

National 5 Physics Course Support Notes



This document may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged. Additional copies of these *Unit Support Notes* can be downloaded from SQA's website: www.sqa.org.uk.

Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Contents

Course Support Notes

Introduction	1
General guidance on the Course	2
Approaches to learning and teaching	4
Approaches to assessment	23
Exemplification of standards	24
Equality and inclusion	35
Appendix 1: Reference documents	36
Appendix 2: Resource pack	37
Administrative information	41

Unit Support Notes — Physics: Electricity and Energy (National 5) 42

Introduction	43
General guidance on the Unit	44
Approaches to learning and teaching	45
Equality and inclusion	47
Appendix 1: Reference documents	48
Administrative information	49

Unit Support Notes — Physics: Waves and Radiation (National 5) 50

Introduction	51
General guidance on the Unit	52
Approaches to learning and teaching	53
Equality and inclusion	55
Appendix 1: Reference documents	56
Administrative information	57

Unit Support Notes — Physics: Dynamics and Space (National 5) 58

Introduction	59
General guidance on the Unit	60
Approaches to learning and teaching	61
Equality and inclusion	63
Appendix 1: Reference documents	64
Administrative information	65

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the National 5 Physics Course. They are intended for teachers and lecturers who are delivering the Course and its Units. They should be read in conjunction with the *Course Specification*, the *Course Assessment Specification* and the *Unit Specifications* for the Units in the Course.

General guidance on the Course

Aims

As stated in the *Course Specification*, the aims of the Course are to enable learners to:

- ♦ develop and apply knowledge and understanding of physics
- ♦ develop an understanding of the role of physics in scientific issues and relevant applications of physics, including the impact these could make in society and the environment
- ♦ develop scientific inquiry and investigative skills
- ♦ develop scientific analytical thinking skills in a physics context
- ♦ develop the use of technology, equipment and materials, safely, in practical scientific activities
- ♦ develop planning skills
- ♦ develop problem solving skills in a physics context
- ♦ use and understand scientific literacy, in everyday contexts, to communicate ideas and issues and to make scientifically informed choices
- ♦ develop the knowledge and skills for more advanced learning in physics
- ♦ develop skills of independent working

Progression into this Course

Entry to this Course is at the discretion of the centre. However, learners would normally be expected to have attained the skills and knowledge required by one or more of the following or by equivalent qualifications and/or experience:

- ♦ National 4 Physics

There may also be progression from National 4 Biology, National 4 Chemistry, National 4 Environmental Science and National 4 Science Courses.

Experiences and outcomes

Learners who have completed relevant Curriculum for Excellence experiences and outcomes will find these an appropriate basis for doing the Course.

In this Course, learners would benefit from having experience of the following:

Organisers	Lines of development	
Planet Earth	Energy sources and sustainability	SCN 04
	Space	SCN 06
Forces, Electricity and Waves	Forces	SCN 07,08
	Electricity	SCN 09,10
	Vibrations and waves	SCN 11
Topical Science	Topical science	SCN 20

More detail is contained in the [Physics Progression Framework](#). The Physics Progression framework shows the development of the key areas throughout the suite of Courses.

Skills, knowledge and understanding covered in the Course

Note: teachers and lecturers should refer to the *Course Assessment Specification* for mandatory information about the skills, knowledge and understanding to be covered in this Course.

Progression from this Course

This Course or its components may provide progression for the learner to:

- ◆ Higher Physics
- ◆ National 5 Course in another science subject
- ◆ Skills for Work Courses (SCQF levels 5 or 6)
- ◆ National Certificate Group Awards
- ◆ National Progression Awards (SCQF levels 5 or 6)
- ◆ Employment and/or training

Hierarchies

Hierarchy is the term used to describe Courses and Units which form a structured sequence involving two or more SCQF levels.

It is important that any content in a Course and/or Unit at one particular SCQF level is not repeated if a learner progresses to the next level of the hierarchy. The skills and knowledge should be able to be applied to new content and contexts to enrich the learning experience. This is for centres to manage.

- ◆ Physics Courses from National 3 to Advanced Higher are hierarchical.
- ◆ Courses from National 3 to National 5 have Units with the same structure and titles.

Approaches to learning and teaching

The purpose of this section is to provide you with advice and guidance on learning and teaching. It is essential that you are familiar with the mandatory information within the National 5 Physics Course Assessment Specification.

Teaching should involve an appropriate range of approaches to develop knowledge and understanding and skills for learning, life and work. This can be integrated into a related sequence of activities, centred on an idea, theme or application of physics, based on appropriate contexts, and need not be restricted to the Unit structure. Learning should be experiential, active, challenging and enjoyable, and include appropriate practical experiments/activities and could be learner-led. The use of a variety of active learning approaches is encouraged, including peer teaching and assessment, individual and group presentations, role-playing and game-based learning, with learner-generated questions.

When developing your Physics Course there should be opportunities for learners to take responsibility for their learning. Learning and teaching should build on learners' prior knowledge, skills and experiences. The Units and the key areas identified within them may be approached in any appropriate sequence, at the centre's discretion. The distribution of time between the various Units is a matter for professional judgement and is entirely at the discretion the centre. Each Unit is likely to require an approximately equal time allocation, although this may depend on the learners' prior learning in the different key areas.

Learning and teaching, within a class, can be organised, in a flexible way, to allow a range of learners' needs to be met, including learners achieving at different levels. The hierarchical nature of the new Physics qualifications provides improved continuity between the levels. Centres can, therefore, organise learning and teaching strategies in ways appropriate for their learners.

Within a class, there may be learners capable of achieving at a higher level in some aspects of the Course. Where possible, they should be given the opportunity to do so. There may also be learners who are struggling to achieve in all aspects of the Course, and may only achieve at the lower level in some areas.

Teachers/lecturers need to consider the Course and Unit Specifications, and Course Assessment Specifications to identify the differences between Course levels. It may also be useful to refer to the [Physics Progression Framework](#).

When delivering this Course to a group of learners, with some working towards different levels, it may be useful for teachers to identify activities covering common concepts and skills for all learners, and additional activities required for some learners. In some aspects of the Course, the difference between levels is defined in terms of a higher level of skill.

An investigatory approach is encouraged in Physics, with learners actively involved in developing their skills, knowledge and understanding by investigating a range of relevant physics applications and issues. A holistic approach should be adopted to encourage simultaneous development of learners' conceptual understanding and skills.

Where appropriate, investigative work/experiments, in Physics, should allow learners the opportunity to select activities and/or carry out extended study. Investigative and experimental work is part of the scientific method of working and can fulfil a number of educational purposes.

All learning and teaching should offer opportunities for learners to work collaboratively. Practical activities and investigative work can offer opportunities for group work, which should be encouraged.

Group work approaches can be used within Units and across Courses where it is helpful to simulate real-life situations, share tasks and promote team working skills. However, there must be clear evidence for each learner to show that the learner has met the required assessment standards for the Unit or Course.

Laboratory work should include the use of technology and equipment that reflects current scientific use in physics.

Learners would be expected to contribute their own time in addition to programmed learning time.

Effective partnership working can enhance the science experience. Where possible, locally relevant contexts should be studied, with visits where this is possible. Guest speakers, further and higher education could be used to bring the world of physics into the classroom.

Information and Communications Technology (ICT) can make a significant contribution to practical work in Physics, in addition to the use of computers as a learning tool. Computer interfacing equipment can detect and record small changes in variables allowing experimental results to be recorded over short periods of time completing experiments in class time. Results can also be displayed in real-time helping to improve understanding. Data logging equipment and video cameras can be set up to record data and make observations over periods of time longer than a class lesson which can then be subsequently downloaded and viewed for analysis.

Assessment should be integral to and improve learning and teaching. The approach should involve learners and provide supportive feedback. Self- and peer-assessment techniques should be encouraged, wherever appropriate. Assessment information should be used to set learning targets and next steps.

Learning about Scotland and Scottish culture will enrich the learners' learning experience and help them to develop the skills for learning, life and work they will need to prepare them for taking their place in a diverse, inclusive and participative Scotland and beyond. Where there are opportunities to contextualise

approaches to learning and teaching to Scottish contexts, teachers and lecturers should consider this.

Suggestions for possible contexts and learning activities, to support and enrich learning and teaching, are detailed in the table below.

The **Mandatory Course key areas** are from the *Course Assessment Specification*. **Suggested learning activities** are not mandatory. This offers examples of suggested activities, from which you could select a range. It is not expected that all will be covered. The contexts for **Mandatory Course key areas** are open to personalisation and choice, so centres may also devise their own learning activities. **Exemplification of key areas** is also not mandatory. It provides an outline of the level of demand and detail of the key areas.

Electricity and Energy		
Mandatory Course key areas	Suggested learning activities	Exemplification of key areas
<p>Conservation of energy Knowledge of the principle of 'conservation of energy' applied to examples where energy is transferred between stores. Identification and explanation of 'loss' of energy where energy is transferred.</p> <p>Use of an appropriate relationship to solve problems involving potential energy, mass, gravitational field strength and height. Use of an appropriate relationship to solve problems involving kinetic energy, mass and speed. Use of appropriate relationships to solve problems involving conservation of energy.</p>	<p>Investigate energy transfers and losses in the generation of electricity, motion down a hill, etc. using model car 'stunt sets'.</p> <p>Research other energy transfers in everyday objects such as solar panels.</p> <p>Discuss and explain why processes are not 100% efficient in terms of useful energy.</p>	$E_p = mgh$ $E_k = \frac{1}{2}mv^2$
<p>Electrical charge carriers and electric fields Definition of electrical current as the electric charge transferred per unit time.</p> <p>Use of an appropriate relationship to solve problems involving charge, current and time.</p>	<p>Investigate the interaction of charged objects, for example, metallised polystyrene spheres attracted and repelled, Van de Graaff generator discharged through a micro ammeter.</p>	$Q = It$

<p>Knowledge of the difference between alternating and direct current.</p>	<p>Discuss and research the uses of electrostatics, for example: laser printers, paint spraying, cling film, forensic science, removal of dust, electrostatic precipitators, electrostatic separators.</p> <p>Research the definition of current and its historical context.</p> <p>Use an oscilloscope/data logging software to compare alternating and direct sources.</p>	
<p>Potential difference (voltage) Awareness of the effect of an electric field on a charged particle.</p> <p>Knowledge that the potential difference (voltage) of the supply is a measure of the energy given to the charge carriers in a circuit.</p>	<p>Observe demonstrations of electric fields using Teltron tubes, olive oil and seeds with high tension supply, Van de Graaff generator, parallel plates and suspended pith ball.</p> <p>Use computer simulations to investigate the behaviour of charges in an electric field.</p> <p>Carry out practical investigations to measure potential differences across components in series circuits. Describe the energy transfers and show that although there is a transfer of energy in the circuit the law of conservation of energy still applies.</p>	
<p>Ohm's law Use of a V-I graph to determine resistance.</p> <p>Use an appropriate relationship to solve problems</p>	<p>Carry out a range of practical investigations to determine the relationship between potential difference, current and resistance using simple</p>	$V = IR$

<p>involving potential difference (voltage), current and resistance.</p> <p>Knowledge of the qualitative relationship between the temperature and the resistance of a conductor.</p>	<p>ohmic components.</p> <p>Carry out practical investigations with non-ohmic conductors, for example, a ray-box lamp.</p>	
<p>Practical electrical and electronic circuits</p> <p>Measurement of current, voltage and resistance, using appropriate meters in complex circuits.</p> <p>Knowledge of the circuit symbol, function and application of standard electrical and electronic components including cell, battery, lamp, switch, resistor, variable resistor, voltmeter, ammeter, LED, motor, microphone, loudspeaker, photovoltaic cell, fuse, diode, capacitor, thermistor, LDR, relay, transistor.</p> <p>For transistors, familiarity with the symbols for an npn transistor and an n-channel enhancement mode MOSFET. Explanation of their function as a switch in transistor switching circuits.</p> <p>Knowledge of current and voltage relationships in series and parallel circuits.</p> <p>Use of appropriate relationships to solve problems involving the total resistance of resistors in series and in parallel circuits, and circuits with a combination of series and parallel resistors.</p>	<p>Carry out experiments to confirm the relationships for current and voltage in series and parallel circuits.</p> <p>Construct and investigate a range of series, parallel and combination circuits using ammeters and voltmeters.</p> <p>Investigate the function of the named components in practical circuits, for example the function of a transistor as a switch.</p> <p>Research and discuss the benefits of a ring circuit over a standard parallel circuit.</p> <p>Investigate the effect on the total resistance of a circuit of combining resistors in series and in parallel.</p>	$R_T = R_1 + R_2 + \dots$ $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$

<p>Electrical power Use an appropriate relationship to solve problems involving energy, power and time.</p> <p>Use appropriate relationships to solve problems involving power, potential difference (voltage), current and resistance in electrical circuits. Selection of an appropriate fuse rating given the power rating of an electrical appliance. (3A fuse for most appliances rated up to 720W, 13A fuse for appliances rated over 720W.)</p>	<p>Measure and compare the power of various electrical devices.</p> <p>Investigate the relationship between power and fuses for household appliances.</p> <p>Investigate power loss using model power transmission lines.</p> <p>Carry out a survey into household/educational establishment energy consumption.</p>	$P = \frac{E}{t}$ $P = IV$ $P = I^2 R$ $P = \frac{V^2}{R}$
<p>Specific heat capacity Knowledge that different materials require different quantities of heat to raise the temperature of unit mass by one degree Celsius.</p> <p>Knowledge that the temperature of a substance is a measure of the mean kinetic energy of its particles.</p> <p>Explanation of the connection between temperature and heat energy.</p> <p>Use an appropriate relationship to solve problems involving mass, heat energy, temperature change and specific heat capacity.</p> <p>Use of the principle of conservation of energy to determine heat transfer.</p>	<p>Heat different masses of water in similar kettles predicting which will reach boiling point first and explain the reasons for this prediction.</p> <p>Carry out experiments to compare the heat energy stored in different materials of the same mass when heated to the same temperature.</p> <p>Research clothing used for specialist jobs, for example fire fighter, astronaut and polar explorer.</p> <p>Explain why some foods seem much warmer on the tongue than others when cooked, eg tomatoes in a cheese and tomato toastie.</p> <p>Design a heating system for example heat pump, solar-heat traps, ground-storage systems, etc.</p>	$E_h = cm\Delta T$

	Design a central-heating boiler to be as 'efficient' as possible and to explain how they plan to reduce heat energy dissipation through the walls of the boiler.	
Gas laws and the kinetic model Knowledge that pressure is the force per unit area exerted on a surface. Description of how the kinetic model accounts for the pressure of a gas. Use of an appropriate relationship to solve problems involving pressure, force and area. Knowledge of the relationship between kelvins and degrees celsius and the absolute zero of temperature. Explanation of the pressure-volume, pressure-temperature and volume-temperature laws qualitatively in terms of a kinetic model. Use of appropriate relationships solve problems involving the volume, pressure and kelvin temperature of a fixed mass of gas.	Research the kinetic theory of gases. Investigate the relationship between pressure and force using gas syringe and masses. Observe Brownian motion in a smoke cell or an animation. . Research the role of Lord Kelvin in the determination of the absolute scale of temperature. Investigate the relationships between the pressure, volume and temperature of a fixed mass of gas. Research and discuss the limitations of the behaviour of real gases.	$p = F/A$ $p_1V_1 = p_2V_2$ $\frac{p_1}{T_1} = \frac{p_2}{T_2}$ $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2}$ $0 \text{ K} = -273 \text{ }^{\circ}\text{C}$

Waves and Radiation		
Mandatory Course key areas	Suggested learning activities	Exemplification of key areas
<p>Wave parameters and behaviours Knowledge that energy can be transferred as waves.</p> <p>Determination of frequency, period, wavelength, amplitude and wave speed for longitudinal and transverse waves.</p> <p>Use of appropriate relationships to solve problems involving wave speed, frequency, period, wavelength, distance, number of waves and time.</p> <p>Awareness of the practical limitations of demonstrating diffraction.</p> <p>Comparison of long wave and short wave diffraction.</p>	<p>Identify, measure and calculate frequency, wavelength and speed for sound waves or water waves, eg using data loggers, or echo methods. Use 'slinkies' to demonstrate transverse and longitudinal waves.</p> <p>Investigate the diffraction of waves around objects and through gaps.</p>	$v = \frac{d}{t}$ $f = \frac{N}{t}$ $v = f\lambda$ $T = \frac{1}{f}$
<p>Electromagnetic spectrum Knowledge of the relative frequency and wavelength of bands of the electromagnetic spectrum with reference to typical sources, detectors and applications.</p> <p>Knowledge of the qualitative relationship between the frequency and energy associated with a form of radiation.</p>	<p>Explore, discuss and compare applications of e-m spectrum beyond the visible. Discuss and compare limitations for applications of e-m waves in relation to frequency.</p>	

Knowledge that all radiations in the electromagnetic spectrum travel at the speed of light.		
Light In ray diagrams showing refraction, identification of the normal, angle of incidence and angle of refraction. Description of refraction in terms of change of wave speed, change of wavelength and change of direction (where the angle of incidence is greater than 0°).	Investigate the reason for the 'apparent depth' of water. Research practical applications of refraction in medicine and industry.	
Nuclear radiation Knowledge of the nature of alpha, beta and gamma radiation, the relative effect of their ionisation, and their relative penetration. Use of an appropriate relationship to solve problems involving activity, number of nuclear disintegrations and time. Knowledge of background radiation sources. Use of appropriate relationships to solve problems involving absorbed dose, equivalent dose, energy, mass and radiation weighting factor. Comparison of equivalent dose due to a variety of natural and artificial sources. Awareness of equivalent dose rate and exposure safety limits for the public and for workers in	Research the extraction of naturally occurring radioactive materials. Measure background radiation in a number of locations. Research into society's reliance on radioactivity for a range of medical and industrial applications, including energy sources. Research annual background radiation in the UK and effective dose limits for a member of the public and for a radiation worker. Average annual background radiation in UK: 2.2 mSv Annual effective dose limit for member of the public: 1 mSv	$A = \frac{N}{t}$ $D = \frac{E}{m}$ $H = Dw_r$ $\dot{H} = \frac{H}{t}$

<p>radiation industries in terms of annual effective equivalent dose.</p> <p>Use of an appropriate relationship to solve problems involving equivalent dose rate, equivalent dose and time.</p> <p>Awareness of applications of nuclear radiation.</p> <p>Definition of <i>half-life</i> Use of graphical or numerical data to determine the half-life of a radioactive material.</p> <p>Qualitative description of fission and fusion, with emphasis on the importance of these processes in the generation of energy.</p>	<p>Annual effective dose limit for radiation worker: 20 mSv</p> <p>Discuss or debate the risks and benefits of radioactivity in society.</p> <p>Discuss or debate the biological effects of radiation.</p> <p>Research the significance of half-life in medical and industrial applications.</p> <p>Research current applications and developments of fission and fusion reactions to generate energy.</p>	
---	--	--

Dynamics and Space		
Mandatory Course key areas	Suggested learning activities	Exemplification of key areas
<p>Velocity and displacement — vectors and scalars</p> <p>Definition of vector and scalar quantities. Identification of force, speed, velocity, distance, displacement, acceleration, mass, time and energy as vector or scalar quantities.</p> <p>Calculation of the resultant of two vector quantities in one dimension or at right angles.</p> <p>Determination of displacement and/or distance using scale diagram or calculation.</p> <p>Use of appropriate relationships to solve problems involving velocity, displacement and time.</p>	<p>Set up an orienteering course in school grounds — calculate displacement and average velocity, distance and average speed..</p> <p>Discuss and compare the difference between vector and scalar quantities.</p> <p>Calculate average speed/velocity using distance/displacement data and time data from a number of contexts, for example athletics, cars, flight, space.</p> <p>Analyse motion vectors using scale diagrams and/or trigonometry.</p>	$\bar{v} = \frac{s}{t}$ $v = \frac{s}{t}$
<p>Velocity–time graphs</p> <p>Sketch of velocity–time graphs for objects from recorded or experimental data.</p> <p>Interpretation of velocity–time graph to describe the motion of an object.</p> <p>Determination of displacement from a velocity–time graph.</p>	<p>Plot graphs from data sets — manually or use of software. Capture and analyse data using appropriate software, eg trolleys running down slopes.</p> <p>Observe the v-t graph of bouncing ball using a motion sensor.</p>	<p>$s = \text{area under } v\text{-}t \text{ graph}$</p>

<p>Acceleration</p> <p>Use of an appropriate relationship to solve problems involving acceleration, initial velocity (or speed), final velocity (or speed) and time.</p> <p>Determination of acceleration from a velocity–time graph.</p>	<p>Determine the acceleration of a vehicle using two light gates and timer recording times for instantaneous speeds and time between.</p> <p>Determine acceleration from a velocity-time graph by finding the gradient using data software.</p>	$a = \frac{v - u}{t}$
<p>Newton's laws</p> <p>Application of Newton's laws and balanced forces to explain constant velocity (or speed), making reference to frictional forces.</p> <p>Use of an appropriate relationship to solve problems involving unbalanced force, mass and acceleration for situations where more than one force is acting.</p> <p>Use of an appropriate relationship to solve problems involving work done, unbalanced force and distance/displacement.</p> <p>Use of an appropriate relationship to solve problems involving weight, mass and gravitational field strength, including on different planets. Knowledge of Newton's second law including its application to space travel, rocket launch and landing.</p> <p>Knowledge of Newton's third law and its application to explain motion resulting from a</p>	<p>Identify forces in vehicles travelling with constant velocity, for example car, helicopter or boat.</p> <p>Investigate 'frictionless movement' using an air hockey puck, linear air-track or model hovercraft.</p> <p>Discuss practical examples of balanced forces, for example gliding, floating in water or tug of war.</p> <p>Investigate Newton's second law using a linear air track or other suitable means.</p> <p>Experiment with water rockets.</p> <p>Observe lunar landing simulations. Investigate parachutes, for example by dropping flat and crushed sheet of paper.</p> <p>Demonstrate balanced forces and terminal velocity by dropping ball bearings into glycerine filled measuring cylinders.</p>	$F = ma$ $W = Fd \text{ or } E_w = Fd$ $W = mg$

<p>'reaction' force. Use of Newton's laws to explain free-fall and terminal velocity.</p>	<p>Relate Newton's laws to car safety measures, for example seatbelts, air bags or crumple zones.</p>	
<p>Projectile motion Explanation of projectile motion.</p> <p>Use of appropriate relationships to solve problems involving projectile motion from a horizontal launch, including the use of motiongraphs.</p> <p>Explanation of satellite orbits in terms of projectile motion.</p>	<p>Observe the 'String of pearls' experiment (using a strobe light to see the separation of projectile motion).</p> <p>Observe the 'Monkey and hunter' experiment.</p> <p>Use tracking software to analyse a video recording of projectile motion.</p> <p>Investigate and calculate 'drop time' and 'time of flight'.</p> <p>Discuss Newton's 'thought' experiment.</p>	<p>Area under v_h-t graphs for horizontal range and area under v_v-t graphs for vertical height.</p> <p>$v_h = \frac{s}{t}$ (constant horizontal velocity)</p> <p>$v_v = u + at$ (constant vertical acceleration)</p>
<p>Space exploration Awareness of evidence supporting current understanding of the universe from telescopes and space exploration.</p> <p>Awareness of the benefits of satellites, for example GPS, weather forecasting, communications and space exploration (Hubble telescope, ISS)</p> <p>Qualitative awareness of the relationship between the altitude of a satellite and its period.</p> <p>Awareness of the potential benefits of space exploration.</p>	<p>Discuss space exploration (emphasising the idea that this is a continually developing area) using suitable simulations and/or DVDs.</p> <p>View videos of re-entry, for example of Joe Kittinger or Felix Baumgartner.</p> <p>Discuss the need for thermal protection systems to protect spacecraft on re-entry, including qualitative and quantitative specific heat capacity.</p>	<p>$E_h = cm\Delta T$</p> <p>$E_h = ml$</p> <p>$E_p = mgh$</p> <p>$E_k = \frac{1}{2}mv^2$</p> <p>$W = Fd$ or</p>

<p>Awareness of the challenges of space travel, including, for example: Travelling large distances with the possible solution of attaining high velocity by using ion drive (producing a small unbalanced force over an extended period of time) or using a 'catapult' from a fast moving asteroid, moon or planet. Manoeuvring a spacecraft in a zero friction environment, possibly to dock with the ISS. Maintaining sufficient energy to operate life support systems in a spacecraft with the possible solution of using solar cells with area that varies with distance from the Sun.</p> <p>Awareness of the risks associated with manned space exploration, for example fuel load on takeoff, potential exposure to radiation, pressure differential and challenges of re-entry to a planet's atmosphere. Use of an appropriate relationship to solve problems involving heat energy, mass and specific latent heat.</p>	<p>Design and make a model heat shield for re-entry.</p>	$E_w = Fd$
<p>Cosmology Use of the term 'light year' and conversion between light years and metres.</p> <p>Description of the observable universe — origin and age of universe.</p> <p>Awareness of the use of different parts of the electromagnetic spectrum in obtaining information</p>	<p>Construct a simple spectroscope from a CD disk and examine common light sources.</p> <p>Use a spectroscope to look at a range of light sources, eg sodium lamp and other gas discharge lamps.</p> <p>Research recent advances in astronomy and in</p>	

about astronomical objects.	our knowledge of the universe.	
Identification of continuous and line spectra.	View the night sky with a telescope.	
Use of spectral data for known elements, to identify the elements present in stars.	Discuss how radio telescopes, the COBE satellite and the SETI institute have advanced our knowledge of the universe.	

National 5 Physics: Units and prefixes

This table applies to the Course and its component Units.

Units, prefixes and scientific notation	Notes
Use of appropriate units and prefixes.	SI units should be used with all the physical quantities. Prefixes should be used where appropriate. These include nano (n), micro (μ), milli (m), kilo (k), mega (M), giga (G).
Use of the appropriate number of significant figures in final answers.	In carrying out calculations and using relationships to solve problems, it is important to give answers to an appropriate number of significant figures. This means that the final answer can have no more significant figures than the value with least number of significant figures used in the calculation.
Appropriate use of scientific notation.	Learners should be familiar with the use of scientific notation and this may be used as appropriate when large and small numbers are used in calculations.

Developing skills for learning, skills for life and skills for work

Learners are expected to develop broad generic skills as an integral part of their learning experience. The *Course Specification* lists the skills for learning, skills for life and skills for work that learners should develop through this Course. These are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and must be built into the Course where there are appropriate opportunities. The level of these skills will be appropriate to the level of the Course.

For this Course, it is expected that the following skills for learning, skills for life and skills for work will be significantly developed:

Numeracy

This is the ability to use numbers in order to solve problems by counting, doing calculations, measuring, and understanding graphs and charts. This is also the ability to understand the results. Learners will have opportunities to extract, process and interpret information presented in numerous formats including tabular and graphical. Practical work will provide opportunities to develop time and measurement skills.

2.1 Number processes

Number processes means solving problems arising in everyday life through carrying out calculations, when dealing with data and results from experiments/investigations and everyday class work, making informed decisions based on the results of these calculations and understanding these results

2.2 Money, time and measurement

This means using and understanding time and measurement to solve problems and handle data in a variety of physics contexts, including practical and investigative.

2.3 Information handling

Information handling means being able to interpret physics data in tables, charts and other graphical displays to draw sensible conclusions throughout the Course. It involves interpreting the data and considering its reliability in making reasoned deductions and informed decisions. It also involves an awareness and understanding of the chance of events happening.

Thinking skills

This is the ability to develop the cognitive skills of remembering and identifying, understanding and applying. The Course will allow learners to develop skills of applying, analysing and evaluating. Learners can analyse and evaluate practical work and data by reviewing the process, identifying issues and forming valid conclusions. They can demonstrate understanding and application of concepts and explain and interpret information and data.

5.3 Applying

Applying is the ability to use existing information to solve physics problems in different contexts, and to plan, organise and complete a task such as an investigation.

5.4 Analysing and evaluating

Analysis is the ability to solve problems in physics and make decisions that are based on available information. It may involve the review and evaluation of relevant information and/or prior knowledge to provide an explanation.

It may build on selecting and/or processing information, so is a higher skill.

In addition, learners will also have opportunities to develop literacy skills, working with others, creativity and citizenship.

Literacy

Learners develop the literacy skills to effectively communicate key Physics concepts and describe, clearly, physics issues in various media forms. Learners will have opportunities to communicate knowledge and understanding of physics, with an emphasis on applications and environmental, ethical and/or social impacts. Learners will have opportunities to develop listening and reading skills when gathering and processing information.

Working with others

Learning activities provide many opportunities, in all areas of the Course, for learners to work with others. Practical activities and investigations, in particular, offer opportunities for group work, which is an important aspect of science and should be encouraged.

Creativity

Learners can demonstrate creativity when learning Physics, in particular, when planning and designing experiments/investigations. Learners also have the opportunities to make, write, say or do something new

Citizenship

Learners will develop citizenship skills, when considering the applications of Physics on our lives, as well as environmental and ethical implications.

Approaches to assessment

Assessment should cover the mandatory skills, knowledge and understanding of the Course. Assessment should be integral to and improve learning and teaching. The approach should involve learners and provide supportive feedback. Self-and peer-assessment techniques should be used, whenever appropriate.

See the *Unit Support Notes* for guidance on approaches to assessment of the Units of the Course.

Added value

Courses from National 4 to Advanced Higher include assessment of added value. At National 5, Higher and Advanced Higher, the added value will be assessed in the Course assessment.

Information given in the *Course Specification* and the *Course Assessment Specification* about the assessment of added value is mandatory.

Suggested investigations

Some suggested investigations are listed below which are likely to be familiar to assessors. Centres are free to select other appropriate investigations.

Topic	Key area
Car safety	Newton's laws
Electricity generation using nuclear sources	Nuclear radiation
Hybrid vehicles	Conservation of energy
Space exploration	Space exploration

A resource pack has been developed for one of these investigations and can be found in Appendix 2. This is not mandatory. Centres are free to develop their own investigations.

Preparation for Course assessment

Each Course has additional time which may be used at the discretion of the teacher or lecturer to enable learners to prepare for Course assessment. This time may be used near the start of the Course and at various points throughout the Course for consolidation and support. It may also be used for preparation for Unit assessment, and towards the end of the Course, for further integration, revision and preparation and/or gathering evidence for Course assessment.

During delivery of the Course, opportunities should be found:

- ♦ for identification of particular aspects of work requiring reinforcement and support

- ♦ to practise skills of scientific inquiry and investigation in preparation for the Assignment
- ♦ to practise question paper techniques

Combining assessment across Units

If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units. If this approach is used, then it is necessary to be able to track evidence for individual Outcomes and Assessment Standards.

Transfer of evidence: Evidence for the achievement of Outcome 1 and Assessment Standard 2.2 for one Unit can be used as evidence of the achievement of Outcome 1 and Assessment Standard 2.2 in the other Units of this Course.

Exemplification of standards

Assessment Standards can be achieved using one or more pieces of evidence covering work done on different occasions.

Assessors should record evidence of achievement of Outcomes and Assessment Standards. The table below shows one way of recording evidence. This table is not mandatory.

Candidate 1

Assessment Standard	Evidence required	Evidence produced
1.1 Planning an experiment/ practical investigation	Aim of experiment	The aim is clear
	Dependent/independent variable	From the method and results table
	Variables to be kept constant	From the diagram
	Measurements/ observations to be made	From the diagram
	Resources	From the diagram
	Method including safety	Clear. No safety issue
1.2 Following procedures safely	Procedures have been followed safely	✓
1.3 Making and recording observations/ measurements correctly	Observations/ measurements taken are correct	✓
1.4 Presenting results in an appropriate format	Results have been presented in an	Table and graph

	appropriate format	
1.5 Drawing valid conclusions	What the experiment shows, with reference to the aim	✓
1.6 Evaluating experimental procedures	The suggestion given will improve the experiment	✓

This candidate has passed all six Assessment Standards for Outcome 1.

Comments

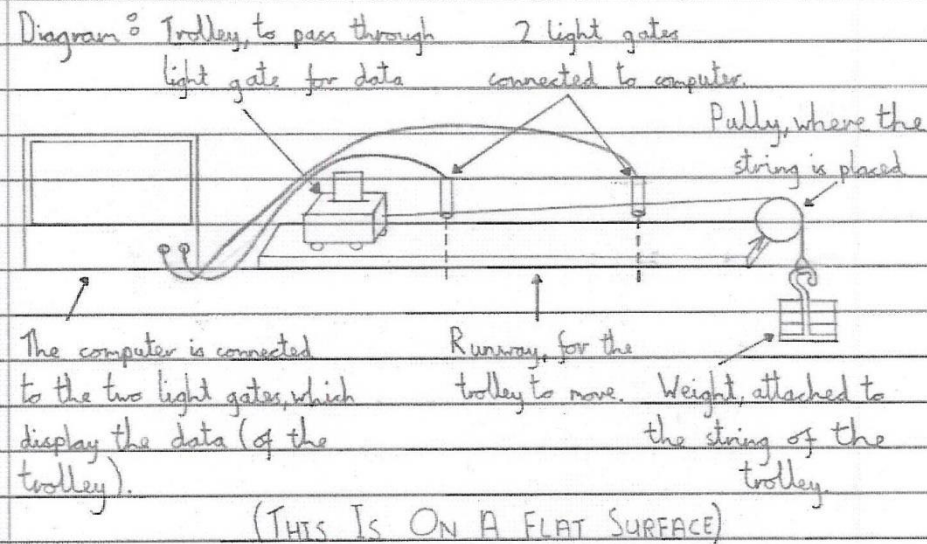
Assessment Standard 1.1: This could be presented more clearly but evidence can be found from the other sections of the report.

Assessment Standard 1.4: Graphs should show the best-fit line and not necessarily go through the origin.

Candidate 1

Newton's 2nd Law

Aim: To find how the size of an unbalanced force affects the acceleration of an object



Method: The trolley is accelerated by adding mass to an end of a string which is attached to the trolley. This will pull the trolley across the 2 light gates, which will give us the acceleration of the trolley, displayed on a computer.

The unbalanced force is increased by adding more masses to the pulley.

Candidate 1 (contd)

Results:	Mass (kg)	Force (N)	Acceleration (m s^{-2})		
	0.02	0.2	①0.289	②0.295	③0.290
	0.04	0.4	①0.597	②0.590	③0.586
	0.06	0.6	①0.874	②0.869	③0.873
	0.08	0.8	①1.133	②1.154	③1.126

Averages - 0.2 N average acceleration is 0.291 m s^{-2}

- 0.4 N average acceleration is 0.591 m s^{-2}

- 0.6 N average acceleration is 0.872 m s^{-2}

- 0.8 N average acceleration is 1.138 m s^{-2}

Conclusion: In the investigation we added weight's to one side of a trolley to give it an unbalanced force, on 1 side of the trolley. After the 3 repeated accel^s, we found out the average.

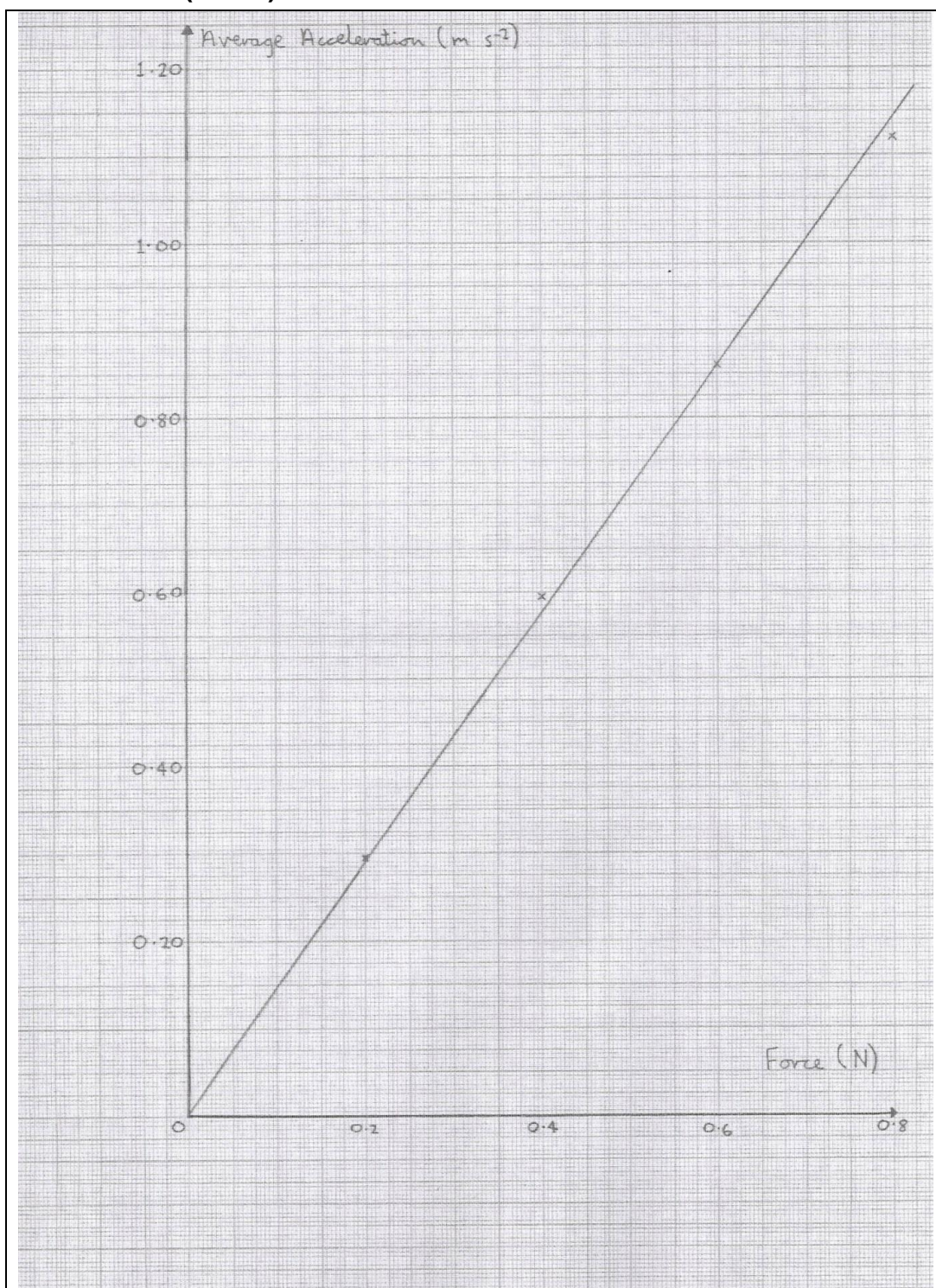
The graph of the result drawn using the averages we found, was a straight line through the origin. This tells us that the Force is directly proportional to accel^s.

$$F \propto a$$

↑
Directly
proportional

Evaluation: To improve this investigation you could make the string shorter, so it doesn't hit the floor before the trolley goes past both light gates. To make it even better you could do more repeated accel^s. You could also check if the surface is flat to be perfect.

Candidate 1 (contd)



Candidate 2

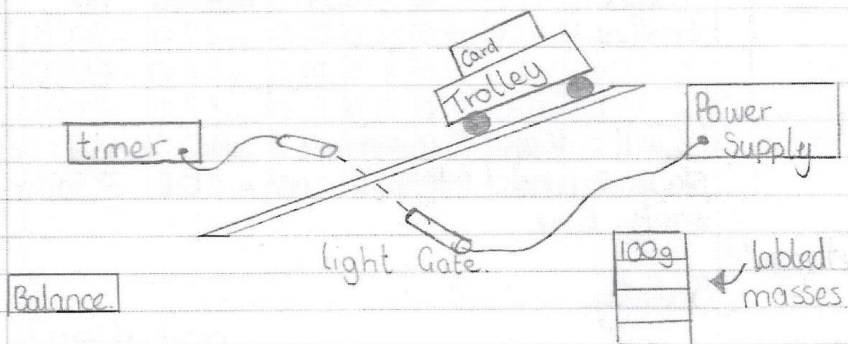
Assessment Standard	Evidence required	Evidence produced
1.1 Planning an experiment/ practical investigation	Aim of experiment	✓
	Dependent/independent variable	Clearly stated
	Variables to be kept constant	Clearly stated
	Measurements/observations to be made	Clearly stated
	Resources	Clear from diagram
	Method including safety	Clearly stated
1.2 Following procedures safely	Procedures have been followed safely	✓
1.3 Making and recording observations/ measurements correctly	Observations/measurements taken are correct	✓
1.4 Presenting results in an appropriate format	Results have been presented in an appropriate format	Table and graph
1.5 Drawing valid conclusions	What the experiment shows, with reference to the aim	✓
1.6 Evaluating experimental procedures	The suggestion given will improve the experiment	✓

This candidate has passed all six Assessment Standards for Outcome 1.

Mass of Trolley v Instantaneous Speed

Aim

My aim is to investigate how the mass of trolley affects the instantaneous speed of the trolley on a slope.



Method

- First I will measure the length of the card on the trolley
- Then I will weigh the trolley on the balance scale to find its mass.
- I will then measure the time it takes for the card to pass through the light gate. I will do this 3 times to get an average.
- Then I will find the instantaneous speed by dividing the length of the card by the time taken for the

Candidate 2 (contd)

card to pass through the light gate.

- I will then repeat this process but I will add an 100g labelled mass and find the instantaneous speed.

- I will then add another 100g until there is 600g masses on the trolley.

I will keep constant the angle of the slope and I will use the same trolley each time.

Safety

Keep fingers away from trolley when it rolls down the slope.

- Do not drop masses.
- Don't stare at light in light gate.
- Don't touch light gate as it may be hot.

Candidate 2 (contd)

Results Tabel

mass of trolley (g)	Card length (m)	time (s)				instantaneous Speed (ms^{-1})
		1	2	3	Avg	
670g	0.25m	0.19	0.19	0.18	0.19	1.3
770g	0.25m	0.18	0.18	0.19	0.18	1.4
870g	0.25m	0.17	0.18	0.20	0.18	1.4
970g	0.25m	0.19	0.18	0.18	0.18	1.4
1070g	0.25m	0.19	0.19	0.19	0.19	1.3
1170g	0.25m	0.19	0.19	0.19	0.19	1.3
1270g	0.25m	0.19	0.19	0.19	0.19	1.3

Conclusion

From my results I found that adding more masses to the trolley did not change the instantaneous speed

This was not what I expected to happen. I expected the speed to become slower the more masses I added.

Candidate 2 (contd)

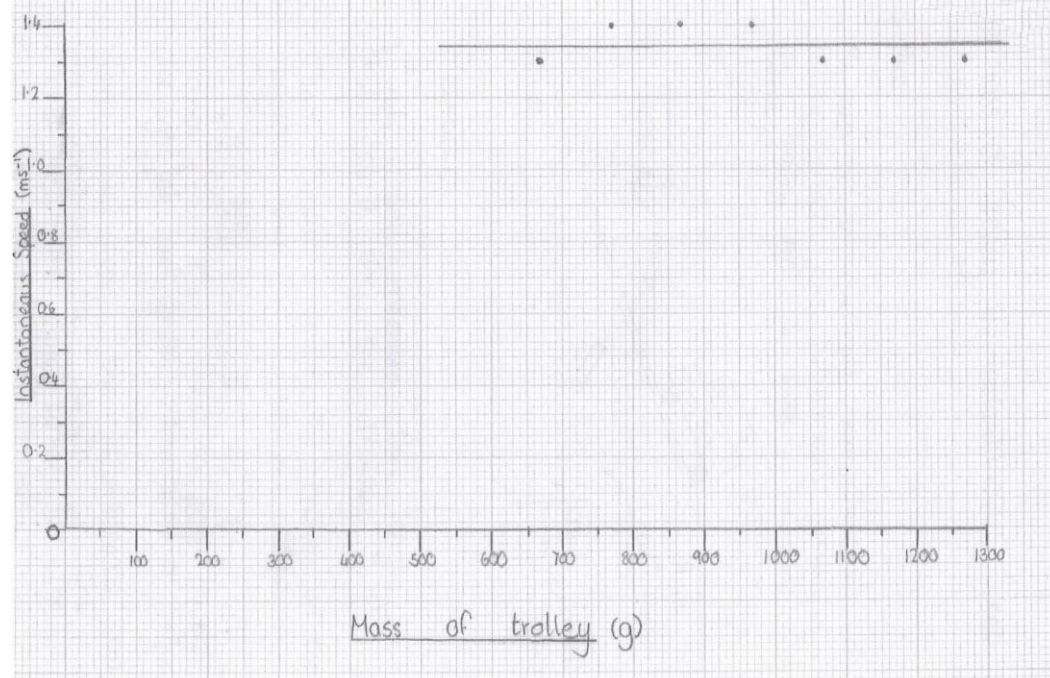
Evaluation

The method I used was suitable however it was difficult to keep the trolley in a straight line.

I kept all the variables, such as the length of the cord and the angle of the slope, the same.

Improvements that could be made to the experiment is to get a more accurate average speed would be to repeat the method more than 3 times. Also using more masses would prove that the instantaneous speed does not change.

Results Graph



Candidate 4

14	Visible Light is the part of the electromagnetic spectrum that is bang in the middle.						
26	Radio & TV Waves	Microwaves	Infrared Radiation	Visible Light	Ultra Violet	X-rays	Gamma Radiation
101	<p>The further left on this, \uparrow increase the more longer the wavelength and smaller the frequency then vice versa on the right. It is the only part that can be seen by the human eye. We are looking at it all the time. Light is a mixture of all the colours of the rainbow. Red, Orange, Yellow, Green, Blue, Indigo & Violet. Once light hits a material, some colours are absorbed, and some are emitted back out. This is why everything is a different colour. The sky is blue because the atmosphere absorbs all colours apart from that those that. Not all light is blocked though because if it was, there would be no colour, or anything at all really. This blockage is called "the Optical Window". Materials emit all differently because their atomic structure is different. This is called the emission spectrum.</p>						
153	<p>A LASER, Light Amplification of Stimulated Emission Radiation, are beams of concentrated light of one colour. This works by the shooting light through a material that absorbs all but one colour a powerful light through a material that absorbs all but one colour. This is then directed out a straight channel and seen as a dot when it hits something. Intense lasers will burn. This is used in Intense lasers will burn laser eye surgery where the cornea is smoothed out to help vision. Tattoos and</p>						
215	<p>birth marks can be removed as well. Cutting a large variety of materials is another use. Accurate grooves can be in discs and circuits are made with lasers too. Visible Light is only dangerous at high concentrations where it will cut through almost anything. At a low concentration it can also damage your eye sight.</p>						

Equality and inclusion

The following should be taken into consideration:

Situation	Reasonable Adjustment
Carrying out practical activities.	Use could be made of practical helpers if learners with physical disabilities, especially manual dexterity, need assistance to carry out practical techniques. Practical helpers may also assist learners who have visual impairment and have difficulty in distinguishing colour changes or other visual information.
Reading, writing and presenting text, symbolic representation, tables, graphs and diagrams.	Use could be made of ICT, enlarged text, alternative paper and/or print colour and/or practical helpers for learners with visual impairment, specific learning difficulties and physical disabilities.
Process information using calculations.	Use could be made of practical helpers for learners with specific cognitive difficulties (eg dyscalculia).
Draw a valid conclusion, giving explanations and making predictions.	Use could be made of practical helpers for learners with specific cognitive difficulties or autism.

As far as possible, reasonable adjustments should be made for the Question Paper and/or Assignment, where necessary. All adjustments currently available for the Question Paper would be available for Component 1. Learners will have a choice of Assignment topic for Component 2, for which reasonable adjustments can be made. This includes the use of 'practical helpers', readers, scribes, adapted equipment or assistive technologies.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Course Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Course.

It is important that centres are aware of and understand SQA's assessment arrangements for disabled learners, and those with additional support needs, when making requests for adjustments to published assessment arrangements. Centres will find more guidance on this in the series of publications on Assessment Arrangements on SQA's website: www.sqa.org.uk/sqa/14977.html.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- ◆ Assessment Arrangements (for disabled learners and/or those with additional support needs) — various publications are available on SQA's website at: www.sqa.org.uk/sqa/14977.html.
- ◆ [*Building the Curriculum 3: A framework for Learning and Teaching*](#)
- ◆ [*Building the Curriculum 4: Skills for learning, skills for life and skills for work*](#)
- ◆ [*Building the Curriculum 5: A framework for assessment*](#)
- ◆ [*Course Specifications*](#)
- ◆ [*Design Principles for National Courses*](#)
- ◆ [*Guide to Assessment* \(June 2008\)](#)
- ◆ [*Overview of Qualification Reports*](#)
- ◆ Principles and practice papers for Sciences curriculum areas
- ◆ Science: A Portrait of current practice in Scottish schools (Nov 2008)
- ◆ [*SCQF Handbook: User Guide*](#) (published 2009) and SCQF level descriptors (to be reviewed during 2011 to 2012): www.sqa.org.uk/sqa/4595.html
- ◆ [*SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work*](#)
- ◆ [*Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool*](#)

Appendix 2: Resource pack

National 5 Physics: Assignment

Resource pack: Car safety



This resource pack gives details of areas that are suitable for an assignment task.

Car safety research/investigation supports:

Unit: Dynamics and Space

Key area: Newton's laws

- ◆ Calculations involving the relationship between unbalanced force, mass and acceleration for situations where more than one force is acting
- ◆ Calculations involving the relationship between work done, unbalanced force and distance/displacement

Background information

Topical issue: Road vehicle safety

Road vehicle safety is a continuous process to find improvements which will reduce the number of road accidents and the severity of any injuries, making road travel safer for everyone.

Research

Car manufacturers research and develop safety features for their vehicles then promote the improvements in order to reassure buyers that their cars are safe. European and government agencies also carry out research in all areas connected with car safety.

Governments carry out vehicle tests to ensure that the cars produced by manufacturers perform safely and meet required standards. Government testing allows the public to compare the safety performance of different cars by using the same standard tests.

Euro NCAP is a European agency set up by the UK and other European governments to investigate vehicle safety, and publish their findings. Euro NCAP organises crash-tests and provides motoring consumers with a realistic and independent assessment of the safety performance of some of the most popular cars sold in Europe.

Energy

Cars have kinetic energy when moving. During braking, the kinetic energy is transferred into heat energy by the brakes. The brakes heat up and then transfer the energy to the surroundings. During collisions, the kinetic energy will not be completely transferred into heat energy in the brakes, but may cause damage to the car and occupants during the collision.

Modern cars have safety features that dissipate kinetic energy during collisions to reduce injury to car occupants.

Assignments

The following areas of car safety research are suitable for an assignment task. Your choice of research topic could be based on one (or more) of these areas

- ◆ The operation and benefit of seat belts.

Since the introduction of seat belts, improvements such as the three-point seat belt, inertia-reel seat belts and pre-tensioning seat belts have been adopted by car manufacturers.

- ◆ The operation and benefit of car 'safety cages'.

The 'safety cage' provides a safe area for passengers in the event of an accident. It has features which protect passengers from certain injuries.

- ◆ The improvement of vehicle braking systems.

Antilock braking systems and electronic stability control have improved car braking.

- ◆ The improvement of steering wheel design.

Steering wheels have been designed to reduce driver injuries during a crash.

- ◆ The use of side-bars to reduce injury.

These have been developed to protect passengers from side impacts.

- ◆ The operation and design of crumple zones.

The front and rear parts of cars have been designed to steadily collapse during a collision to reduce injury to the car occupants.

- ◆ The design and operation of air bags to reduce injury.

Air bags reduce injury to the driver and passengers during collisions.

- ◆ The design and use of pedestrian air bags to reduce injury.

Car manufacturers are developing these to help protect pedestrians who are struck by cars.

- ◆ The use of dynamic car data to minimise injuries when an accident is happening.

Car manufacturers are developing systems which detect whether emergency action is being taken by the driver, and then apply measures to reduce

injuries (for example, taking the slack out of seat belts by using reversible tensioners or closing windows and the sunroof if the car is likely to roll over) .

Websites

The following websites contain information about research which has been carried out into car safety.

<http://hyperphysics.phy-astr.gsu.edu/hbase/carcr.html#cc1>

<http://www.nhtsa.gov/Research/Databases+and+Software>

http://www.theaa.com/allaboutcars/ncap/ncap_car_results.jsp?make=Fiat&modelYear=Doblo:2004&publicationDate=2004-06-01

http://www.theaa.com/motoring_advice/euroncap/crash_tests.html

http://www.thatcham.org/safety/pdfs/bumper_test_development.pdf

<http://www.euroncap.com/Content-Web-Page/c6f9d381-1889-4c66-bfcd-c5c0a69a364d/technical-papers.aspx>

Administrative information

Published: May 2015 (version 2.0)

History of changes to Course Support Notes

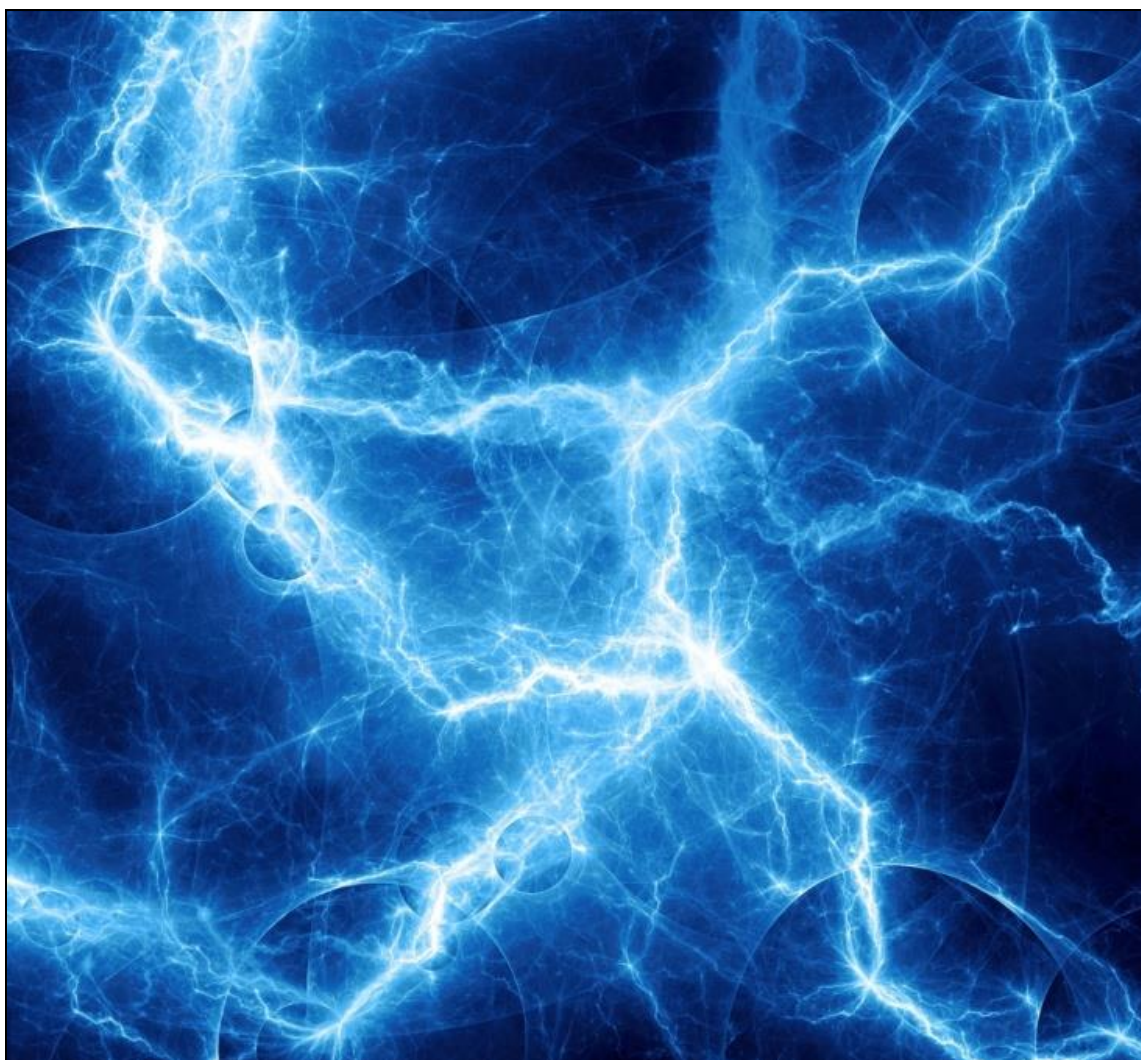
Course details	Version	Description of change	Authorised by	Date
	1.1	Exemplar materials and resource pack added.	Qualifications Development Manager	June 2013
	2.0	In both the 'Mandatory Course key areas' column and the 'Suggested Learning Activities' column of table, detail has been added to increase clarity. References to Assessment Standards 2.3.and 2.4 removed.	Qualifications Manager	May 2015

© Scottish Qualifications Authority 2015

This document may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged. Additional copies can be downloaded from SQA's website at **www.sqa.org.uk**.

Note: You are advised to check SQA's website (**www.sqa.org.uk**) to ensure you are using the most up-to-date version.

Unit Support Notes — Physics: Electricity and Energy (National 5)



This document may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged. Additional copies of these *Unit Support Notes* can be downloaded from SQA's website: www.sqa.org.uk.

Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Physics: Electricity and Energy (National 5) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- ♦ the *Unit Specification*
- ♦ the *Course Specification*
- ♦ the *Course Assessment Specification*
- ♦ the *Course Support Notes*
- ♦ appropriate assessment support materials

General guidance on the Unit

Aims

The general aim of this Unit is to develop skills of scientific inquiry, investigation and analytical thinking, along with knowledge and understanding of electricity and energy.

Learners will apply these skills when considering the applications of electricity and energy on our lives, as well as the implications on society/ the environment. This can be done by using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of:

- ♦ Energy transfer
- ♦ Heat
- ♦ The gas laws

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Progression into this Unit

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by the following or equivalent qualifications and/or experience:

- ♦ National 4 Physics Course

There may also be progression from National 4 Biology, National 4 Chemistry, National 4 Environmental Science and National 4 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 5 *Physics Course Support Notes*.

If this Unit is being delivered on a free-standing basis, teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Progression from this Unit

This Unit may provide progression to:

- ♦ other qualifications in physics or related areas
- ♦ further study, employment and/or training

Approaches to learning and teaching

Approaches to learning and teaching and suggested learning activities are given in the *Course Support Notes*.

Developing skills for learning, skills for life and skills for work

Information about developing skills for learning, skills for life and skills for work in this Unit, is given in the relevant *Course Support Notes*.

Approaches to assessment and gathering evidence

The purpose of this section is to give advice on approaches to assessment for the Unit. There will be other documents produced for centres to provide exemplification of assessments and guidance on how to write them.

Approaches to the assessment of a Unit when it forms part of a Course may differ from approaches to assessing the same Unit when it is not being delivered as part of a Course. If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units.

Assessments must be valid, reliable and fit for purpose for the subject and level, and should fit in with learning and teaching approaches.

Unit assessment should support learning and teaching and where possible enable personalisation and choice for learners in assessment methods and processes. Teachers and lecturers should select the assessment methods they believe are most appropriate, taking into account the needs of their learners and the requirements of the Unit.

There is no mandatory order for delivery of the Outcomes. These should be overtaken throughout the Unit and are an integral part of learning and teaching.

The table below gives guidance and advice on possible approaches to assessment and gathering evidence.

Strategies for gathering evidence
There may be opportunities in the day-to-day delivery of the Units in a Course to observe learners providing evidence which satisfies completely or partially a Unit or Units. This is naturally occurring evidence and can be recorded as evidence for an Outcome or parts of an Outcome. In some cases, additional evidence may also be required to supplement and confirm the naturally occurring evidence.

Approaches to assessment might cover the whole Unit or be combined across Outcomes. A holistic approach can enrich the assessment process for the learner by bringing together different Outcomes and/or Assessment Standards. If a holistic approach is used then it is necessary to be able to track individual Assessment Standard evidence.

Strategies for gathering evidence and ensuring that the learners' work is their own could include:

- ◆ personal interviews during which the teacher or lecturer can ask additional questions about completed work
- ◆ an oral presentation on their work
- ◆ writing reports in supervised conditions
- ◆ checklists to record the authenticity
- ◆ supplementary sources of evidence, such as witness testimony, film or audio clips

Evidence can be gathered from classwork, experiments, investigations and/or research carried out in this Unit. It can be obtained using one or more of the strategies outlined above or by alternative methods, which could include a test of knowledge, understanding and skills.

Equality and inclusion

The *Course Support Notes* provide full information on equality and Inclusion for this Unit.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Unit Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and where the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- ◆ Assessment Arrangements (for disabled learners and/or those with additional support needs) — various publications on SQA’s website:
<http://www.sqa.org.uk/sqa/14976.html>
- ◆ [*Building the Curriculum 3: A framework for Learning and Teaching*](#)
- ◆ [*Building the Curriculum 4: Skills for learning, skills for life and skills for work*](#)
- ◆ [*Building the Curriculum 5: A framework for assessment*](#)
- ◆ [*Course Specifications*](#)
- ◆ [*Design Principles for National Courses*](#)
- ◆ [*Guide to Assessment* \(June 2008\)](#)
- ◆ [*Overview of Qualification Reports*](#)
- ◆ Principles and practice papers for Sciences curriculum area
- ◆ Research Report 4 — Less is More: Good Practice in Reducing Assessment Time
- ◆ Coursework Authenticity — a Guide for Teachers and Lecturers
- ◆ [*SCQF Handbook: User Guide* \(published 2009\)](#) and SCQF level descriptors (to be reviewed during 2011 to 2012): www.sqa.org.uk/sqa/4595.html
- ◆ SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work
- ◆ Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool
- ◆ SQA Guidelines on e-assessment for Schools
- ◆ SQA Guidelines on Online Assessment for Further Education
- ◆ SQA e-assessment web page: www.sqa.org.uk/sqa/5606.html

Administrative information

Published: June 2013 (version 1.1)

Superclass: RC

History of changes to Unit Support Notes

Unit details	Version	Description of change	Authorised by	Date
	1.1	Exemplar materials and resource pack added.	Qualifications Development Manager	June 2013

© Scottish Qualifications Authority 2013

This document may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged. Additional copies can be downloaded from SQA's website at **www.sqa.org.uk**.

Note: You are advised to check SQA's website (**www.sqa.org.uk**) to ensure you are using the most up-to-date version.

Unit Support Notes — Physics: Waves and Radiation (National 5)



This document may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged. Additional copies of these *Unit Support Notes* can be downloaded from SQA's website: www.sqa.org.uk.

Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Physics: Waves and Radiation (National 5) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- ♦ the *Unit Specification*
- ♦ the *Course Specification*
- ♦ the *Course Assessment Specification*
- ♦ the *Course Support Notes*
- ♦ appropriate assessment support materials

General guidance on the Unit

Aims

The general aim of this Unit is to develop skills of scientific inquiry, investigation and analytical thinking, along with knowledge and understanding of waves and radiation. Learners will apply these skills when considering the applications of waves and radiation on our lives, as well as the implications on society/ the environment. This can be done by using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of:

- ♦ Waves
- ♦ Nuclear Radiation

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Progression into this Unit

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by the following or equivalent qualifications and/or experience:

- ♦ National 4 Physics Course

There may also be progression from National 4 Biology, National 4 Chemistry, National 4 Environmental Science and National 4 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 5 Physics *Course Support Notes*.

If this Unit is being delivered on a free-standing basis, teachers and lecturers should cover the mandatory skills and key areas in ways, which are most appropriate for delivery in their centres.

Progression from this Unit

This Unit may provide progression to:

- ♦ other qualifications in physics or related areas
- ♦ further study, employment and/or training

Approaches to learning and teaching

Approaches to learning and teaching and suggested learning activities are given in the *Course Support Notes*.

Developing skills for learning, skills for life and skills for work

Information about developing skills for learning, skills for life and skills for work in this Unit, is given in the relevant *Course Support Notes*.

Approaches to assessment and gathering evidence

The purpose of this section is to give advice on approaches to assessment for the Unit. There will be other documents produced for centres to provide exemplification of assessments and guidance on how to write them.

Approaches to the assessment of a Unit when it forms part of a Course may differ from approaches to assessing the same Unit when it is not being delivered as part of a Course. If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units.

Assessments must be valid, reliable and fit for purpose for the subject and level, and should fit in with learning and teaching approaches.

Unit assessment should support learning and teaching and where possible enable personalisation and choice for learners in assessment methods and processes. Teachers and lecturers should select the assessment methods they believe are most appropriate, taking into account the needs of their learners and the requirements of the Unit.

There is no mandatory order for delivery of the Outcomes. These should be overtaken throughout the Unit and are an integral part of learning and teaching.

The table below gives guidance and advice on possible approaches to assessment and gathering evidence.

Strategies for gathering evidence
There may be opportunities in the day-to-day delivery of the Units in a Course to observe learners providing evidence which satisfies completely or partially a Unit or Units. This is naturally occurring evidence and can be recorded as evidence for an Outcome or parts of an Outcome. In some cases, additional evidence may also be required to supplement and confirm the naturally occurring evidence.

Approaches to assessment might cover the whole Unit or be combined across Outcomes. A holistic approach can enrich the assessment process for the learner by bringing together different Outcomes and/or Assessment Standards. If a holistic approach is used then it is necessary to be able to track individual Assessment Standard evidence.

Strategies for gathering evidence and ensuring that the learners' work is their own could include:

- ◆ personal interviews during which the teacher or lecturer can ask additional questions about completed work
- ◆ an oral presentation on their work
- ◆ writing reports in supervised conditions
- ◆ checklists to record the authenticity
- ◆ supplementary sources of evidence, such as witness testimony, film or audio clips

Evidence can be gathered from classwork, experiments, investigations and/or research carried out in this Unit. It can be obtained using one or more of the strategies outlined above or by alternative methods, which could include a test of knowledge, understanding and skills.

Equality and inclusion

The *Course Support Notes* provide full information on equality and inclusion for this Unit.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Unit Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and where the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- ♦ Assessment Arrangements (for disabled learners and/or those with additional support needs) — various publications on SQA's website:
<http://www.sqa.org.uk/sqa/14976.html>
- ♦ [*Building the Curriculum 3: A framework for Learning and Teaching*](#)
- ♦ [*Building the Curriculum 4: Skills for learning, skills for life and skills for work*](#)
- ♦ [*Building the Curriculum 5: A framework for assessment*](#)
- ♦ [*Course Specifications*](#)
- ♦ [*Design Principles for National Courses*](#)
- ♦ [*Guide to Assessment \(June 2008\)*](#)
- ♦ [*Overview of Qualification Reports*](#)
- ♦ Principles and practice papers for sciences curriculum area
- ♦ Research Report 4 — Less is More: Good Practice in Reducing Assessment Time
- ♦ Coursework Authenticity — a Guide for Teachers and Lecturers
- ♦ Science: A Portrait of current practice in Scottish schools (Nov 2008)
- ♦ [*SCQF Handbook: User Guide*](#) (published 2009) and
SCQF level descriptors (to be reviewed during 2011 to 2012):
www.sqa.org.uk/sqa/4595.html
- ♦ [*SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work*](#)
- ♦ [*Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool*](#)
- ♦ SQA Guidelines on e-assessment for Schools
- ♦ SQA Guidelines on Online Assessment for Further Education
- ♦ SQA e-assessment web page: www.sqa.org.uk/sqa/5606.html

Administrative information

Published: June 2013 (version 1.1)

Superclass: RC

History of changes to Unit Support Notes

Unit details	Version	Description of change	Authorised by	Date
	1.1	Exemplar materials and resource pack added.	Qualifications Development Manager	June 2013

© Scottish Qualifications Authority 2013

This document may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged. Additional copies can be downloaded from SQA's website at **www.sqa.org.uk**.

Note: You are advised to check SQA's website (**www.sqa.org.uk**) to ensure you are using the most up-to-date version.

Unit Support Notes — Physics: Dynamics and Space (National 5)



This document may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged. Additional copies of these *Unit Support Notes* can be downloaded from SQA's website: www.sqa.org.uk.

Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Physics: Dynamics and Space (National 5) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- ♦ the *Unit Specification*
- ♦ the *Course Specification*
- ♦ the *Course Assessment Specification*
- ♦ the *Course Support Notes*
- ♦ appropriate assessment support materials

General guidance on the Unit

Aims

The general aim of this Unit is to develop skills of scientific inquiry, investigation and analytical thinking, along with knowledge and understanding of dynamics and space.

Learners will apply these skills when considering the applications of dynamics and space on our lives, as well as the implications on society/ the environment. This can be done by using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of:

- ♦ Kinematics
- ♦ Forces
- ♦ Space

Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Progression into this Unit

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by the following or equivalent qualifications and/or experience:

- ♦ National 4 Physics Course

There may also be progression from National 4 Biology, National 4 Chemistry, National 4 Environmental Science and National 4 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 5 *Physics Course Support Notes*.

If this Unit is being delivered on a free-standing basis, teachers and lecturers should cover the mandatory skills and key areas in ways which are most appropriate for delivery in their centres.

Progression from this Unit

This Unit may provide progression to:

- ♦ other qualifications in physics or related areas
- ♦ further study, employment and/or training

Approaches to learning and teaching

Approaches to learning and teaching and suggested learning activities are given in the *Course Support Notes*.

Developing skills for learning, skills for life and skills for work

Information about developing skills for learning, skills for life and skills for work in this Unit, is given in the relevant *Course Support Notes*.

Approaches to assessment and gathering evidence

The purpose of this section is to give advice on approaches to assessment for the Unit. There will be other documents produced for centres to provide exemplification of assessments and guidance on how to write them.

Approaches to the assessment of a Unit when it forms part of a Course may differ from approaches to assessing the same Unit when it is not being delivered as part of a Course. If an integrated approach to Course delivery is chosen, then there may be opportunities for combining assessment across Units.

Assessments must be valid, reliable and fit for purpose for the subject and level, and should fit in with learning and teaching approaches.

Unit assessment should support learning and teaching and where possible enable personalisation and choice for learners in assessment methods and processes. Teachers and lecturers should select the assessment methods they believe are most appropriate, taking into account the needs of their learners and the requirements of the Unit.

There is no mandatory order for delivery of the Outcomes. These should be overtaken throughout the Unit and are an integral part of learning and teaching.

The table below gives guidance and advice on possible approaches to assessment and gathering evidence.

Strategies for gathering evidence
There may be opportunities in the day-to-day delivery of the Units in a Course to observe learners providing evidence which satisfies completely or partially a Unit or Units. This is naturally occurring evidence and can be recorded as evidence for an Outcome or parts of an Outcome. In some cases, additional evidence may also be required to supplement and confirm the naturally occurring evidence.

Approaches to assessment might cover the whole Unit or be combined across Outcomes. A holistic approach can enrich the assessment process for the learner by bringing together different Outcomes and or Assessment Standards. If a holistic approach is used then it is necessary to be able to track individual Assessment Standard evidence.

Strategies for gathering evidence and ensuring that the learners' work is their own could include:

- ◆ personal interviews during which the teacher or lecturer can ask additional questions about completed work
- ◆ an oral presentation on their work
- ◆ writing reports in supervised conditions
- ◆ checklists to record the authenticity
- ◆ supplementary sources of evidence, such as witness testimony, film or audio clips

Evidence can be gathered from classwork, experiments, investigations and/or research carried out in this Unit. It can be obtained using one or more of the strategies outlined above or by alternative methods, which could include a test of knowledge, understanding and skills.

Equality and inclusion

The *Course Support Notes* provide full information on equality and inclusion for this Unit.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Unit Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and where the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- ◆ Assessment Arrangements (for disabled learners and/or those with additional support needs) — various publications on SQA's website:
<http://www.sqa.org.uk/sqa/14976.html>
- ◆ Building the Curriculum 3: A framework for Learning and Teaching
- ◆ [*Building the Curriculum 4: Skills for learning, skills for life and skills for work*](#)
- ◆ [*Building the Curriculum 5: A framework for assessment*](#)
- ◆ [Course Specifications](#)
- ◆ [Design Principles for National Courses](#)
- ◆ [Guide to Assessment \(June 2008\)](#)
- ◆ [Overview of Qualification Reports](#)
- ◆ Principles and practice papers for curriculum areas
- ◆ Research Report 4 — Less is More: Good Practice in Reducing Assessment Time
- ◆ Coursework Authenticity — a Guide for Teachers and Lecturers
- ◆ Science: A Portrait of current practice in Scottish schools (Nov 2008)
- ◆ [*SCQF Handbook: User Guide*](#) (published 2009) and
SCQF level descriptors (to be reviewed during 2011 to 2012):
www.sqa.org.uk/sqa/4595.html
- ◆ SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work
- ◆ Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool
- ◆ SQA Guidelines on e-assessment for Schools
- ◆ SQA Guidelines on Online Assessment for Further Education
- ◆ SQA e-assessment web page: www.sqa.org.uk/sqa/5606.html

Administrative information

Published: June 2013 (version 1.1)

Superclass: RC

History of changes to Unit Support Notes

Unit details	Version	Description of change	Authorised by	Date
	1.1	Exemplar materials and resource pack added.	Qualifications Development Manager	June 2013

© Scottish Qualifications Authority 2013

This document may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged. Additional copies can be downloaded from SQA's website at **www.sqa.org.uk**.

Note: You are advised to check SQA's website (**www.sqa.org.uk**) to ensure you are using the most up-to-date version.