanding of **electrical systems (3 topics)**

7. Resistors and Capacitors in DC Circuits

- Internal resistance
- simple application of Kirchhoff's Laws
- parallel plate capacitor;
- capacitance
- dielectrics;
- series and parallel capacitors
- charge/time, voltage/time and current/time graphs for a capacitor
- time constant
- energy stored in a capacitor.

Relationships:

$\mathbf{E} = \frac{1}{2}\mathbf{QV}$ $\quad Q = CV$ $\quad C = \frac{\varepsilon_o \varepsilon_r A}{d}$ $\quad C_T = C_1 + C_2 + \ldots$ $\quad \frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots$ $\quad \tau = RC$

8. Inductors in DC Circuits

- Magnetic flux
- magnetic flux density
- Faraday's Law
- Lenz's Law
- The inductor
- voltage/time and current/time graphs for an inductor
- time constant
- self inductance
- energy stored in an inductor
- the transformer

Relationships:

$\phi = BA$ $\quad \varepsilon = -L\frac{\Delta I}{\Delta t}$ $\quad \varepsilon = -\frac{\Delta \phi}{\Delta t}$ $\quad \frac{N_p}{N_s} = \frac{V_p}{V_s}$ $\quad E = \frac{1}{2}LI^2$ $\quad \tau = \frac{L}{R}$

9. AC Circuits

- The comparison of the energy dissipation in a resistor carrying direct current and alternating current
- peak and rms voltage and current
- Voltage and current and their phase relationships in LR and CR series circuits
- phasor diagrams
- reactance and impedance and their frequency dependence in a series circuit
- resonance in LCR circuits

Relationships:

$I = I_{MAX}\sin\omega t$ $\quad V = V_{MAX}\sin\omega t$ $\quad I_{MAX} = \sqrt{2}I_{rms}$ $\quad V_{MAX} = \sqrt{2}V_{rms}$

$X_C = \frac{1}{\omega C}$ $\quad X_L = \omega L$ $\quad V = IZ$ $\quad \omega = 2\pi f$ $\quad f_o = \frac{1}{2\pi\sqrt{LC}}$

91525 Physics 3.5 v2, Internal, 3 Credits

Demonstrate understanding of **Modern Physics**

Assessment will take the form of a class test. **One further assessment opportunity will be offered.**

10. Modern Physics

- The Bohr model of the hydrogen atom
- the photon; the quantisation of energy
- discrete atomic energy levels
- electron transition between energy levels
- ionisation
- atomic line spectra (infrared, visible and ultraviolet)
- the photoelectric effect; the electron volt
- description of the particle/wave duality of light, nuclear binding energy and mass deficit
- conservation of mass-energy for nuclear reactions.

Relationships:

$E = hf$ $\quad hf = \phi + E_K$ $\quad E = \Delta mc^2$ $\quad E_n = -\frac{hcR}{n^2}$

$\frac{1}{\lambda} = R(\frac{1}{S^2} - \frac{1}{L^2})$ $\quad E = qV$ $\quad v = f\lambda$

91523 Physics 3.3 v1, External, 4 Credits

Demonstrate understanding of **wave systems**

11. Waves

- Interference (quantitative) of electromagnetic and sound waves, including multi-slit interference and diffraction gratings
- standing waves in strings and pipes
- harmonics and overtones; resonance
- beats
- Doppler Effect (stationary observer).

Relationships:

$d\sin\theta = n\lambda$ $\quad n\lambda = \frac{dx}{L}$ $\quad f' = f\frac{v_w}{v_w \pm v_s}$ $\quad v = f\lambda$ $\quad f = \frac{1}{T}$

Optional Topic

91522 v1 3.2 v1, Internal, 3 Credits

Demonstrate understanding of the application of physics to a selected context

12 Physics and Technology

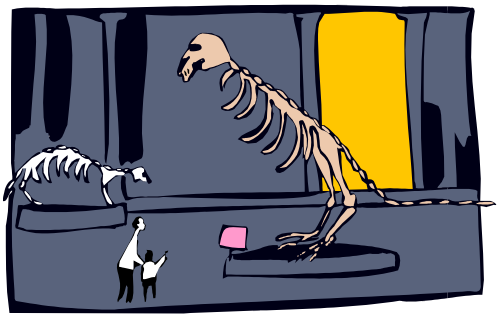
A project that students may choose to undertake at any time during the year, but must be handed in no later than the last day of term 3 (earlier in the year is recommended)

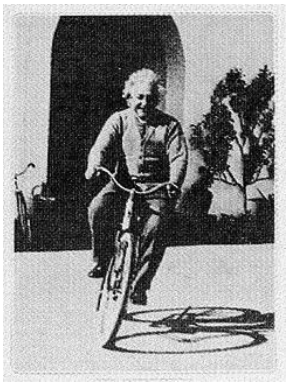
Students select a real life context and have this approved by your teacher. Some examples of real life contexts are:

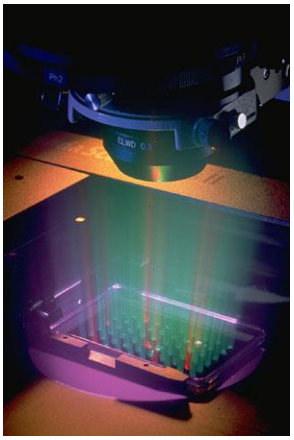
- *General* – bridge building, musical instruments, sound recording, stellar evolution, radio astronomy, and particle accelerators
- *Specific* – GPS, the Large Hadron Collider.

Students investigate how physics applies to their chosen context. They need to clearly link key physics ideas together to provide a coherent picture of the physics relevant to their selected context.

The results of this research investigation are to be submitted as an article (or it can be some other sort of presentation, by agreement with the teacher).







KĀPITI COLLEGE ASSESSMENT SCHEDULE 2016

SUBJECT | **Physics 301** | **YEAR** | **13**

One week before each assessment you will be told
* what learning outcomes will be assessed
* how they will be assessed
* how the assessment contributes towards your report.

Student to enter Achieved (A), Merit (M), Excellence (E) or Not Achieved (N)

Term	Week	Date	Achievement / Unit Task	Int/Ext	Credits	N, A,M,E
1	1					
	2					
	3					
	4		***AS 91524 (3.4 v1) Translational and***			
	5		***Circular Motion Test***	***E***	6	
	6		***AS 91527 (3.7 v1) Physics and***	***I***	3	
	7		***a Socioscientific Issue***			
	8					
	9					
	10					
	11		***AS 91524 (3.4 v1) Mechanical Systems***	***E***	**6**	
2	1					
	2					
	3		***AS 91521 (3.1 v1) Practical Investigation***	***I***	**4**	
	4					
	5					
	6					
	7					
	8					
	9					
	10					
3	1		***AS 91526 (3.5 v1) Electrical systems***	***E***	**6**	
	2					
	3					
	4		**Exams: AS 91524 & 91526**	***E***	**12**	
	5					
	6					
	7		***AS 91525 (3.5 v1) Modern Physics***	***I***	**3**	
	8					
	9		***AS 91522 (3.2 v1) Physics in Context***	***I***	***3***	
4	1					
	2		***AS 91523 (3.3 v1) Wave Systems***	***E***	**4**	
	3					
	4					