# Sample Unit – Physics – Module 1 Kinematics – Year 11

***Sample for implementation for Year 11 from 2018***

| **Module 1** - Kinematics | **Duration** | 35 hours (including 3 hours of Depth Study) |
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| Motion is a fundamental observable phenomenon. The study of kinematics involves describing, measuring and analysing motion without considering the forces and masses involved in that motion. Uniformly accelerated motion is described in terms of relationships between measurable scalar and vector quantities, including displacement, speed, velocity, acceleration and time.Representations, including graphs and vectors, and equations of motion, can be used qualitatively and quantitatively to describe and predict linear motion.By studying this module, students come to understand that scientific knowledge enables scientists to offer valid explanations and make reliable predictions, particularly in regard to the motion of an object. |
| **Outcomes****A student:*** designs and evaluates investigations in order to obtain primary and secondary data and information PH11/12- 2
* conducts investigations to collect valid and reliable primary and secondary data and information PH11/12-3
* selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media PH11/12-4
* analyses and evaluates primary and secondary data and information PH11/12-5
* solves scientific problems using primary and secondary data, critical thinking skills and scientific processes PH11/12-6
* describes and analyses motion in terms of scalar and vector quantities in two dimensions and makes quantitative measurements and calculations for distance, displacement, speed, velocity and acceleration PH11-8
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| **Course requi**r**ements** * Three hours of depth study time devoted to practical investigations related to the assessment task.
* Content and skills related to outcomes and practical investigations
 | **Formal assessment*** Assessment Task 2 – Depth Study Investigation and Report
* Assessment Task 3 – Yearly Examination
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| **Topics**1. Motion in a Straight Line
2. Motion on a Planet
 | **Essential Questions**1. How is the motion of an object moving in a straight line described and predicted?
2. How is the motion of an object that changes its direction of movement on a plane described?
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| **Module 1 – Kinematics** | **Duration** | 30 Hours (including 3 hours of depth study) |
| **Working Scientifically Skills****W/S – Conducting investigations – PH11/12-3**A student conducts investigations to collect valid and reliable primary and secondary data and information.Students:* employ and evaluate safe work practices and manage risks (ACSCH031)
* use appropriate technologies to ensure and evaluate accuracy
* select and extract information from a wide range of reliable secondary sources and acknowledge them using an accepted referencing style

W/S - Processing Data and Information – PH11/12-4A student selects and processes appropriate qualitative and quantitative data and information using a range of appropriate media Students:* select qualitative and quantitative data and information and represent them using a range of formats, digital technologies and appropriate media (ACSCH004, ACSCH007, ACSCH064, ACSCH101)
* apply quantitative processes where appropriate
* evaluate and improve the quality of data

W/S - Analysing Data and Information – PH11/12-5A student analyses and evaluates primary and secondary data and information Students: * derive trends, patterns and relationships in data and information
* assess error, uncertainty and limitations in data (ACSCH004, ACSCH005, ACSCH033, ACSCH099)
* assess the relevance, accuracy, validity and reliability of primary and secondary data and suggest improvements to investigations (ACSCH005)

W/S – Problem Solving – PH11/12-6A student solves scientific problems using primary and secondary data, critical thinking skills and scientific processes Students: * use modelling (including mathematical examples) to explain phenomena, make predictions and solve problems using evidence from primary and secondary sources (ACSCH006, ACSCH010)
* use scientific evidence and critical thinking skills to solve problems

W/S – Communicating – PH11/12-7A student communicates scientific understanding using suitable language and terminology for a specific audience or purposeStudents: * select and use suitable forms of digital, visual, written and/or oral forms of communication
* select and apply appropriate scientific notations, nomenclature and scientific language to communicate in a variety of contexts (ACSCH008, ACSCH036, ACSCH067, ACSCH102)
* construct evidence-based arguments and engage in peer feedback to evaluate an argument or conclusion (ACSCH034, ACSCH036)
 | **Depth study** This module will provide students with the opportunity to formulate questions, plan and conduct investigations, as well as processing data and information. Focus should be placed on the development of skills related to questioning, planning and conducting investigations, as well as processing and communicating information.  |

| **Topic:** Motion in a Straight Line |
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| **Inquiry question:** How is the motion of an object moving in a straight line described and predicted? |
| **Content** | **Teaching, learning and assessment** |
| Students:● describe uniform straight-line (rectilinear) motion and uniformly accelerated motion through:– qualitative descriptions– the use of scalar and vector quantities (ACSPH060) ● conduct an investigation to gather data to facilitate the analysis of instantaneous and average velocity through:– quantitative, first-hand measurement– the graphical representation and interpretation of data (ACSPH061)● calculate the relative velocity of two objects moving along the same line, using vector analysis● conduct investigations, selecting from a range of technologies, to record and analyse the motion of objects in a variety of situations in one dimension in order to measure or calculate:– time– distance– displacement– speed– velocity– acceleration● use mathematical modelling and graphs, selected from a range of technologies, to analyse and derive relationships between time, distance, displacement, speed, velocity and acceleration in rectilinear motion, including:(ACSPH061) | * Students, using ICT tools (eg google maps, satnav, mobile phone applications) compare and contrast the differences between distance, displacement, speed, velocity and acceleration to describe the motion of objects in situations such as players on a basketball court, a journey to school, a passenger in an elevator
* Students use a simulation to interpret and draw position, velocity and acceleration graphs for common situations. <https://phet.colorado.edu/en/simulation/legacy/moving-man>
* Students conduct an investigation, using ICT tools such as data loggers and motion sensors to measure the instantaneous and average velocity of a ball rolling down a slope, falling, and rolling across a flat surface.
* Students construct graphs of displacement–time and distance–time graphs from the investigation to demonstrate the difference between vector and scalar quantities <http://www.scootle.edu.au/ec/viewing/L10093/html/index.html>
* Students construct a velocity time graph and explore the uses for the gradient and the area under the graph in terms of displacement and acceleration.
* Students calculate relative velocities of trains travelling (a) towards each other, (b) away from each other and (c) travelling in the same direction at various speeds.
* Students analyse motion of a uniformly accelerating dynamics trolley or similar along a bench using: (a) ruler and stopwatch; (b) ticker timers; (c) data loggers and photogates, (d) ICT tools
* Students analyse the motion of a mass on a spring using motion sensors, dataloggers or any available ICT tools.
* Students conduct an investigation to predict and measure time taken, final velocity and acceleration for a ball to fall or roll a given distance.
* Students examine the gradient formula for acceleration from a velocity vs time graph to derive $\vec{v}=\vec{u}+\vec{a}t$
* Students derive $\vec{s}=\vec{u}t+\frac{1}{2}\vec{a}t^{2}$ by investigating the area of a velocity–time graph
* Derive $\vec{v}^{2}=\vec{u}^{2}+2\vec{a}\vec{s}$ by combining and rearranging other two equations.
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| **Topic :** Motion on a Plane |
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| **Inquiry question:** How is the motion of an object that changes its direction of movement on a plane described? |
| **Content** | **Teaching, learning and assessment** |
| Students:* analyse vectors in one and two dimensions to:

– resolve a vector into two perpendicular components– add two perpendicular vector components to obtain a single vector (ACSPH061)* represent the distance and displacement of objects moving on a horizontal plane using:

– vector addition– resolution of components of vectors (ACSPH060)* describe and analyse algebraically, graphically and with vector diagrams, the ways in which the motion of objects changes, including:

– velocity– displacement (ACSPH060, ACSPH061)● describe and analyse, using vector analysis, the relative positions and motions of one object relative to another object on a plane (ACSPH061)● analyse the relative motion of objects in two dimensions in a variety of situations, for example:– a boat on a flowing river relative to the bank– two moving cars– an aeroplane in a crosswind relative to the ground (ACSPH060, ACSPH132) | * Students use the online tutorial to introduce vector components, addition and subtraction: <http://www.animations.physics.unsw.edu.au/jw/vectors.htm>
* Students draw horizontal and vertical components of vectors for displacements, velocities and accelerations from selected exercises.
* Students use computer simulations to depict vectors and find the sum of two perpendicular vectors. <https://phet.colorado.edu/en/simulation/vector-addition>
* Students use “The Physics classroom” to examine and practice exercises on vector addition, vector resolution and component addition

<http://www.physicsclassroom.com/class/vectors>* Students solve problems about changes in the displacement and velocity of objects in various situations.
* Students carry out online investigation of Sea Rescue activity: <http://www.scootle.edu.au/ec/viewing/L54/index.html>
* Students solve a range of problems to determine relative position and velocity from different perspectives in a variety of situations. <https://www.youtube.com/watch?v=BLuI118nhzc> <http://hyperphysics.phy-astr.gsu.edu/hbase/airpw.html> <http://newt.phys.unsw.edu.au/~jw/sailing.html>
* Depth study: Students produce a video report of an experiment that they have designed and carried out to test a hypothesis about relative motion in two dimensions.

Focus should be placed on the development of one knowledge and understanding outcomeand the Working Scientifically skills related to:* questioning PH11/12-1
* communicating PH11/12-7
* plus two additional skills
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**Reflection and Evaluation**

# TEACHER: CLASS:

**DATE UNIT COMMENCED: DATE UNIT CONCLUDED:**

* **Variations to program:** (List additional resources and outline alternative strategies used.
* **The most effective teaching/ learning strategies and resources in this unit were:** (Please nominate 3 at least)
* **Less effective teaching strategies and resources for this unit were:** (Please nominate 2 at least)

**TEACHER’S SIGNATURE\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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