# Physics syllabus resource links

This supporting document is provided to assist you in starting your research and collating resources, including articles and websites, in preparing programs, units of work and lesson plans. They are only provided as a suggestion.

Although this document may contain links to third party websites and resources, the NSW Department of Education is not responsible for the condition or content of these sites or resources as they are not under the control of the Department.

The [Physics Classroom](https://www.physicsclassroom.com/) is a resource for the physics syllabus.

## Analysis of forces and motion in two dimensions using vectors

* PhET
	+ [Vector addition](https://phet.colorado.edu/en/contributions/view/2840)
	+ [Vector addition simulation](https://phet.colorado.edu/en/simulation/legacy/vector-addition)
	+ [Vector Addition: Understanding Force equilibrium](https://phet.colorado.edu/en/contributions/view/2904)
	+ [LadyBug 2D motion](https://phet.colorado.edu/en/simulation/legacy/ladybug-motion-2d) and Vector addition
	+ [Force Vectors](https://phet.colorado.edu/en/contributions/view/3088)
	+ [Vector activity](https://phet.colorado.edu/en/contributions/view/2844)
* Scootle
	+ [Vectors](http://www.scootle.edu.au/ec/viewing/R11217/R11217/index.html)
	+ [The Physics of Sailing](https://www.scootle.edu.au/ec/login.action;jsessionid=530C129A2B39E905DBC59E714B269BC3?redirect=ecf454878618e4e522d8e4426988e43139704974f6ad0637f3a4ad640f0baefddb29de01a698a5362b5f6a79504be750f13e60f525ff57a102fbd1c58f83b496b175f2f3de7628abb250d466ce9f45bbeaf861ac86746fb906ca6e906636d2f87ea48cd800710447)
	+ [Sea Rescue](http://www.scootle.edu.au/ec/viewing/L54/index.html)
	+ [River currents](http://www.scootle.edu.au/ec/viewing/L55/index.html)

## Standing waves

* [Simple Harmonic Motion](https://www.scootle.edu.au/ec/login.action?redirect=ecf454878618e4e522d8e4426988e43139704974f6ad0637f3a4ad640f0baefddb29de01a698a5362b5f6a79504be750f13e60f525ff57a102fbd1c58f83b49609debe40bcdafded1c6a0f3e0dd6aeb7d483b7438f5a839d6d30369f8ea95ae3f8d55afef4a4f421) – Scootle
* PhET
	+ [Standing Waves Lab](https://phet.colorado.edu/en/contributions/view/4540)
	+ [Standing Waves Exploration](https://phet.colorado.edu/en/contributions/view/3463)
	+ Transverse [Standing Waves](https://phet.colorado.edu/en/contributions/view/2924) Exploration
	+ [Waves on A String Lesson](https://phet.colorado.edu/en/contributions/view/4079)
	+ [Waves on A String – Inquiry Based](https://phet.colorado.edu/en/contributions/view/2819)
	+ [Waves on A String](https://phet.colorado.edu/en/contributions/view/4428)
	+ [Waves on a String Discovery Activity](https://phet.colorado.edu/en/contributions/view/2948)
* Physics classroom
* [Beats Interactive](https://www.physicsclassroom.com/Physics-Interactives/Waves-and-Sound/Beats)
* [Interference and Beats](https://www.physicsclassroom.com/class/sound/Lesson-3/Interference-and-Beats)
* [The Doppler Effect](https://www.physicsclassroom.com/class/waves/Lesson-3/The-Doppler-Effect)
* [Mathematics of Standing Waves](https://www.physicsclassroom.com/class/waves/Lesson-4/Mathematics-of-Standing-Waves)
* YouTube
	+ [Wave number](https://www.youtube.com/watch?v=YMW8CcnDp7A) (duration 17:12)
	+ [The Doppler Effect: what does motion do to waves](https://www.youtube.com/watch?v=h4OnBYrbCjY) (duration 3:02)
	+ [The Doppler Effect Animated Examples](https://www.youtube.com/watch?v=eo_owZ2UK7E) (duration 1:42).

## Electricity and magnetism

* [Kirchhoff’s voltage law](https://www.khanacademy.org/science/physics/circuits-topic/circuits-resistance/v/ee-kirchhoffs-voltage-law) (duration 6:49) – Khan Academy
* [Kirchhoff’s laws](https://www.khanacademy.org/science/physics/circuits-topic/circuits-resistance/a/ee-kirchhoffs-laws) – Khan Academy (article)
* [How to Solve a Kirchhoff’s Rules Problems](https://www.youtube.com/watch?v=Z2QDXjG2ynU) (duration 9:11)
* [Kirchhoff’s Laws Practice Problems 1](https://www.youtube.com/watch?v=C1NVOLf4gnc) (duration 4:36).

## Elementary thermodynamics

* [Motion and Energy Transfer](https://www.sciencebydoing.edu.au/) – Science by Doing
* [Application of the First Law of Thermodynamics](https://phet.colorado.edu/en/contributions/view/3256) – PhET
* [Basic Thermodynamic Inquiry](https://phet.colorado.edu/en/contributions/view/3175) – PhET
* [Specific Heat Capacity](https://phet.colorado.edu/en/contributions/view/4400) – PhET
* [Energy Forms Simulation Activity](https://phet.colorado.edu/en/contributions/view/3780) (Radiation, conduction and convection) – PhET
* [Latent heat 1](https://www.bbc.co.uk/bitesize/guides/zchgqhv/revision/1) – Bitesize
* [Latent heat 2](https://www.khanacademy.org/science/physics/thermodynamics/specific-heat-and-heat-transfer/v/specific-heat-and-latent-leat-of-fusion-and-vaporization-2) (duration 14:56) – Khan Academy
* [Change of State and Specific Latent Heat](https://www.youtube.com/watch?v=gDbo_vGOycU) (duration 2:26)
* [Thermal conduction in solids](https://content.echalk.co.uk/login/loginFailed.aspx?ReturnUrl=%2Fesa%2FScience%2Fphysics%2Fconduction%2Fconduction%2Ehtml) – eChalk
* [Can you feel it? Judging hot and cold](https://education.abc.net.au/home#!/media/103440/) – ABC Education
* [Particles – heat and movement](https://www.scootle.edu.au/ec/viewing/L3254/index.html) – Scootle.

## The nature of light

* Huygen and the [wave model of light](https://www.physicsclassroom.com/Teacher-Toolkits/Wave-Model-of-Light/Wave-Model-of-Light-Complete-ToolKit) – Physics Classroom
* [Malus’ Law](http://www.physicshandbook.com/laws/maluslaw.htm) – Physics Handbook
* [Polarization](https://www.physicsclassroom.com/class/light/Lesson-1/Polarization) – Physics Classroom
* [Malus’ law](https://www.youtube.com/watch?v=utY72MD-Ii4) (duration 3:54)
* [Wein’s Law](http://hyperphysics.phy-astr.gsu.edu/hbase/wien.html)
* [Wein’s Law - old version](https://www.youtube.com/watch?v=__x4IjPQnro) (duration 4:00)
* [Temperature and Luminosity of Stars: Wein’s Law](https://phet.colorado.edu/en/contributions/view/3873) – PhET
* [Wein’s Law and the Stefan-Bolzmann Law](https://www.youtube.com/watch?v=_ILvBAVInhI) (duration 7:27).

## Standard model of matter

### Websites

* [Light and Matter](http://www.resources.det.nsw.edu.au/Resource/Access/3f9047be-1ee3-40ca-a844-998ba2d9956a/1) – NSW DoE
* [Cosmology](https://www.atnf.csiro.au/outreach/education/senior/cosmicengine/cosmologytop.html) (Transformation of radiation into matter) – CSIRO
* [Expansion of the universe](https://assist.asta.edu.au/resource/2986/expansion-universe-year-10-cle?search-id=8f0fb16) (Big Bang and Hubble) – ASTA
* [Our Universe](http://scienceweb.asta.edu.au/years-9-10/unit3/overview/yr910-unit3-overview.html) – ASTA
* [The expanding Universe](https://www.bbc.co.uk/bitesize/guides/z8gqpbk/revision/2) – Bitesize
* [Standard model](https://home.cern/science/physics/standard-model) – CERN
* [The life cycle of a star](https://www.bbc.co.uk/bitesize/guides/zpxv97h/revision/2) (Nuclear reactions in stars) – Bitesize
* [Edwin Hubble and the Expanding Universe](https://www.atnf.csiro.au/outreach/education/senior/cosmicengine/hubble.html) – CSIRO
* [Einsteinlight – a simple introduction to relativity](https://www.scootle.edu.au/ec/search?topic=%22Frames+of+reference%22&browseBy=topic) – Scootle
* [Atomic Spectra](https://phet.colorado.edu/en/contributions/view/3872) (using Spectra to classify stars) – PhET
* [Analysing Spectra (PDF 15 pages)](https://nasaeclips.arc.nasa.gov/resources/guides) – NASA
* [Black Body Radiation](https://phet.colorado.edu/en/contributions/view/3212) – PhET
* [How are Spectra Produced?](https://www.atnf.csiro.au/outreach/education/senior/astrophysics/spectroscopyhow.html) – CSIRO
* [Blackbody Spectrum](https://phet.colorado.edu/en/simulation/blackbody-spectrum) – PhET
* [Colour and Spectral Types (PDF 29 pages)](https://studylib.net/doc/8659763/colours-and-spectral-types--learning-about-stars-from-the...) – SAO
* [Spectra of Light](https://phet.colorado.edu/en/contributions/view/3075) (stellar spectra) – PhET
* [Hertzsrpung-Russell Diagram](https://www.atnf.csiro.au/outreach/education/senior/astrophysics/stellarevolution_hrintro.html) – CSIRO
* [Interactive HR Diagrams](http://aspire.cosmic-ray.org/Labs/OldStarLife/hr_interactive.html) (Hertzsprung-Russell Diagram Interactive 1)
* [Hertzsprung-Russell Diagram](https://lco.global/spacebook/stars/h-r-diagram/) – LCO
* [Hertzsprung-Russell Diagram activities](https://www.atnf.csiro.au/outreach/education/senior/cosmicengine/stars_hractivity.html) – CSIRO
* [Main Sequence Stars](https://www.atnf.csiro.au/outreach/education/senior/astrophysics/stellarevolution_mainsequence.html) – CSIRO
* [Proton-Proton Chain Activity (PDF 2 pages)](http://denisemeeks.com/science/activities/ast/proton_proton_chain_activity.pdf) and [answers (PDF 1 page)](http://denisemeeks.com/science/index.php) – denisemeeks
* [Carbon-nitrogen-oxygen cycle](https://astronomy.swin.edu.au/cosmos/C/CNO%2Bcycle) – Cosmos
* [Nucleosynthesis](https://wmap.gsfc.nasa.gov/universe/bb_tests_ele.html) – NASA
* [Characteristics of Stars](https://padlet.com/faith_nor/wunkmamr6dvs) – Padlet
* [Millikan’s oil drop experiment simulation](http://www.furryelephant.com/content/radioactivity/discovery-electron-thomson/millikan-oil-drop-simulation/) – Furry Elephant
* [Geiger-Marsden experiment](https://www.bbc.co.uk/bitesize/guides/zcvq4qt/revision/1) – Bitesize
* [Rutherford-Geiger Marsden Experiment](http://physicsopenlab.org/2017/04/11/the-rutherford-geiger-marsden-experiment/) – Physics Open Lab
* [Rutherford Scattering Simulation](https://phet.colorado.edu/en/contributions/view/3149) – PhET
* [Atomic Structure](http://www.scootle.edu.au/ec/viewing/L2562/index.html) – Scootle
* [Atomic Structure (Rutherford Scattering)](https://phet.colorado.edu/en/contributions/view/3064) – PhET
* [Chadwick’s Discovery of the Neutron](http://webs.mn.catholic.edu.au/physics/emery/hsc_quanta_quarks.htm) – Catholic Education Dept
* [Bohr model of the atom](https://phet.colorado.edu/en/contributions/view/3070) – PhET
* [Models of Atom](https://phet.colorado.edu/en/contributions/view/3894) – PhET
* [Model of the Hydrogen Atom](https://phet.colorado.edu/en/contributions/view/3465) – PhET
* [Development of the Atomic Theory](http://www.abcte.org/files/previews/chemistry/s1_p6.html) (Schrodinger) – ABCTE
* [Schrodinger’s contribution to the atomic theory](https://prezi.com/glz_1advlpi1/schrodingers-contribution-to-the-atomic-theory/) – Prezi
* [Atomic Structure Timeline](http://atomictimeline.net/)
* [Alpha Decay](https://phet.colorado.edu/en/simulation/legacy/alpha-decay) – PhET
* [Alpha Decay Investigations](https://phet.colorado.edu/en/contributions/view/3558) – PhET
* [Alpha Decay Simulation Lab](https://phet.colorado.edu/en/contributions/view/3013) – PhET
* [Beta Decay](https://phet.colorado.edu/en/simulation/legacy/beta-decay) – PhET
* [Beta Decay Investigations](https://phet.colorado.edu/en/contributions/view/3559) – PhET
* [Beta Decay Simulation Lab](https://phet.colorado.edu/en/contributions/view/3012) – PhET
* [Making Stable Atoms Lab](https://phet.colorado.edu/en/contributions/view/4418) – PhET
* [Radioactive Decay](https://www.scootle.edu.au/ec/viewing/L8031/index.html) – Scootle
* [Radioactive Decay Half Life](https://www.scootle.edu.au/ec/viewing/L8032/index.html) – Scootle
* [Physical Science – nuclear decay](https://www.scootle.edu.au/ec/viewing/L8992/index_490.html) – Scootle
* [Radioactive Decay, Fission and Chain Reactions](https://phet.colorado.edu/en/contributions/view/2888) – PhET
* [Fission control](http://www.scootle.edu.au/ec/viewing/L47/index.html) – Scootle
* [Nuclear Fission](https://phet.colorado.edu/en/simulation/legacy/nuclear-fission) – PhET
* [Nuclear Fission Inquiry](https://phet.colorado.edu/en/contributions/view/3335) – PhET
* [Nuclear Fission Simulation Lab](https://phet.colorado.edu/en/contributions/view/3273) – PhET
* [Exploring Nuclear Fission](https://phet.colorado.edu/en/contributions/view/4462) – PhET
* [Nuclear fission and fusion](https://www.bbc.co.uk/bitesize/guides/zx86y4j/revision/1) – BBC Bitesize
* [Nuclear Fission – Nuclear Power](https://www.nuclear-power.net/nuclear-power/fission/)
* [Nuclear fusion future](https://education.abc.net.au/home#!/media/29862/) – ABC Education
* [Nuclear Fusion – Nuclear Energy](https://nuclear-energy.net/what-is-nuclear-energy/nuclear-fusion)
* [CERN legend stuff of angels and demons](http://www.abc.net.au/science/articles/2008/04/08/2211092.htm) – ABC Science
* [Exploring atoms](http://www.scootle.edu.au/ec/viewing/L3125/index.html) – Scootle
* [Exploring atoms – Atom builder](http://www.scootle.edu.au/ec/viewing/L2564/index.html) – Scootle
* [Exploring atoms – Ion builder](http://www.scootle.edu.au/ec/viewing/L2565/index.html) – Scootle
* [Exploring atoms – Assisted atom builder](http://www.scootle.edu.au/ec/viewing/L2563/index.html) – Scootle
* [What happens when protons collide](http://helios.gfsc.nasa.gov/neucleo)– ABC Education
* [Quarks](https://particleadventure.org/quarks.html) – The Particle Adventure
* [Hadrons](https://particleadventure.org/hadrons.html) – Particle Adventure
* [Classification of Particles](http://physicsnet.co.uk/a-level-physics-as-a2/particles-radiation/classification-of-particles/) – Physics UK
* [Leptons](https://particleadventure.org/leptons.html) – Particle Adventure
* [What’s a neutrino?](http://www.astro.wisc.edu/~heroux/neutrino.html) – ASTRO
* [Leptons – Nuclear Power](https://www.nuclear-power.net/nuclear-power/reactor-physics/atomic-nuclear-physics/fundamental-particles/leptons/)
* [The leptons](http://resources.schoolscience.co.uk/PPARC/16plus/partich3pg2.html) – Atoms – the inside story
* [How an accelerator works](https://home.cern/science/accelerators/how-accelerator-works) – CERN
* [Australian Synchrotron](https://www.ansto.gov.au/education/nuclear-facts/what-is-synchrotron-light) – ANSTO

### YouTube

* [Equivalence of energy and mass and transformation of radiation](https://www.youtube.com/watch?v=AQlmDQq0yN8) (duration 8:45)
* [Mass-Energy equivalence](https://www.youtube.com/watch?v=hWcACTswM9A) (duration 5:21)
* [Emission and Absorption Spectra](https://www.youtube.com/watch?v=1uPyq63aRvg) (duration 5:17)
* [Proton-Proton Chain](https://www.youtube.com/watch?v=VLwp0xjSifs) (duration 1:00)
* [The carbon-nitrogen-oxygen cycle animation](https://www.youtube.com/watch?v=O48tNoZCzb8) (duration 3:48)
* [Millikan’s Oil Drop Experiment 1](https://www.youtube.com/watch?v=ijHKu6iXiRk) (duration 1:13)
* [Millikan’s Oil Drop Experiment 2](https://www.youtube.com/watch?v=ijHKu6iXiRk) (duration 5:51)
* [Rutherford Scattering Experiment](https://www.youtube.com/watch?v=y5mO_uY0fI4) (duration 10:50)
* [Geiger Marsden experiment](https://www.youtube.com/watch?v=LTfVEyG9h98) (duration 21:50)
* [Rutherford’s Model of an Atom](https://www.youtube.com/watch?v=4z46Bs3fRCY) (duration 5:15)
* [Discovery of Neutrons](https://www.youtube.com/watch?v=HnmEI94URK8) (duration 2:13))
* [Discovery of the Neutron](https://www.youtube.com/watch?v=_7DAlvRI1M4) (duration 10:11)
* [Limitations of the Bohr Model](https://www.youtube.com/watch?v=W6Vl-VULw9o) (duration 6:48)
* [Drawbacks of the Rutherford Atom Model](https://www.youtube.com/watch?v=tIaiAVhC_0M) (duration 1:27)
* [Balmer Series and Hydrogen Emission](https://www.youtube.com/watch?v=RYD96LB7BkY) (duration 7:46)
* [Balmer Series and Spectral Emission Lines](https://www.youtube.com/watch?v=hj1QaojnlBs) (duration 8:10)
* [The Rydberg Equation and Balmer Series of Hydrogen](https://www.youtube.com/watch?v=gFEti-IfI5A) (duration 4:56)
* [Rydberg Equation](https://www.youtube.com/watch?v=4kOdbqoycmY) (duration 7:00)
* [De Broglie Wavelength](https://www.youtube.com/watch?v=ZqspDsQSZuI) (duration 4:28)
* [Modern Atomic Theory, De Broglie’s, Schrodinger and Heisenberg](https://www.youtube.com/watch?v=NYZOKCzhljo) (duration 10:08)
* [Nuclear Fission reaction explained](https://www.youtube.com/watch?v=mBdVK4cqiFs) (duration 3:43))
* [Nuclear Transmutation Part 1](https://www.youtube.com/watch?v=Hpn5G1FiuCs) (duration 12:55)
* [Nuclear Fusion explained](https://www.youtube.com/watch?v=Cb8NX3HiS4U) (duration 3:19)
* [Mass-Energy Equivalence](https://www.youtube.com/watch?v=hWcACTswM9A) (duration 5:21)
* [What is Nuclear Binding Energy?](https://www.youtube.com/watch?v=XuMFluHBUQg) (duration 2:12)
* [Nuclear Binding Energy Calculation](https://www.youtube.com/watch?v=4N3Srx0xRQc) (duration 20:08)
* [What are Quarks?](https://www.youtube.com/watch?v=nlv06lSAC7c) (duration 3:17)
* [Classroom Aid – Hadrons](https://www.youtube.com/watch?v=lNGVBx5sE4k) (duration 2:00)
* [Quarks and leptons for beginners](https://www.youtube.com/watch?v=pdVybAwVqUs) (duration 4:01)
* [Four Fundamental Forces Explained](https://www.youtube.com/watch?v=a-6skWBuHaE) (duration 3:46)
* [Four Fundamental Forces of Physics](https://www.youtube.com/watch?v=Yv3EMq2Dgq8) (duration 3:36)
* [Inside The World’s Largest Particle Accelerator](https://www.youtube.com/watch?v=328pw5Taeg0) (duration 6:13)
* [How particle accelerators work](https://www.youtube.com/watch?v=ZEc7r3rjNlk) (duration 6:09).

### Other videos

* Khan Academy
	+ [Emission spectrum of hydrogen](https://www.khanacademy.org/science/physics/quantum-physics/atoms-and-electrons/v/emission-spectrum-of-hydrogen) (duration 10:49)
	+ [Absorption and emission](https://www.khanacademy.org/science/physics/quantum-physics/atoms-and-electrons/v/absorption-and-emission) (duration 10:29)
	+ [Bohr model energy levels](https://www.khanacademy.org/science/physics/quantum-physics/atoms-and-electrons/v/bohr-model-energy-levels) (duration 9:46)
	+ [De Broglie wavelength](https://www.khanacademy.org/science/physics/quantum-physics/atoms-and-electrons/v/de-broglie-wavelength) (duration 11:19)
	+ [Mass defect and binding energy](https://www.khanacademy.org/science/physics/quantum-physics/in-in-nuclei/v/mass-defect-and-binding-energy) (duration 11:27)
	+ [Four fundamental forces](https://www.khanacademy.org/science/cosmology-and-astronomy/universe-scale-topic/light-fundamental-forces/v/four-fundamental-forces) (duration 10:29).
* Space telescope video – [Hertzsprung-Russell diagram animation](https://www.spacetelescope.org/videos/heic1017b/) (duration 1:39)
* [Brightstorm video – Mass-Energy Equivalence](https://www.brightstorm.com/science/physics/nuclear-physics/mass-energy-equivalence/) (duration 7:21)