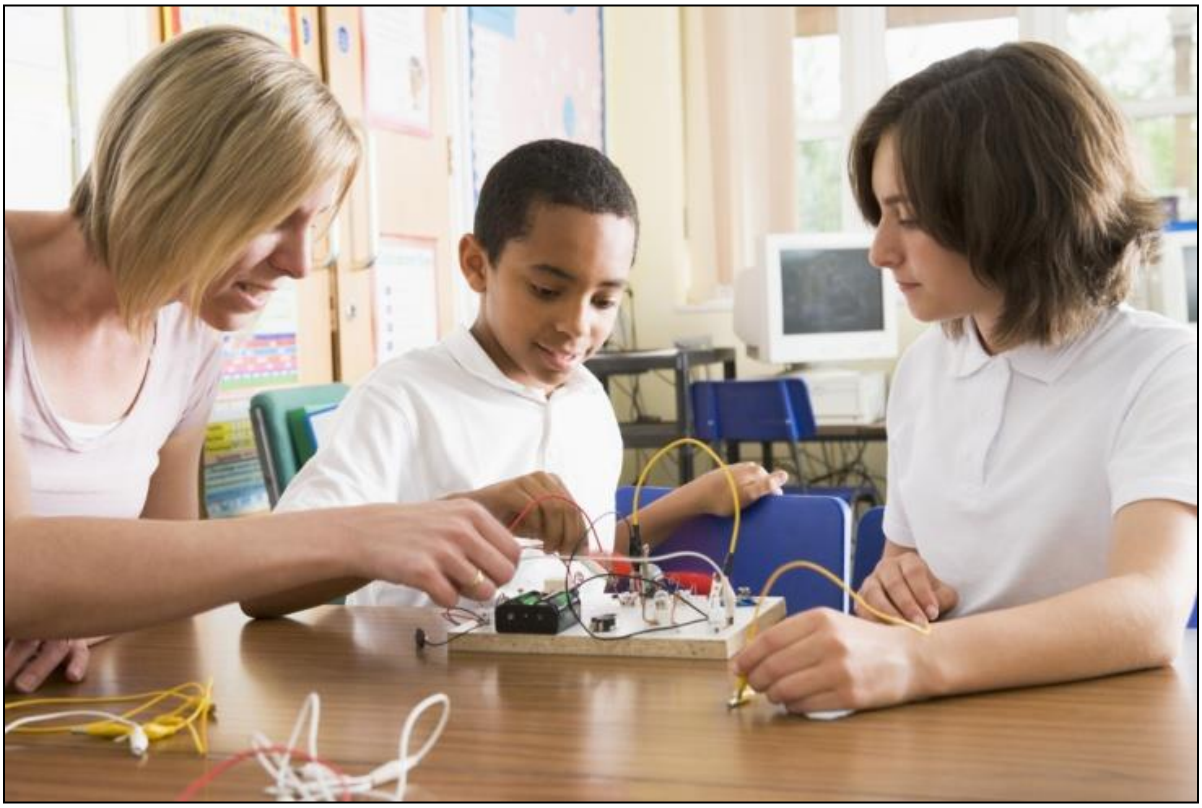
Course Support Notes

National 4 Physics Course Support Notes



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

Contents

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the National 4 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 *Added Value Unit 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 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 problem solving skills in a physics context
- use and understand scientific literacy, in everyday contexts, to communicate ideas and issues
- develop the knowledge and skills for more advanced learning in physics

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 3 Physics or relevant component Units

There may also be progression from National 3 Biology, National 3 Chemistry, National 3 Environmental Science or National 3 Science Courses.

Experiences and Outcomes

National Courses have been designed to draw on and build on the curriculum experiences and outcomes as appropriate. Qualifications developed for the senior phase of secondary education are benchmarked against SCQF levels. SCQF level 4 and the curriculum level 4 are broadly equivalent in terms of level of demand although qualifications at SCQF level 4 will be more specific to allow for more specialist study of subjects.

Learners who have completed 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 *Added Value Unit 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:

- National 5 Physics Course
- National 4 or 5 Course in another science subject
- Skills for Work Courses (SCQF levels 4 or 5)
- National Certificate Group Awards
- National Progression Awards (SCQF levels 4 or 5)
- 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 Physics Added Value Unit.

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 from industry, 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.

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.

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.

Suggestions for possible contexts and learning activities, to support and enrich learning and teaching, are detailed in the table below. The **key areas** are from the Added Value Unit 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 key areas are open to personalisation and choice, so centres are likely to 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		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
Generation of electricity Advantages and disadvantages of different methods of electricity generation and distribution. The potential role of different methods of electricity generation in future sustainable energy supply. The concept of energy efficiency and energy efficiency issues related to generation, distribution and use of electricity.	Research energy supply and demand projections from current data. Research different energy sources. Prepare a plan for a Scottish island to be self-sufficient in electricity from natural resources. Research generation and transmission losses. Discuss the implications of distribution methods — overhead cables versus underground cables. Carry out investigations into generation of electricity, for example, dynamo, magnet through coil of wire, etc. Compare input and output power for power stations using different energy sources. Research or investigate the factors affecting the electrical output from a range of sources (solar cells, etc.)	

	Research the effect of wind speed on wind turbines. Research microgeneration (eg home-based wind or hydro.) Model power lines.	
Electrical power Electrical power as a measure of the energy transferred electrically by an appliance every second. Power consumption of different appliances, qualitative and quantitative. Use of the appropriate relationship between power, energy and time to justify energy saving measures. Energy efficiency as a key factor in energy generation, distribution and use. Calculation of efficiency given input and output power/energy.	Efficiency of microwave oven by heating water. Input power from smart meter or rated power and output from heat energy in water using specific heat capacity. Efficiency of electric motor lifting weight or water pump. Comparison of brightness of different bulbs using light meter. Investigations with power/energy meters. Investigate power rating plates.	$P = E/t$ $\% \text{ efficiency} = \frac{\text{useful } E_o}{E_i} \times 100\%$ $\% \text{ efficiency} = \frac{\text{useful } P_o}{P_i} \times 100\%$
Electromagnetism Relationship between electricity and magnetism. Practical applications of magnets and electromagnets.	Drawing of magnetic fields from permanent magnets using iron filings, etc. Magnetic fields of different shapes of electromagnets (solenoid, horseshoe). Examine a range of applications using permanent	

	and electromagnets and justify why each type of magnet is used. Range of applications — relays, bells, loudspeakers, fire door retainers, fail-safe brakes on lifts, Maglev trains, etc.	
Practical electrical and electronic circuits Measurement of current, voltage and resistance using appropriate meters in series or parallel circuits. Identification and use a range of electrical and electronic components to construct practical electronic circuits and systems. Current and voltage relationships in a series circuit. Practical applications of series and parallel circuits. Qualitative factors that affect resistance. Use of the appropriate relationships between voltage, current and resistance in calculations for series circuits.	Hairdryer wiring/car heater blowers, etc. for different heat settings Vehicle electrical systems such as wiring of ignition and other switches and bulbs and heaters. Home security systems. Environmental and biological monitoring systems. Logic gates to replace series/parallel switching in car electrics, eg interior light from door sensors. Current and voltage related to distribution of electricity. Investigate factors affecting resistance. Resistance of electrical supply cables and flexes for high current appliances.	Series circuit rules: $I_1 = I_2 = I_3 = I_4 \ldots$ $V_S = V_1 + V_2 + V_3 \ldots$ $V = IR$
Gas laws and the kinetic model Kinetic model of a gas. Applications of the kinetic model of a gas using knowledge of pressure, volume and temperature (for a fixed mass of gas).	Demonstration using kinetic theory apparatus. Tyre pressures at different temperatures. Scuba gas tanks. Saturation diving.	

	Free diving — volume of air in free diver's lung. Weather balloons. Pressurised aircraft cabins. Research heating and cooling of gases.	
Waves and Radiation		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
Wave characteristics Comparison of longitudinal and transverse waves. Frequency as the number of waves per second. Wavelength and amplitude of transverse waves. Use of numerical or graphical data to determine the frequency of a wave. Use of appropriate relationship between wave speed, frequency and wavelength. Use of appropriate relationship between distance, speed and time for waves.	Video analysis of 'slinky' waves to determine characteristics. Computer simulations to determine characteristics. Speed, wavelength and frequency of water waves moving along rainwater gutters filled to different depths or ripple tanks. Use of frequency meters to measure frequency.	$v = f\lambda$ $d = \bar{v}t$
Sound Analysis of sound waveforms including changing amplitude and frequency. Different methods of measurement of speed of sound in air.	Oscilloscope patterns. Voice recognition software. Measurement of speed of sound in solids, liquids and gases.	

Sound level measurement including decibel scale. Noise pollution; risks to human hearing and methods of protecting hearing. Applications of sonar and ultrasound. Sound reproduction technologies. Noise cancellation.	Measurement of typical sound levels in a building. Research of different sound levels and the dangers of prolonged exposure to high sound levels. Investigation of the absorption of sound by different materials. Modern hearing aids. Maritime uses of Sonar — depth locators and fish finders. Noise-cancelling headphones and noise-cancellation technology in Humvees and helicopters. Tuning forks. Production of notes on musical instruments. Research use of ultrasound in medical scanning. Use ultrasonic ranging devices. Explore technology used to record and enhance sound.	
Electromagnetic Spectrum Applications and hazards associated with electromagnetic radiations. Approaches to minimising risks associated with electromagnetic radiations.	 Research of parts of the EM spectrum including: Applications in industry or leisureTypical jobs which would use the radiation. Possible hazards of the radiation.	

	Safety precautions to be taken with the radiation. Light — application of lenses to correct long and short sight Detection of EM radiation: ♦ Microwave leakage from electrical devices (eg ovens, TVs, mobile phones, tablet computers and Wi-Fi hubs ♦ Display of pulses from a remote control handset on an oscilloscope using phototransistor, IR sensitive sheets or similar ♦ Dye/paint sensitive to ultraviolet radiation. ♦ Spectral analysis plot on digital camera display or photo editing software Sunglasses to protect from UV and IR.	
Nuclear radiation Natural and artificial sources of nuclear radiation and associated medical and industrial applications. Consideration of the pros and cons of generating electricity using nuclear fuel. Comparison of risk due to nuclear radiation and other environmental hazards and the management of this risk.	Discuss arrangement of neutrons, protons and electrons in an atom. Research into sources and effects of nuclear radiation including natural sources (eg radon) man-made sources (eg plutonium), effects on living things (eg leukaemia) and effects on non-living things (scintillation, sparks between high voltages).	

Dynamics and Space		
Key areas	**Suggested learning activities**	**Exemplification of key areas**
Speed and acceleration Calculations involving the relationship between speed, distance, and time. Determination of average and instantaneous speed. Interpretation of speed-time graphs to describe motion including calculation of distance (for objects which are speeding up, slowing down, stationary and moving with constant speed.) Motion in one direction only. Use of relationships of acceleration, change in speed and time.	Average speed of trolley moving down a slope or along level. Use light gates/motion sensors to measure speed. Measure acceleration using two light gates and a stopwatch. Speed time graphs using motion sensors. Speed time graph of car by measuring speed at different times from video of speedometer during journey. Discuss how light gates could be used in sports (timing races, measuring instantaneous and average speed). Calculate acceleration of sports cars, theme park rides and space vehicles.	$d = \bar{v}t$ $a = \frac{\Delta v}{t}$
Relationship between forces, motion and energy The use of Newton's first law and balanced forces to explain constant speed, making reference to frictional forces.	Measurement of forces needed to change the shape, speed and direction of objects (mould plasticine, push learners on skateboards, tug of war etc).	

The use of Newton's second law to explain the movement of objects in situations involving constant acceleration. Calculations using the relationship between force, mass and acceleration in situations where only one force is acting. Calculations using the relationship between weight, mass and gravitational field strength within our solar system. Risks and benefits associated with space exploration including challenges of re-entry to a planet's atmosphere. The use of thermal protection systems to protect spacecraft on re-entry.	Use of office fan to move low-friction trolley with 'sail'. Use of office fan to change direction of light ball thrown into a bin. Experiment with placing different weights onto all ball of Plasticine and determine change in shape. Investigate mass and weight (using a Newton balance) of a range of different objects — relationship between results. Use sandpaper/rubber etc to show how friction converts movement energy to heat. Relate to space shuttle re-entry. Investigate thermal conductivity of different materials.	$F = ma$ $W = mg$
Satellites The range of heights and functions of satellites in orbit around the earth, including geostationary and natural satellites. The dependence of period of orbit on height. The use of parabolic reflectors to send and receive signals. Use of the relationship between distance, speed and time applied to satellite communication. Range of applications of satellite including telecommunications; weather monitoring; the use of	Investigate the relationship between orbital height and period by using computer simulations or data from internet. Investigate the uses of different satellites related to the orbital period or height and their potential impact on society. Investigate reflection from curved reflectors with ray boxes or microwave kit. Research the use of solar furnaces for heating water in developing countries and the potential social benefits.	$d = \bar{v}t$

satellites in environmental monitoring. The use of satellites in developing our understanding of the global impact of mankind's actions.		
Cosmology Description of planet, moon, star, solar systems, exo-planet, galaxy and universe. Scale of the solar system and universe measured in light years. Space exploration and its impact on our understanding of the universe and planet Earth. Conditions required for an exo-planet to sustain life.	Research data for solar system including mass, time to orbit the Sun, surface temperature range, number of moons, time for one rotation, etc and present data graphically or pictorially. Research the nature and scale of the universe (planet is part of a solar system; solar system is part of a galaxy, etc) using computer simulation or internet search. Calculate distances to other galaxies — 'Whirlpool'. Royal Observatory Edinburgh Galaxies Project: Galaxy Zoo software: Investigate whether exo-planets could support life (Royal Observatory Edinburgh Exo-planets Project).	

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 of 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. 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

This covers the ability to identify and weigh-up the features of a situation or issue in physics and use judgement of them in coming to a conclusion. It includes reviewing and considering any potential solutions.

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 4, the added value will be assessed in the Added Value Unit.

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

The Physics Added Value Unit is assessed by an Assignment. Prior to doing this Unit, learners would benefit from having covered key areas from at least one of:

- Physics: Electricity and Energy (National 4)
- Physics: Waves and Radiation (National 4)
- Physics: Dynamics and Space (National 4)

It is intended that the majority of this time be spent in learning and teaching activities which develop the skills necessary to conduct investigative/practical work in Physics. In addition to ensuring that learners are suitably prepared to conduct simple background research using the internet, learners should also have the opportunity to become familiar with practical techniques.

If the Added Value Unit is delivered as part of a Course, centres can deliver this Unit at an appropriate point during the Course.

Learners will use the skills, knowledge and understanding necessary to undertake an investigation into a topical issue in physics. The teacher/lecturer may provide guidance to learners on topics for study, taking into account the needs of their learners and the relevance to everyday issues. While the learner should choose the topic to be investigated, it would be reasonable for the choice the learner makes to be one where the teacher/lecturer has some expertise and has resources available to enable the learner to successfully meet the Assessment Standards.

The Assignment offers opportunities for learners to work in partnership and in teams, though it must be clear, at each stage, that the learner has produced evidence of their contribution to any group work carried out.

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	Relationship between forces, motion and energy
Electricity generation using nuclear sources	Generation of electricity, nuclear radiation
Medical uses of electromagnetic radiation	Electromagnetic spectrum
Water waves as a source of energy	Generation of electricity
Hybrid vehicles	Generation of electricity

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.

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 Standards 2.2, 2.3 and 2.4 for one Unit can be used as evidence of the achievement of Outcome 1 and Assessment Standards 2.2, 2.3 and 2.4 in the other Units of this Course.

Exemplification of standards

Candidate 1
Assessment Standards can be achieved using one or a number of 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.

Assessment Standard	**Evidence required**	**Evidence produced**
1.1 Planning an experiment/practical investigation	Aim of experiment	✓
	Variable to be kept constant	From text
	Measurements/observations to be made	✓
	Resources	Clear from diagram
	Method including safety	Clear
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.

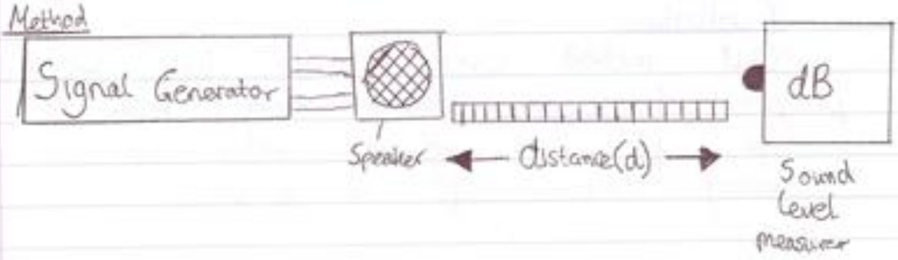
Comment
AS 1.1 (Variable) Sound level to be kept constant should have been ‘Volume from signal generator’.

Candidate 1

Aim

To find out what happens to a sound coming from a speaker changes over a distance and how it effects it in dB.

Method



- The measurements I will make are is Sound levels in (dB) deciBells and the distence will be measured in (m) metres
- The sound level will be kept constant throughout the whole experiment.
- Do not turn up the volume too high as it will damage your hearing.

Results

Distance from sound source (m)	Sound Level (dB)
0.4	100
0.8	97
1.2	95
1.6	87
2.0	85

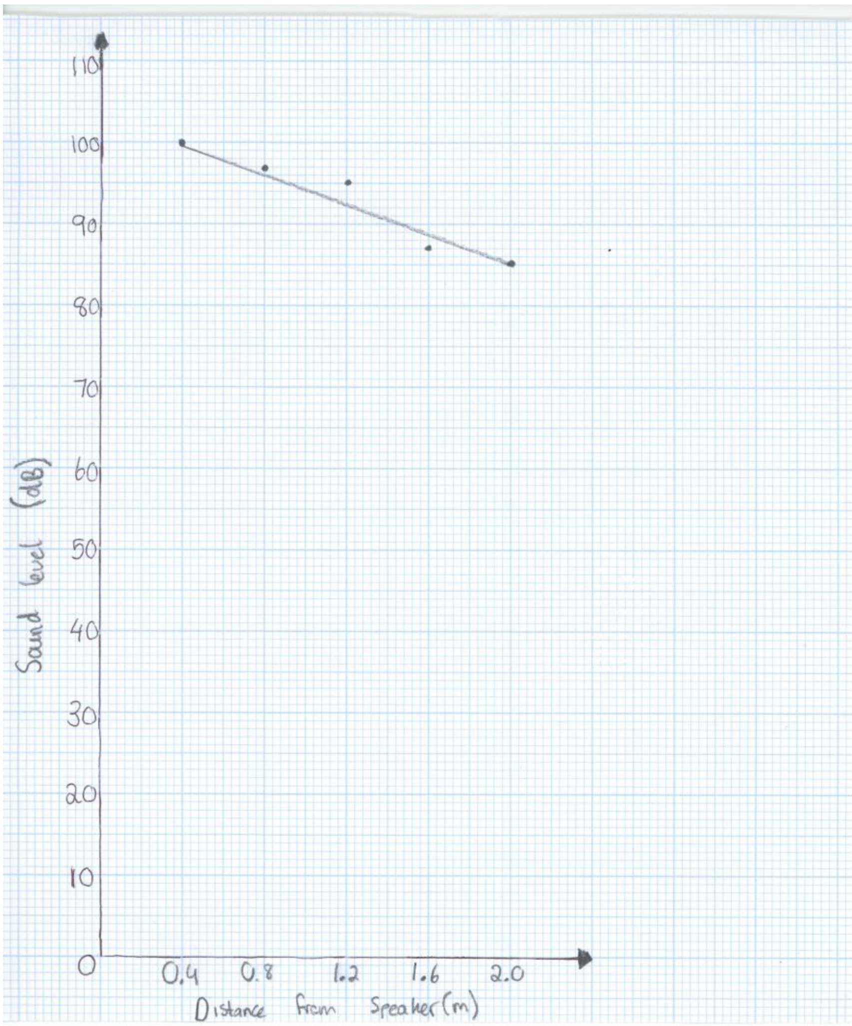
Candidate 1 (contd)

Conclusion

~~The~~ As the distance from the speaker increased the sound decreased. I thought this was going to happen as sound gets quieter as you go further away from it.

Evaluation

Our method was suitable but we could of done it further away from a wall to get more accurate results as we were getting reflection off of ~~a~~ wall.



Candidate 2

Assessment Standards can be achieved using one or a number of 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.

Assessment Standard	Evidence required	Evidence produced
1.1 Planning an experiment/ practical investigation	Aim of experiment	✓
	Variable to be kept constant	From diagram
	Measurements/observations to be made	✓
	Resources	Clear from diagram
	Method including safety	Clear
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	✗
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 Assessment Standards 1.1, 1.2, 1.3 and 1.6 but has failed Assessment Standards 1.4 and 1.5.

Comment

AS 1.4 Format appropriate. However, the units in the table are incorrect.

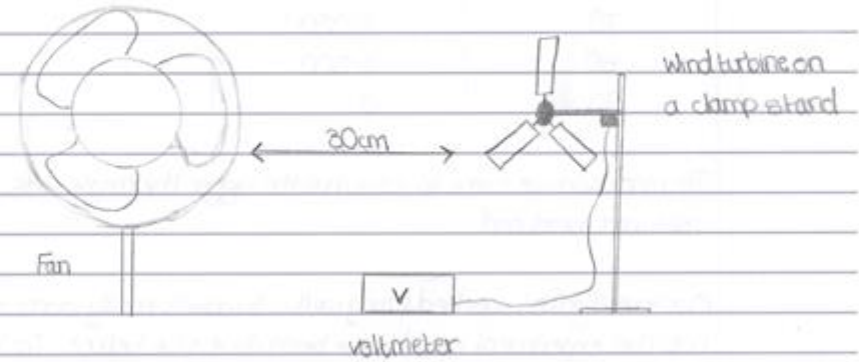
AS 1.5 Does not fit observations. Note: The term ‘hypothesis’ is not required at this level.

Candidate 2

What affects the output voltage from a wind turbine?

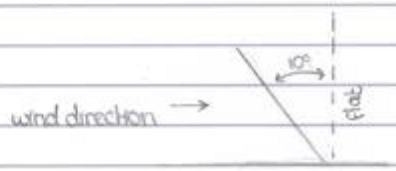
Our aim was to see how the angle of the blades of the wind turbine affect the amount of volts produced.

Diagram of the experiment carried out:



Method

We set up the experiment with a fan, 30 cm away from the wind turbine. We kept all the blades the same length at 3cm long and the power of the fan stayed the same to make it a fair experiment. We were testing how the angle of the blades affect the volts produced by the wind turbine therefore we changed the angle of the blades by 10° each time using a protractor. Our results changed because of this. The group all had to wear goggles because there was a risk of the blades flying off. The amount of volts produced was measured by a voltmeter.



This is how we measured the angle.

Candidate 2 (contd)

Angle (oc)	Voltage (V)
0	0
10	0·630
20	0·820
30	1·320
40	1·750
50	1·950
60	2·700
70	3·050
80	3·500
90	0

These are the results that we got.

The conclusion we came to was that the bigger the angle was, the more volts were produced.

Our investigation worked fairly well. It wasn't really surprising results but the experiment could have been done a bit better. The length of the blades weren't all exactly the same and the structure of the wind turbine itself could have been more stable. We could have kept the fan on for the same amount of time for each angle tested as it could have made the experiment more fair. Overall, my hypothesis was that the bigger the angle, the better the wind turbine will spin and because of that will produce more voltage. My hypothesis was right.

Candidate 3

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

Assessors should record evidence of achievement of Outcomes and Assessment Standards. The tables below show one way of recording evidence. These tables are not mandatory.

Individual evidence for Assessment Standard 2.2

Assessment Standard	Evidence required	Evidence produced
2.2 Describing an application	The application is related to a key area of the Course	Electromagnetic spectrum
	Application stated	✓
	The description should demonstrate knowledge and understanding of the application.	Some appropriate understanding of physics

Individual evidence for Assessment Standard 2.3

Assessment Standard	Evidence required	Evidence produced
2.3 Describing a physics issue in terms of its effect on the environment/ society	The issue is related to a key area of the Course	Electromagnetic spectrum
	A physics issue is stated	✓
	A physics issue should be described in such a way that its effect on the environment/society is clear	Some appropriate understanding of physics

This candidate has passed Assessment Standards 2.2 and 2.3

Candidate 3

Gamma Radiation

Gamma radiation is one of the three types of natural radioactivity. Gamma radiation has the highest frequency in the electromagnetic Spectrum this means it well have the Smallest wave length in the electromagnetic Spectrum.

Gamma radiation can be useful in Society because it can be used to kill cancer cells but it can also kill regular cells aswell, builders also use gamma to find holes in pipes, they do this by feeding gamma radiation through the pipe and Scan for it and Where ever they pick it up thats where the hole/leek is.

Gamma radiation can also Cause problems because it kills health cells and high levels of gamma ray exposure have negative health affects and patients that have radiation theropy get Sick. pregnant women exposed to gamma radiation have an increased risk of birth defect

Candidate 4
Assessment Standards can be achieved using one or a number of pieces of evidence covering work done on different occasions.

Assessors should record evidence of achievement of Outcomes and Assessment Standards. The tables below show one way of recording evidence. These tables are not mandatory.

Individual evidence for Assessment Standard 2.2

Assessment Standard	**Evidence required**	**Evidence produced**
2.2 Describing an application	The application is related to a key area of the Course	Electromagnetic spectrum
	Application stated	✓
	The description should demonstrate knowledge and understanding of the application.	Some appropriate understanding of physics

Individual evidence for Assessment Standard 2.3

Assessment Standard	**Evidence required**	**Evidence produced**
2.3 Describing a physics issue in terms of its effect on the environment/ society	The issue is related to a key area of the Course	Electromagnetic spectrum
	A physics issue is stated	✓
	A physics issue should be described in such a way that its effect on the environment/society is clear	Some appropriate understanding of physics

This candidate has passed Assessment Standards 2.2 and 2.3.

Candidate 4

Gamma Ray's

(Notes used for em spectrum)

RADIO	TV	Microwaves	infra red	UV	X-rays	Gamma

Gamma can be found at the highest part of the electromagnetic spectrum. Gamma Rays have a high frequency and short wavelenghth.

Gamma rays can benefit society in a few ways, both medical and militry. Gamma rays benifit medicly because gamma can detect blood claughts, this means the doctors know where to operate. Gamma is used in military to make nuclear bombs, one example of this is the bomb America dropped on Japan at the end of World war 2.

The dangers/disadvantages of Gamma are really severe, you have all sorts of things from nuclear radiation to death. One example of nuclear radiation is Chernobyl, Chernobyl is a tawn in Ukraine that got hit by nuclear radiation. No-one is aloud to enter the town anymore, some of the radiation can be found as far south of Italy.

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 Assignment, where necessary. 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 candidates 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 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
- *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 4 Physics: Added Value Unit

Resource Pack: Car Safety

This resource pack gives details of areas that are suitable for the Added Value Unit.

Car safety research/investigation supports:

Unit: Dynamics and Space
Key area: Relationship between forces, motion and energy

- The use of Newton's first law and balanced forces to explain constant speed, making reference to frictional forces.

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.

Added Value Unit task

The following areas of car safety research are suitable for the Added Value Unit task.

Your choice of research topic could be based on one (or more) of these areas.

1 Primary safety developments that have been applied to reduce the probability of an accident:

   (a) Vehicle braking systems which help the driver keep control of the vehicle under emergency conditions.

   (b) Tyre pressure monitoring systems. These warn drivers when tyre pressure is low and allow action to be taken before road holding and handling are affected.

2 Secondary safety developments that have been designed to reduce the injuries sustained during an accident:

   (a) Seat belts have been improved to reduce the effect of a crash on the occupants of the vehicle.

   (b) Air bags which inflate and cushion the occupants of the vehicle from damage when it moves during a crash.

   (c) Side impact bars which dissipate the effect of a crash and spread the force over a larger area.

   (d) Crumple zones which are designed to collapse a part of the vehicle and reduce the effect of the crash on the occupants of the vehicle.

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: June 2013 (version 1.1)

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

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

Unit Support Notes — Physics: Electricity and Energy (National 4)

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 4) 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 *Added Value Unit Specification*
- the *Course Support Notes*
- appropriate assessment support materials

General guidance on the Unit

Aims

In this Unit learners 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:

- Generation of electricity
- Electrical power
- Electromagnetism
- Practical electrical and electronic circuits
- Gas laws and the kinetic model

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 3 Physics

There may also be progression from National 3 Chemistry, National 3 Biology, National 3 Environmental Science and National 3 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 4 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 a 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.

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 that the alternative approaches 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 candidates and/or those with additional support needs) — various publications on SQA's website: http://www.sqa.org.uk/sqa/14976.html
- *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
- *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*
- *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: QA

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

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

Unit Support Notes — Physics: Waves and Radiation (National 4)

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 4) 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 *Added Value Unit Specification*
- the *Course Support Notes*
- appropriate assessment support materials

General guidance on the Unit

Aims

In this Unit learners 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:

- Wave characteristics
- Sound
- Electromagnetic spectrum
- 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 3 Physics Course

There may also be progression from National 3 Chemistry, National 3 Biology, National 3 Environmental Science and National 3 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 4 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 that the alternative approaches 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 candidates and/or those with additional support needs) — various publications on SQA's website: http://www.sqa.org.uk/sqa/14976.html
- *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
- *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*
- *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: QA

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

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

Unit Support Notes — Physics: Dynamics and Space (National 4)

Unit
Support
Notes

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 4) 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 *Added Value Unit Specification*
- the *Course Support Notes*
- appropriate assessment support materials

General guidance on the Unit

Aims

In this Unit learners 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:

- Speed and acceleration
- Relationships between forces, motion and energy
- Satellites and cosmology

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 3 Physics Course

There may also be progression from National 3 Chemistry, National 3 Biology, National 3 Environmental Science and National 3 Science Courses.

Skills, knowledge and understanding covered in this Unit

Information about skills, knowledge and understanding is given in the National 4 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 an Outcome completely or partially. 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 that the alternative approaches 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 candidates and/or those with additional support needs) — various publications on SQA's website: http://www.sqa.org.uk/sqa/14976.html
- *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
- *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*
- *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: QA

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