

PHYSICS
Access 3

Third edition – published June 2002

**NOTE OF CHANGES TO ARRANGEMENTS
FOURTH EDITION PUBLISHED JUNE 2002**

CLUSTER TITLE: Physics (Access 3)

CLUSTER NUMBER: C069 09

National Cluster Specification:

No changes

National Unit Specification:

D373 09 Telecommunications

General information	Outcome 2 modified
Statement of standards	Outcome 2, associated Performance criteria and Evidence requirements modified
Support notes	advice regarding Outcome 2 modified
Content statements	minor change: 1.5.2, 1.5.7

D374 09 Practical Electricity

General information	Outcome 2 modified
Statement of standards	Outcome 2 and associated Evidence requirements modified
Support notes	advice regarding Outcome 2 modified
Content statements	minor change: 2.1.8

D375 09 Radiations

General information	Outcome 2 modified
Statement of standards	Outcome 2, associated Performance criteria and Evidence requirements modified
Support notes	advice regarding Outcome 2 modified

D376 09 Sound and Music

General information	Outcome 2 modified
Statement of standards	Outcome 2 and associated Evidence requirements modified
Support notes	advice regarding Outcome 2 modified
Content statements	minor change: 4.1.7, 4.1.8

NOTE OF CHANGES TO ARRANGEMENTS (cont)

CLUSTER TITLE: Physics (Access 3)

CLUSTER NUMBER: C069 09

D377 09 Movement

General information	Outcome 2 modified
Statement of standards	minor change to title of one Content area specified in Evidence requirements of Outcome 1
Support notes	Outcome 2 and associated Evidence requirements modified
Content area	advice regarding Outcome 2 modified
Content statements	minor change of title: 5.3
	minor change: 5.1.4, 5.1.7, 5.1.9, 5.3.4
	new statements: 5.1.10, 5.1.11, 5.1.12

D378 09 Electronics

General information	Outcome 2 modified
Statement of standards	Outcome 2 and associated Evidence requirements modified
Support notes	advice regarding Outcome 2 modified
Content statements	minor change: 6.1.11
	statement deleted 6.1.4
	statement renumbered 6.1.5 (old) → 6.1.4
	new statement 6.1.5

National Cluster Specification: general information

PHYSICS (ACCESS 3)

CLUSTER NUMBER C069 09

STRUCTURE

This cluster has six units, as follows.

<i>D373 09</i>	<i>Telecommunications (Acc 3)</i>	<i>0.5 credit (20 hours)</i>
<i>D374 09</i>	<i>Practical Electricity (Acc 3)</i>	<i>0.5 credit (20 hours)</i>
<i>D375 09</i>	<i>Radiations (Acc 3)</i>	<i>0.5 credit (20 hours)</i>
<i>D376 09</i>	<i>Sound and Music (Acc 3)</i>	<i>0.5 credit (20 hours)</i>
<i>D377 09</i>	<i>Movement (Acc 3)</i>	<i>0.5 credit (20 hours)</i>
<i>D378 09</i>	<i>Electronics (Acc 3)</i>	<i>0.5 credit (20 hours)</i>

These units are based on the six units available at Intermediate 1, with the outcomes modified to meet the needs of candidates who may be achieving at Access 3.

It is envisaged that appropriate groups of candidates can be taught at Intermediate 1 level using the content, contexts, applications, illustrations and activities provided in the Intermediate 1 National Course Specification. Candidates can then be assessed to provide evidence of their actual level of achievement, ie to determine whether this is at Intermediate 1 or Access 3. Appropriate assessment material will be provided through the National Assessment Bank.

This cluster includes 40 hours over and above the 120 hours for the component units. This may be used for induction, extending the range of learning and teaching approaches, support, consolidation and integration of learning.

Administrative Information

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National Cluster Specification: general information (cont)

CLUSTER Physics (Access 3)

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates will normally be expected to have attained appropriate Access 2 units.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Unit Specification: general information

UNIT Telecommunications (Access 3)

NUMBER D373 09

CLUSTER Physics (Access 3)

SUMMARY

The unit seeks to develop the candidate's knowledge and understanding of simple concepts and facts related to telecommunications. It also provides an opportunity for developing the ability to apply this knowledge and understanding in the handling of information related to telecommunications.

OUTCOMES

1. Handle information related to telecommunications.
2. Report on one practical application of Access 3 Physics.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates will normally be expected to have attained appropriate Access 2 units.

CREDIT VALUE

0.5 credit at Access 3.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

Administrative Information

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National Unit Specification: statement of standards

UNIT Telecommunications (Access 3)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Handle information related to telecommunications.

Performance criteria

- (a) Quantities and their units are used correctly in relation to telecommunications.
- (b) Facts are used correctly in relation to telecommunications.
- (c) Relevant information is selected and presented appropriately.
- (d) Conclusions drawn are valid, and explanations given are supported by evidence.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed book test with items covering all the above performance criteria. The test must sample the Content Statements in each of the following areas:

- Radio
- Television
- Satellites
- Optical fibres
- Telephone.

OUTCOME 2

Report on one practical application of Access 3 Physics.

Performance criteria

- (a) The sources of information are used appropriately.
- (b) The practical application is described clearly.
- (c) Conclusions drawn are valid.

Evidence requirements

A completed report, based on a given structure, on a practical use of radio or television or satellites or optical fibres or telephone, covering the above performance criteria is required. The report must be the individual work of the candidate.

An Outcome 3 report of practical work in the Access 3 Physics unit D375 09 Radiations may be used as evidence of achievement of Outcome 3 of this unit. An Outcome 3 report of practical work in this unit may be used as evidence of achievement of Outcome 3 of the Access 3 Physics unit D375 09 Radiations.

National Unit Specification: support notes

UNIT Telecommunications (Access 3)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The content and suggested contexts, applications, illustrations and activities for this unit are given on the following pages. The subheadings in the tables correspond to the areas mentioned in the evidence requirements for Outcome 1. The tasks chosen for Outcome 2 must relate to the content of Access 3 Physics and must allow opportunity for all the performance criteria for this outcome to be demonstrated within any single report.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The learning and teaching of this unit are most effective when the concepts, principles and theories are set in a relevant context, eg by making reference to applications of physics and to real-world situations. The use of the suggested contexts, applications, illustrations and activities is recommended. It is suggested that emphasis is given to practical activities and the associated knowledge and understanding are developed during these activities. Practical activities also provide opportunities to develop a wide range of skills associated with scientific enquiry.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcome 1

This outcome is assessed by an end of unit test with questions covering all of the associated performance criteria. Each question can assess achievement of a number of performance criteria. Assessment items are available from the National Assessment Bank.

Outcome 2

The teacher/lecturer should ensure that the task relates to the content of Access 3 Physics, that it is about a current practical application of physics and that it provides an appropriate level of demand. Candidates should be provided with an outline structure of a report.

In relation to PC(a), the teacher/lecturer should ensure that the candidate plays an active part in gathering information for the report. Candidates should have access to a range of suitable resources, eg, CD-ROM, library, internet.

In relation to PCs (b) and (c) the following provides an indication of what may be included in a candidate's report.

National Unit Specification: support notes (cont)

UNIT Telecommunications (Access 3)

PC (b)

- a statement of name of the telecommunication system
- a few concise sentences describing the practical application

PC (c)

Conclusions should contain, as appropriate, a statement relating to:

- one advantage and one disadvantage of the application
- benefits of the application
- comment on effects of the application on individuals and/or society.

It is appropriate to give limited support to candidates in producing their reports. Re-drafting of reports after necessary supportive criticism is to be encouraged, both as part of the learning and teaching process and to produce evidence for assessment. Advice should be given on how to access suitable sources of information eg CD-ROM, internet and library.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

National Unit Specification: support notes (cont)

UNIT Telecommunications (Access 3)

The Content Statements given in the left-hand column of the table below describe in detail what the candidate should be able to do in demonstrating knowledge and understanding associated with Telecommunications.

The right-hand column gives suggested contexts, applications, illustrations and activities associated with the Content Statements.

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>1.1 Radio</p> <ol style="list-style-type: none"> 1 State that radio communication does not require wires between transmitter and receiver. 2 State that radio signals are waves which transfer energy. 3 State that radio signals are transmitted through air at a speed of 300 million metres per second. 4 Complete a block diagram of a radio receiver showing in the correct order: the aerial, tuner, decoder, amplifier and loudspeaker. 5 Describe in simple terms the function of the aerial, tuner, amplifier and loudspeaker in a radio receiver. 6 State that the frequency of a radio signal is the number of waves produced in one second. 7 State that the frequency is measured in hertz. 8 State that a radio station can be identified by the frequency of the signal it transmits. <p>1.2 Television</p> <ol style="list-style-type: none"> 1 State that television signals are radio signals with a higher frequency. 2 State that a television station can be identified by the frequency of the signal it transmits. 3 Complete a block diagram of a television receiver showing in the correct order: the aerial, tuner, decoders, amplifiers, tube and loudspeaker. 	<p>Use model transmitter and receiver to transmit a message across the laboratory.</p> <p>View suitable video on radio transmission and reception.</p> <p>Construct a block diagram of a radio receiver. Assemble and examine the main parts of a radio receiver specially built to give a simple layout. Experiments to investigate the function of the main parts of the radio.</p> <p>Obtain information on the frequency of radio stations. Tune into different radio stations.</p> <p>Compare television and radio frequencies. View suitable video on television transmission and reception.</p> <p>Construct a block diagram of a television receiver.</p>

National Unit Specification: support notes (cont)

UNIT Telecommunications (Access 3)

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>1.2 Television (cont)</p> <p>4 Describe in simple terms the function of the aerial, tuner, amplifiers, tube and loudspeaker in a television receiver.</p> <p>5 State that mixing red, green and blue light produces all colours seen on a colour television screen.</p> <p>1.3 Satellites</p> <p>1 Describe how satellites are used in communication.</p> <p>2 State that a geostationary satellite stays above the same point on the Earth's surface.</p> <p>3 State that curved reflectors on receiving aerials make the signal stronger.</p> <p>4 Explain why curved reflectors on receiving aerials make the signal stronger.</p> <p>1.4 Optical fibres</p> <p>1 State that light can be reflected.</p> <p>2 Describe the direction of the reflected light ray from a plane mirror.</p> <p>3 State what is meant by an optical fibre.</p> <p>4 State that optical fibres are used in some telecommunication systems.</p> <p>5 State that optical fibres transmit light signals.</p> <p>6 State that signal transmission along an optical fibre takes place at a speed of nearly 200 million metres per second.</p> <p>7 Describe the transmission of the light signal along an optical fibre.</p> <p>8 State that many telecommunication links into the home are by optical fibres.</p> <p>9 Describe one advantage and one disadvantage of using optical fibres for transmission of signals into the home.</p>	<p>Examine colour television screen or monitor.</p> <p>Investigate colour mixing using raybox kits and colour filters. Use a prism to produce a visible spectrum.</p> <p>View suitable video on communication satellites.</p> <p>Obtain information on communication satellites.</p> <p>Satellite TV.</p> <p>Use raybox kits to investigate the focusing effect of curved reflectors.</p> <p>Simple ray diagrams to demonstrate the focusing effects of curved reflectors.</p> <p>Direction and size of satellite dishes.</p> <p>Use raybox kits to investigate reflection from a plane surface.</p> <p>Use optical fibre to transmit a message.</p> <p>View suitable video on fibre optic communication.</p> <p>Use raybox kits to investigate total internal reflection (qualitatively only).</p> <p>Simple ray diagram to show the path of light along an optical fibre.</p> <p>Obtain information on modern communication links to the home, eg cable television, home banking, Internet.</p> <p>Discuss advantages and disadvantages of optical fibre with radio communication.</p>

National Unit Specification: support notes (cont)

UNIT Telecommunications (Access 3)

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>1.5 Telephone</p> <ol style="list-style-type: none"> 1 State that in a telephone, coded messages or signals are sent out by a transmitter and are picked up by a receiver. 2 State that telephone communication may use electrical signals in metal wires, light signals in optical fibres or radio wave signals in air between transmitter and receiver. 3 State that a mobile phone acts as a radio transmitter and receiver. 4 State one advantage and one disadvantage of a mobile phone. 5 State that the mouthpiece of a telephone is the transmitter and it contains a microphone. 6 State that the earpiece of a telephone is the receiver and it contains a loudspeaker. 7 State the useful energy changes in: <ol style="list-style-type: none"> a) microphone (sound → electrical) b) loudspeaker (electrical → sound). 8 State that a telephone signal in a metal wire is transmitted very quickly, at a speed of almost 300 million metres per second. 9 State that fax is the name given to the transmission of documents by telephone communication. 10 State one advantage of using fax. 11 Describe the effect on the signal pattern displayed on an oscilloscope due to a change in: <ol style="list-style-type: none"> a) loudness of sound b) frequency of sound 	<p>Use a pair of telephones to communicate through wires.</p> <p>Obtain information on mobile phones.</p> <p>Look at telephone handset – dismantle and identify mouthpiece and earpiece</p> <p>Investigate the energy changes in a microphone and a loudspeaker.</p> <p>Obtain information on fax machines.</p> <p>Investigate the electrical signals in telephone wires using an oscilloscope. Use signal generator and oscilloscope to look at frequency and loudness effects.</p>

National Unit Specification: general information

UNIT Practical Electricity (Access 3)

NUMBER D374 09

CLUSTER Physics (Access 3)

SUMMARY

The unit seeks to develop the candidate's knowledge and understanding of simple concepts and facts related to electricity. It also provides an opportunity for developing the ability to apply this knowledge and understanding in the handling and analysis of information related to electricity.

OUTCOMES

1. Handle information related to practical electricity.
2. Collect and analyse information related to Access 3 Physics obtained by experiment.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates will normally be expected to have attained appropriate Access 2 units.

CREDIT VALUE

0.5 credit at Access 3.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

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National Unit Specification: statement of standards

UNIT Practical Electricity (Access 3)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Handle information related to practical electricity.

Performance criteria

- (a) Quantities and their units are used correctly in relation to practical electricity.
- (b) Facts are used correctly in relation to practical electricity.
- (c) Symbols are described correctly in relation to practical electricity.
- (d) Relevant information is selected and presented appropriately.
- (e) Conclusions drawn are valid, and explanations given are supported by evidence.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed book test with items covering all the above performance criteria. The test must sample the Content Statements in each of the following areas:

- Electrical circuits
- Resistance
- Mains electricity.

OUTCOME 2

Collect and analyse information related to Access 3 Physics obtained by experiment.

Performance criteria

- (a) The information is collected by active participation in the experiment.
- (b) The experimental procedures are described accurately.
- (c) Relevant measurements and observations are recorded in an appropriate format.
- (d) Recorded information is analysed and presented in an appropriate format.
- (e) Conclusions drawn are valid.

Evidence requirements

A completed report, based on a given structure, of one experimental activity related to Access 3 Physics covering the above performance criteria is required. Evidence submitted in support of attainment of PC (d) must be in the form of a table or graph as appropriate. The teacher/lecturer responsible must attest that the report is the individual work of the candidate derived from active participation in an experiment involving the candidate in planning the experiment; deciding how it is to be managed; selecting resources; carrying out the experiment. Depending on the activity, the collection of the information may be through group work.

An Outcome 3 report of practical work in the Access 3 Physics unit D376 09 Sound and Music or D377 09 Movement may be used as evidence of achievement of Outcome 3 of this unit. An Outcome 3 report of practical work in this unit may be used as evidence of achievement of Outcome 3 of the Access 3 Physics units D376 09 Sound and Music and D377 09 Movement.

National Unit Specification: support notes

UNIT Practical Electricity (Access 3)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The content and suggested contexts, applications, illustrations and activities for this unit are given on the following pages. The subheadings in the tables correspond to the areas mentioned in the evidence requirements for Outcome 1. The practical activities chosen for Outcome 2 must relate to the content of Access 3 Physics and must allow opportunity for all the performance criteria for this outcome to be demonstrated within any single report.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The learning and teaching of this unit are most effective when the concepts, principles and theories are set in a relevant context, eg by making reference to applications of physics and to real-world situations. The use of the suggested contexts, applications, illustrations and activities is recommended. It is suggested that emphasis is given to practical activities and the associated knowledge and understanding are developed during these activities. Practical activities also provide opportunities to develop a wide range of skills associated with scientific enquiry.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcome 1

This outcome is assessed by an end of unit test with questions covering all of the associated performance criteria. Each question can assess achievement of a number of performance criteria. Assessment items are available from the National Assessment Bank.

Outcome 2

The teacher/lecturer should ensure that the experimental activity to be undertaken in connection with the assessment of Outcome 2 affords opportunity for the candidate to demonstrate the ability to undertake the planning and organising of an experimental activity at an appropriate level of demand. The activity must relate to the content of Access 3 Physics and candidates should be made aware of the range of skills which must be demonstrated to ensure attainment of Outcome 2. Candidates should be provided with an outline structure of a report.

In relation to PC (a), the teacher/lecturer should check by observation that the candidate participates in the collection of the experimental information by playing an active part in planning the experiment, deciding how it will be managed, selecting resources and carrying out the experiment.

In relation to PCs (b) to (e), the following provides an indication of what may be included in a candidate's report.

National Unit Specification: support notes (cont)

UNIT Practical Electricity (Access 3)

PC (b)

Many experiments will follow a given procedure or method hence there is no need for a detailed description. The procedure may be described briefly in outline. The impersonal passive voice should be encouraged. The following should be included, as appropriate:

- aim of the experiment
- a labelled diagram, description of apparatus, instruments used
- how the independent variable was altered
- how measurements were taken or observations made.

PC (c)

Readings or observations should be recorded in a clear table. The table must include:

- correct headings
- appropriate units
- correctly entered readings/observations.

PC (d)

Readings should be analysed and presented using the following, as appropriate:

- a table with suitable headings and units
- a table with ascending or descending independent variable
- a table showing appropriate computations
- a graph with independent and dependent variables plotted
- a graph with suitable scales and axes labelled with quantities and units
- a graph with data correctly plotted with a line or a curve of best fit
- a bar chart.

PC (e)

Conclusions should contain, as appropriate, a statement relating to:

- overall pattern to readings or observations
- trends in analysed information or results
- measurement of a physical quantity.

The references under each performance criterion give an indication of what should be provided as evidence in order to achieve the criterion. The relevance of these will vary according to the experiment. These references are intended to assist the teacher/lecturer in making a judgement of the candidate's achievement against the performance criteria. It is appropriate to support candidates in producing their reports. Re-drafting of reports after necessary supportive criticism is to be encouraged, both as part of the learning and teaching process and to produce evidence for assessment.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

National Unit Specification: support notes

UNIT Practical Electricity (Access 3)

The Content Statements given in the left-hand column of the table below describe in detail what the candidate should be able to do in demonstrating knowledge and understanding associated with Practical Electricity.

The right-hand column gives suggested contexts, applications, illustrations and activities associated with the Content Statements.

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>2.1 Electrical circuits</p> <ol style="list-style-type: none"> 1 Draw and identify the circuit symbols for a battery, lamp and switch. 2 State that a battery is a source of electrical energy. 3 State that lamps, heaters and motors convert electrical energy into other forms. 4 Describe a series circuit. 5 State that an ammeter is used to measure current. 6 Draw and identify the circuit symbol for an ammeter. 7 Draw a circuit diagram showing the correct position of an ammeter in the circuit. 8 State that current is a flow of charge and is measured in amperes. 9 State that in a series circuit, the current is the same at all points. 10 Describe a parallel circuit. 11 State that the sum of currents in two parallel branches is equal to the current drawn from the supply. 12 State that a voltmeter is used to measure voltage. 13 Draw and identify the circuit symbol for a voltmeter. 14 Draw a circuit diagram showing the correct position of a voltmeter in a circuit. 15 State that voltage is measured in volts. 16 State that the sum of the voltages across components in series is equal to the voltage of the supply. 17 State that the voltage across two components in parallel is the same for each component 	<p>Match up component and circuit symbol.</p> <p>Set up a series circuit. Set and use ammeters and multimeters appropriately.</p> <p>Draw series circuit using appropriate symbols.</p> <p>Measure current in series circuit. Draw parallel circuit using appropriate symbols. Set up parallel circuit. Measure current in a parallel circuit. Set and use voltmeters and multimeters appropriately.</p> <p>Measure voltage across lamps in series.</p> <p>Measure voltage across lamps in parallel. Examine practical situations of series and parallel circuits, eg car circuits.</p>

National Unit Specification: support notes (cont)

UNIT Practical Electricity (Access 3)

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>2.2 Resistance</p> <ol style="list-style-type: none"> 1 Draw and identify the circuit symbol for a resistor and a variable resistor. 2 State that resistors convert electrical energy into heat energy. 3 State that an ohmmeter is used to measure resistance. 4 State that resistance is measured in ohms. 5 State that an increase in resistance of a circuit leads to a decrease in the current in the circuit. 6 Calculate resistance using: $resistance = \frac{voltage}{current}$. 7 Give two practical uses of a variable resistor. <p>2.3 Mains electricity</p> <ol style="list-style-type: none"> 1 State that household wiring connects appliances in parallel so that they receive the same voltage. 2 State that the declared value for mains voltage is 230V. 3 Draw and identify the circuit symbol for a fuse. 4 Identify the live, neutral and earth wire from the colour of their insulation. 5 Identify the live, neutral and earth terminals in a plug. 6 Explain how a fuse acts as a safety device. 7 State that electrical energy costs for the home increase as: <ol style="list-style-type: none"> (a) the power of the appliance increases (b) the time of use of the appliance increases. 	<p>Match up component with circuit symbol.</p> <p>Use ohmmeter to measure resistance.</p> <p>Measure current in a circuit for different values of resistance.</p> <p>Measure current and voltage in a circuit containing a resistor and calculate V/I. Measure resistance using ohmmeter and compare with V/I. Examine practical uses of variable resistors.</p> <p>Look at: consumer unit, diagrams and models of household wiring, rating plates of mains-operated appliances.</p> <p>Wire a ceiling rose, lamp and switch circuit using twin and earth 1.0 mm² cable. Wiring of household appliances. Demonstrate the action of a fuse. Use meter to measure energy supplied in the same time to different appliances. Power cards. Investigate the wattage of various domestic appliances and compare the running costs. Rating plates.</p>

National Unit Specification: support notes (cont)

UNIT Practical Electricity (Access 3)

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>2.3 Mains electricity (cont)</p> <p>8 Select an appropriate fuse given the power rating of an appliance.</p> <p>9 State that a circuit breaker is an automatic switch which can be used instead of a fuse.</p> <p>10 State that the human body is a conductor of electricity and that moisture increases its ability to conduct.</p> <p>11 State that the earth wire is a safety device.</p> <p>12 State that electrical appliances which have the double insulation symbol do not require an earth wire.</p> <p>13 Explain why connecting too many appliances to one socket is dangerous.</p> <p>14 Explain why situations involving electricity could result in accidents.</p> <p>15 Describe how to make a simple continuity tester.</p> <p>16 Describe how a continuity tester may be used to identify an open circuit.</p>	<p>Select 3A or 13A fuses as appropriate. Examine fuses and circuit breakers. Experiments with circuit breakers and 12V appliances.</p> <p>Experiment with 1.5V cell to demonstrate the conductivity of the human body when dry and when wet.</p> <p>Experiments to demonstrate the importance of the earth wire.</p> <p>Examine household appliances to see if an earth wire is fitted or a double insulation symbol is shown.</p> <p>Examine drawings to identify potential hazards in the incorrect use of electrical appliances.</p> <p>Use simple continuity tester and ohmmeter to find circuit faults.</p>

National Unit Specification: general information

UNIT Radiations (Access 3)

NUMBER D375 09

CLUSTER Physics (Access 3)

SUMMARY

The unit seeks to develop the candidate's knowledge and understanding of simple concepts and facts related to radiations. It also provides an opportunity for developing the ability to apply this knowledge and understanding in the handling of information related to radiations.

OUTCOMES

1. Handle information related to radiations.
2. Report on one practical application of Access 3 Physics.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates will normally be expected to have attained appropriate Access 2 units.

CREDIT VALUE

0.5 credit at Access 3.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

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National Unit Specification: statement of standards

UNIT Radiations (Access 3)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Handle information related to radiations.

Performance criteria

- (a) Facts are used correctly in relation to radiations.
- (b) Relevant information is selected and presented appropriately.
- (c) Conclusions drawn are valid, and explanations given are supported by evidence.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed book test with items covering all the above performance criteria. The test must sample the Content Statements in each of the following areas:

- Light
- X-rays
- Gamma rays
- Infrared and ultraviolet.

OUTCOME 2

Report on one practical application of Access 3 Physics.

Performance criteria

- (a) The sources of information are used appropriately.
- (b) The practical application is described clearly.
- (a) Conclusions drawn are valid.

Evidence requirements

A completed report, based on a given structure, on a practical use of X-rays or gamma rays or ultraviolet or infrared or lasers, in a medical or non-medical context and covering the above performance criteria is required. The report must be the individual work of the candidate.

An Outcome 3 report of practical work in the Access 3 Physics unit D373 09 Telecommunications may be used as evidence of achievement of Outcome 3 of this unit. An Outcome 3 report of practical work in this unit may be used as evidence of achievement of Outcome 3 of the Access 3 Physics unit D373 09 Telecommunications.

National Unit Specification: support notes

UNIT Radiations (Access 3)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The content and suggested contexts, applications, illustrations and activities for this unit are given on the following pages. The subheadings in the tables correspond to the areas mentioned in the evidence requirements for Outcome 1. The tasks chosen for Outcome 2 must relate to the content of Access 3 Physics and must allow opportunity for all the performance criteria for this outcome to be demonstrated within any single report.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The learning and teaching of this unit are most effective when the concepts, principles and theories are set in a relevant context, eg by making reference to applications of physics and to real-world situations. The use of the suggested contexts, applications, illustrations and activities is recommended. It is suggested that emphasis is given to practical activities and the associated knowledge and understanding are developed during these activities. Practical activities also provide opportunities to develop a wide range of skills associated with scientific enquiry.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcome 1

This outcome is assessed by an end of unit test with questions covering all of the associated performance criteria. Each question can assess achievement of a number of performance criteria. Assessment items are available from the National Assessment Bank.

Outcome 2

The teacher/lecturer should ensure that the task relates to the content of Access 3 Physics, that it is about a current application of physics and that it provides an appropriate level of demand. Candidates should be provided with an outline structure of a report.

In relation to PC(a), the teacher/lecturer should ensure that the candidate plays an active part in gathering information for the report. Candidates should have access to a range of suitable resources, eg, CD-ROM, library, internet.

In relation to PCs (b) and (c) the following provides an indication of what may be included in a candidate's report.

National Unit Specification: support notes (cont)

UNIT Radiations (Access 3)

PC (b)

- a statement of name of the radiation
- a few concise sentences describing the practical application

PC (c)

Conclusions should contain, as appropriate, a statement relating to:

- one advantage and one disadvantage of the application
- benefits of the application
- comment on effects of the application on individuals and/or society.

It is appropriate to give limited support to candidates in producing their reports. Re-drafting of reports after necessary supportive criticism is to be encouraged, both as part of the learning and teaching process and to produce evidence for assessment. Advice should be given on how to access sources of information, eg CD-ROM, internet and library.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

National Unit Specification: support notes (cont)

UNIT Radiations (Access 3)

The Content Statements given in the left-hand column of the table below describe in detail what the candidate should be able to do in demonstrating knowledge and understanding associated with Radiations.

The right-hand column gives suggested contexts, applications, illustrations and activities associated with the Content Statements.

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>3.1 Light</p> <ol style="list-style-type: none"> 1 State that the laser is a concentrated source of light of only one colour. 2 Describe how the laser is used in one practical application. 3 State that light can be reflected. 4 State that all visible objects give out, or reflect, light to the eye. 5 Describe the direction of the reflected light ray from a plane mirror. 6 Describe one use of optical fibres in medicine. 7 Describe the shapes of converging and diverging lenses. 8 Describe the effect of a converging and a diverging lens on parallel rays of light. 9 Describe, in words or using a diagram, the eye defects called long and short sight. 10 State that a converging lens can correct long sight and a diverging lens can correct short sight. <p>3.2 X-rays</p> <ol style="list-style-type: none"> 1 State that X-rays are invisible to the naked eye. 2 State that photographic film may be used to detect X-rays. 3 Describe one use of X-rays in medicine. 4 Describe one use of X-rays in industry. 5 State that X-rays are dangerous since they can damage living cells. 	<p>Demonstrate properties of laser. Obtain information on the uses of lasers.</p> <p>Use raybox kits to investigate reflection including total internal reflection. Optical fibres in medicine.</p> <p>Use raybox kits to investigate refraction with converging and diverging lens shapes. Model eye to investigate long and short sight.</p> <p>Obtain information on X-rays. Examine X-ray photographs. CAT scan. View suitable video on the use of X-rays. Inspection of welded joints. Security inspection of luggage. Protection of radiographers</p>

National Unit Specification: support notes (cont)

UNIT Radiations (Access 3)

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>3.3 Gamma rays</p> <ol style="list-style-type: none"> 1 State that gamma radiation is invisible to the naked eye. 2 State that gamma radiation can kill living cells or change the nature of living cells. 3 State that gamma radiation can pass through most materials. 4 Describe how gamma radiation can be used as a tracer in both medicine and industry. 5 State that the strength of a source of gamma radiation decreases with time. 6 Describe the safety precautions needed when dealing with a source of gamma radiation. 7 State that there is gamma radiation present in our surroundings. <p>3.4 Infrared and ultraviolet</p> <ol style="list-style-type: none"> 1 State that infrared radiation is invisible to the naked eye. 2 State that infrared radiation is called heat radiation. 3 Describe one use of infrared radiation in medicine. 4 Describe one non-medical use of infrared radiation. 5 State that ultraviolet radiation is invisible to the naked eye. 6 Describe one use of ultraviolet radiation in medicine. 7 State that some chemicals glow ie fluoresce when they absorb ultraviolet radiation ie fluoresce 8 Describe how ultraviolet radiation can be used in identifying security markings. 9 State that excessive exposure to ultraviolet radiation may produce skin cancer. 	<p>Obtain information on the use of gamma radiation in the treatment of cancer and sterilisation of instruments. Demonstrate the absorption of gamma rays using the Geiger Müller tube. Simulate a tracer experiment emphasising that extremely small quantities of gamma radiation can be detected. View video on tracers.</p> <p>Obtain information on the precautions necessary when handling radioactive substances. Measure background radiation.</p> <p>Heat lamps. Obtain information on the uses of infrared radiation. Thermograms. Infrared cameras. Night sights.</p> <p>Obtain information on the uses of ultraviolet radiation. 'Sun' beds, treatment of acne, vitamin D deficiency. Soap powders, fluorescent lamps, disco lights.</p> <p>'Invisible' ink pens. Forged bank notes.</p> <p>Sun tan. Sun tan creams. Effect of ozone layer.</p>

National Unit Specification: general information

UNIT Sound and Music (Access 3)

NUMBER D376 09

CLUSTER Physics (Access 3)

SUMMARY

The unit seeks to develop knowledge and understanding of simple concepts and facts related to sound and music. It also provides an opportunity for developing the ability to apply this knowledge and understanding in the handling and analysis of information related to sound and music.

OUTCOMES

1. Handle information related to sound and music.
2. Collect and analyse information related to Access 3 Physics obtained by experiment.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates will normally be expected to have attained appropriate Access 2 units.

CREDIT VALUE

0.5 credit at Access 3.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

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National Unit Specification: statement of standards

UNIT Sound and Music (Access 3)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Handle information related to sound and music.

Performance criteria

- (a) Quantities and their units are used correctly in relation to sound and music.
- (b) Facts are used correctly in relation to sound and music.
- (c) Relevant information is selected and presented appropriately.
- (d) Conclusions drawn are valid, and explanations given are supported by evidence.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed book test with items covering all the above performance criteria. The test must sample the Content Statements in each of the following areas:

- Sound waves
- Speed of sound
- Using sound
- Amplified sound.

OUTCOME 2

Collect and analyse information related to Access 3 Physics obtained by experiment.

Performance criteria

- (a) The information is collected by active participation in the experiment.
- (b) The experimental procedures are described accurately.
- (c) Relevant measurements and observations are recorded in an appropriate format.
- (d) Recorded information is analysed and presented in an appropriate format.
- (e) Conclusions drawn are valid.

Evidence requirements

A completed report, based on a given structure, of one experimental activity related to Access 3 Physics covering the above performance criteria is required. Evidence submitted in support of attainment of PC (d) must be in the form of a table or graph as appropriate. The teacher/lecturer responsible must attest that the report is the individual work of the candidate derived from active participation in an experiment involving the candidate in planning the experiment; deciding how it is to be managed; selecting resources; carrying out the experiment. Depending on the activity, the collection of the information may be through group work.

An Outcome 3 report of practical work in the Access 3 Physics unit D374 09 Practical Electricity or D377 09 Movement may be used as evidence of achievement of Outcome 3 of this unit. An Outcome 3 report of practical work in this unit may be used as evidence of achievement of Outcome 3 of the Access 3 Physics units D374 09 Practical Electricity and D377 09 Movement.

National Unit Specification: support notes

UNIT Sound and Music (Access 3)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The content and suggested contexts, applications, illustrations and activities for this unit are given on the following pages. The subheadings in the tables correspond to the areas mentioned in the evidence requirements for Outcome 1. The practical activities chosen for Outcome 2 must relate to the content of Access 3 Physics and must allow opportunity for all the performance criteria for this outcome to be demonstrated within any single report.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The learning and teaching of this unit are most effective when the concepts, principles and theories are set in a relevant context, eg by making reference to applications of physics and to real-world situations. The use of the suggested contexts, applications, illustrations and activities is recommended. It is suggested that emphasis is given to practical activities and the associated knowledge and understanding are developed during these activities. Practical activities also provide opportunities to develop a wide range of skills associated with scientific enquiry.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcome 1

This outcome is assessed by an end of unit test with questions covering all of the associated performance criteria. Each question can assess achievement of a number of performance criteria. Assessment items are available from the National Assessment Bank.

Outcome 2

The teacher/lecturer should ensure that the experimental activity to be undertaken in connection with the assessment of Outcome 2 affords opportunity for the candidate to demonstrate the ability to undertake the planning and organising of an experimental activity at an appropriate level of demand. The activity must relate to the content of Access 3 Physics and candidates should be made aware of the range of skills which must be demonstrated to ensure attainment of Outcome 2. Candidates should be provided with an outline structure of a report.

In relation to PC (a), the teacher/lecturer should check by observation that the candidate participates in the collection of the experimental information by playing an active part in planning the experiment, deciding how it will be managed, selecting resources and carrying out the experiment.

In relation to PCs (b) to (e), the following provides an indication of what may be included in a candidate's report.

National Unit Specification: support notes (cont)

UNIT Sound and Music (Access 3)

PC (b)

Many experiments will follow a given procedure or method hence there is no need for a detailed description. The procedure may be described briefly in outline. The impersonal passive voice should be encouraged. The following should be included, as appropriate:

- aim of the experiment
- a labelled diagram, description of apparatus, instruments used
- how the independent variable was altered
- how measurements were taken or observations made.

PC (c)

Readings or observations should be recorded in a clear table. The table must include:

- correct headings
- appropriate units
- correctly entered readings/observations.

PC (d)

Readings should be analysed and presented using the following, as appropriate:

- a table with suitable headings and units
- a table with ascending or descending independent variable
- a table showing appropriate computations
- a graph with independent and dependent variables plotted
- a graph with suitable scales and axes labelled with quantities and units
- a graph with data correctly plotted with a line or a curve of best fit
- a bar chart.

PC (e)

Conclusions should contain, as appropriate, a statement relating to:

- overall pattern to readings or observations
- trends in analysed information or results
- measurement of a physical quantity.

The references under each performance criterion give an indication of what should be provided as evidence in order to achieve the criterion. The relevance of these will vary according to the experiment. These references are intended to assist the teacher/lecturer in making a judgement of the candidate's achievement against the performance criteria. It is appropriate to support candidates in producing their reports. Re-drafting of reports after necessary supportive criticism is to be encouraged, both as part of the learning and teaching process and to produce evidence for assessment.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

National Unit Specification: support notes (cont)

UNIT Sound and Music (Access 3)

The Content Statements given in the left-hand column of the table below describe in detail what the candidate should be able to do in demonstrating knowledge and understanding associated with Sound and Music.

The right-hand column gives suggested contexts, applications, illustrations and activities associated with the Content Statements.

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>4.1 Sound waves</p> <ol style="list-style-type: none"> 1 State that for sound to be produced an object must vibrate. 2 State that sound is a wave which transfers energy. 3 State that the frequency of a sound is the number of waves produced in one second. 4 State that frequency is measured in hertz. 5 State that the higher the pitch of a sound the larger the frequency. 6 Identify from oscilloscope traces the signal which would produce: <ol style="list-style-type: none"> (a) the louder sound (b) the higher frequency. 7 Describe how the frequency produced by a vibrating string can be increased by shortening the length of the string and increasing the tightness of the string. 8 Describe how the frequency produced by a vibrating air column can be increased by shortening the length of the air column. <p>4.2 Speed of sound</p> <ol style="list-style-type: none"> 1 Give an example which shows that the speed of sound in air is less than the speed of light in air. 2 Describe a method for measuring the speed of sound in air using the relationship between distance, time and speed. 3 Calculate the speed of sound using: $speed = \frac{distance}{time}$. 	<p>Investigate various sounding objects. Musical instruments, speech, loudspeaker. Use oscilloscope to compare frequencies.</p> <p>Use signal generator and oscilloscope to investigate frequency, amplitude and loudness effects. Slinky. Drums and cymbals.</p> <p>Investigate the factors affecting the frequency produced by a vibrating string.</p> <p>Investigate the frequency produced by a vibrating air column. Musical instruments. Synthesisers. Investigate instrument sounds using computer interface.</p> <p>Produce sound and light signals at the same time. Thunder and lightning, sound switches and computer. Measure the speed of sound in air – measure distance and time.</p>

National Unit Specification: support notes (cont)

UNIT Sound and Music (Access 3)

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>4.3 Using sound</p> <ol style="list-style-type: none"> 1 State that sound can pass through solids, liquids and gases. 2 State that sound cannot pass through a vacuum. 3 State that the normal range of human hearing is from 20 hertz to 20,000 hertz. 4 State that high frequency sounds beyond the range of human hearing are called ultrasounds. 5 Give one example of the use of ultrasound in medicine. 6 Give one example of a non-medical use of ultrasound. 7 State that sound levels are measured in decibels. 8 Give two examples of noise pollution. 9 State that excessive noise can damage hearing. <p>4.4 Amplified sound</p> <ol style="list-style-type: none"> 1 State that the output signal from an amplifier has the same frequency but a bigger amplitude than the input signal. 2 State the function of each of the three major components needed to amplify speech (microphone, amplifier, loudspeaker). 3 Define voltage gain of an amplifier in terms of input and output voltages. 4 Calculate voltage gain using: $voltage\ gain = \frac{output\ voltage}{input\ voltage}$. 5 Explain why your recorded voice sounds different to you. 6 State the advantages of a compact disc compared to a tape cassette. 	<p>Investigate the transmission of sound through solids, liquids and gases. Plastic cup and string ‘telephone’. Bell in jar connected to vacuum pump. Investigate range of hearing using signal generator and loudspeaker.</p> <p>High frequency deafness. Dog whistles. Bats.</p> <p>Medical uses of ultrasound. Sonar. Use sound level meter to measure ‘noise’. Health and Safety, permitted decibel levels. Investigate ways of minimising the effects of noise, eg ear mufflers, double glazing, sound insulation.</p> <p>Discuss various devices containing amplifiers. Use oscilloscope to compare the input to, and output from, an audio amplifier. Put together a simple amplifier for use with a microphone and loudspeaker.</p> <p>Measure voltage gain of an amplifier. Hi-fi systems.</p> <p>Study the use of graphic equalisers. Record and play back your own voice. Obtain information on compact discs and tape cassettes.</p>

National Unit Specification: general information

UNIT Movement (Access 3)

NUMBER D377 09

CLUSTER Physics (Access 3)

SUMMARY

The unit seeks to develop the candidate's knowledge and understanding of simple concepts and facts related to movement. It also provides an opportunity for developing the ability to apply this knowledge and understanding in the handling and analysis of information related to movement.

OUTCOMES

1. Handle information related to movement.
2. Collect and analyse information related to Access 3 Physics obtained by experiment.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates will normally be expected to have attained appropriate Access 2 units.

CREDIT VALUE

0.5 credit at Access 3.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

Administrative Information

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National Unit Specification: statement of standards

UNIT Movement (Access 3)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Handle information related to movement.

Performance criteria

- (a) Quantities and their units are used correctly in relation to movement.
- (b) Facts are used correctly in relation to movement.
- (c) Relevant information is selected and presented appropriately.
- (d) Conclusions drawn are valid, and explanations given are supported by evidence.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed book test with items covering all the above performance criteria. The test must sample the Content Statements in each of the following areas:

- Forces
- Speed and acceleration
- Moving objects.

OUTCOME 2

Collect and analyse information related to Access 3 Physics obtained by experiment.

Performance criteria

- (a) The information is collected by active participation in the experiment.
- (b) The experimental procedures are described accurately.
- (c) Relevant measurements and observations are recorded in an appropriate format.
- (d) Recorded information is analysed and presented in an appropriate format.
- (e) Conclusions drawn are valid.

Evidence requirements

A completed report, based on a given structure, of one experimental activity related to Access 3 Physics covering the above performance criteria is required. Evidence submitted in support of attainment of PC (d) must be in the form of a table or graph as appropriate. The teacher/lecturer responsible must attest that the report is the individual work of the candidate derived from active participation in an experiment involving the candidate in planning the experiment; deciding how it is to be managed; selecting resources; carrying out the experiment. Depending on the activity, the collection of the information may be through group work.

An Outcome 3 report of practical work in the Access 3 Physics unit D374 09 Practical Electricity or D376 09 Sound and Music may be used as evidence of achievement of Outcome 3 of this unit. An Outcome 3 report of practical work in this unit may be used as evidence of achievement of Outcome 3 of the Access 3 Physics units D374 09 Practical Electricity and D376 09 Sound and Music.

National Unit Specification: support notes

UNIT Movement (Access 3)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The content and suggested contexts, applications, illustrations and activities for this unit are given on the following pages. The subheadings in the tables correspond to the areas mentioned in the evidence requirements for Outcome 1. The practical activities chosen for Outcome 2 must relate to the content of Access 3 Physics and must allow opportunity for all the performance criteria for this outcome to be demonstrated within any single report.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The learning and teaching of this unit are most effective when the concepts, principles and theories are set in a relevant context, eg by making reference to applications of physics and to real-world situations. The use of the suggested contexts, applications, illustrations and activities is recommended. It is suggested that emphasis is given to practical activities and the associated knowledge and understanding are developed during these activities. Practical activities also provide opportunities to develop a wide range of skills associated with scientific enquiry.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcome 1

This outcome is assessed by an end of unit test with questions covering all of the associated performance criteria. Each question can assess achievement of a number of performance criteria. Assessment items are available from the National Assessment Bank.

Outcome 2

The teacher/lecturer should ensure that the experimental activity to be undertaken in connection with the assessment of Outcome 2 affords opportunity for the candidate to demonstrate the ability to undertake the planning and organising of an experimental activity at an appropriate level of demand. The activity must relate to the content of Access 3 Physics and candidates should be made aware of the range of skills which must be demonstrated to ensure attainment of Outcome 2. Candidates should be provided with an outline structure of a report.

In relation to PC (a), the teacher/lecturer should check by observation that the candidate participates in the collection of the experimental information by playing an active part in the experiment, deciding how it will be managed, selecting resources and carrying out the experiment.

In relation to PCs (b) to (e), the following provides an indication of what may be included in a candidate's report.

National Unit Specification: support notes (cont)

UNIT Movement (Access 3)

PC (b)

Many experiments will follow a given procedure or method hence there is no need for a detailed description. The procedure may be described briefly in outline. The impersonal passive voice should be encouraged. The following should be included, as appropriate:

- aim of the experiment
- a labelled diagram, description of apparatus, instruments used
- how the independent variable was altered
- how measurements were taken or observations made.

PC (c)

Readings or observations should be recorded in a clear table. The table must include:

- correct headings
- appropriate units
- correctly entered readings/observations.

PC (d)

Readings should be analysed and presented using the following, as appropriate:

- a table with suitable headings and units
- a table with ascending or descending independent variable
- a table showing appropriate computations
- a graph with independent and dependent variables plotted
- a graph with suitable scales and axes labelled with quantities and units
- a graph with data correctly plotted with a line or a curve of best fit
- a bar chart.

PC (e)

Conclusions should contain, as appropriate, a statement relating to:

- overall pattern to readings or observations
- trends in analysed information or results
- measurement of a physical quantity.

The references under each performance criterion give an indication of what should be provided as evidence in order to achieve the criterion. The relevance of these will vary according to the experiment. These references are intended to assist the teacher/lecturer in making a judgement of the candidate's achievement against the performance criteria. It is appropriate to support candidates in producing their reports. Re-drafting of reports after necessary supportive criticism is to be encouraged, both as part of the learning and teaching process and to produce evidence for assessment.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

National Unit Specification: support notes (cont)

UNIT Movement (Access 3)

The Content Statements given in the left-hand column of the table below describe in detail what the candidate should be able to do in demonstrating knowledge and understanding associated with Movement.

The right-hand column gives suggested contexts, applications, illustrations and activities associated with the Content Statements.

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>5.1 Forces</p> <ol style="list-style-type: none"> 1 Describe how to use a newton balance to measure force. 2 State that weight is a force and is the Earth's pull on an object. 3 Calculate weight using: $weight = 10 \times mass$. 4 State that the force of friction can oppose the motion of an object. 5 Describe one way in which the force of friction can be increased. 6 Describe one way in which the force of friction can be decreased. 7 State that streamlining reduces the effect of air friction on an object. 8 Describe two features of a car which improve streamlining. 9 State that equal forces acting in opposite directions on an object are called balanced forces. 10 Identify situations where the forces acting on an object are <ol style="list-style-type: none"> (a) balanced (b) not balanced. 11 State that when the forces acting on an object are balanced the movement of the object does not change. 12 State that when the forces acting on an object are not balanced the speed and/or direction of movement of the object changes. 	<p>Investigate the effect of forces on an object. Use newton balance to lift and pull different objects. Find force needed to lift known masses and use results to show that the ratio of weight to mass is 10 newtons per kilogram. Investigate which type of surface has the best 'grip'.</p> <p>Experiments on 'removing' friction. Lubrication, car tyres, brakes, road conditions, sports shoes. Investigate the effect of the shape of an object on reducing friction.</p> <p>Tug-of-war, aircraft in flight, skydiver.</p> <p>Qualitative only – calculations are not required. Stationary objects and objects moving at constant speed in a straight line Qualitative only – calculations are not required. Objects changing speed and objects changing direction.</p>

National Unit Specification: support notes (cont)

UNIT Movement (Access 3)

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>5.2 Speed and acceleration</p> <ol style="list-style-type: none"> Describe how to measure average speed. Calculate average speed using: $average\ speed = \frac{distance}{time}$. Describe the term ‘acceleration’. <p>5.3 Moving objects</p> <ol style="list-style-type: none"> Describe how the effect of a collision increases with the mass and speed of the objects involved. State that the change in speed of an object increases with: <ol style="list-style-type: none"> the size of the force acting the time the force acts. State that the range of a ball thrown at an angle is affected by: <ol style="list-style-type: none"> the speed of the throw the angle of the throw. State that the height a ball rebounds on hitting a surface is affected by: <ol style="list-style-type: none"> the speed on impact the material of the surface the material of the ball. 	<p>Measure average speeds for everyday moving objects, eg car, student, bicycle. Average speeds for car, train and bus journeys. Average speeds for different athletic events.</p> <p>Information on performance figures for cars.</p> <p>Observe collisions between objects – vary mass and speed. Linear air track experiments. Car collisions, rugby players. Observe motion in Newton’s cradle. Investigate the effect of force and contact time on a ball. Racquet sports, hockey, cricket, etc.</p> <p>Investigate the factors affecting the range of a ball thrown at an angle.</p> <p>Investigate the factors affecting the rebound height of a ball.</p>

National Unit Specification: general information

UNIT Electronics (Access 3)

NUMBER D378 09

CLUSTER Physics (Access 3)

SUMMARY

The unit seeks to develop the candidate's knowledge and understanding of simple concepts and facts related to electronics. It also provides an opportunity for developing the ability to apply this knowledge and understanding in the handling of information and analysis of simple problems related to electronics.

OUTCOMES

1. Handle information related to electronics.
2. Use a systems approach to produce a practical solution to a simple, real-life problem.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates will normally be expected to have attained appropriate Access 2 units.

CREDIT VALUE

0.5 credit at Access 3.

CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

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National Unit Specification: statement of standards

UNIT Electronics (Access 3)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Handle information related to electronics.

Performance criteria

- (a) Facts are used correctly in relation to electronics.
- (b) Symbols are described correctly in relation to electronics.
- (c) Relevant information is selected and presented appropriately.
- (d) Conclusions drawn are valid, and explanations given are supported by evidence.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed book test with items covering all the above performance criteria. The test must sample the Content Statements in each of the following areas:

- Input, process and output
- Digital logic gates.

OUTCOME 2

Use a systems approach to produce a practical solution to a simple, real-life problem.

Performance criteria

- (a) Selected subsystems are appropriate for a specific function.
- (b) Justification for choice of each subsystem is correctly made.
- (c) Subsystems are correctly assembled.
- (d) System provides a solution to the problem.

Evidence requirements

One report, based on a given structure, of a practical solution to a real-life problem related to electronics and covering the above performance criteria is required. The teacher/lecturer responsible must attest that the report is the individual work of the candidate derived from active participation in problem solving activities involving the candidate in planning the activities; deciding how the activities are to be managed; selecting resources; carrying out the activities. The report must contain a block diagram of the system and a written justification of the choice of subsystems. An explanation of how the system functions in terms of the subsystems selected must also be included.

National Unit Specification: support notes

UNIT Electronics (Access 3)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The content and suggested contexts, applications, illustrations and activities for this unit are given on the following pages. The subheadings in the tables correspond to the areas mentioned in the evidence requirements for Outcome 1. The practical activities chosen for Outcome 2 must relate to the content of the unit and must allow opportunity for all the performance criteria for this outcome to be demonstrated within any single report.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The learning and teaching of this unit are most effective when the concepts, principles and theories are set in a relevant context, eg by making reference to applications of physics and to real-world situations. The use of the suggested contexts, applications, illustrations and activities is recommended. It is suggested that emphasis is given to practical activities and the associated knowledge and understanding are developed during these activities. Practical activities also provide opportunities to develop a wide range of skills associated with scientific enquiry.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcome 1

This outcome is assessed by an end of unit test with questions covering all of the associated performance criteria. Each question can assess achievement of a number of performance criteria. Assessment items are available from the National Assessment Bank.

Outcome 2

The teacher/lecturer should ensure that the activities undertaken in connection with the assessment of Outcome 2 present a practical real-life problem. The activities must relate to the unit content and be at an appropriate level of demand. Candidates should be provided with an outline structure of a report.

In relation to PC (c) the teacher/lecturer should check by observation that the system is assembled correctly.

In relation to PCs (a), (b) and (d), the following provides an indication of what may be included in a candidate's report.

National Unit Specification: support notes (cont)

UNIT Electronics (Access 3)

PC (a)

Comments should be provided on the selected subsystems with

- a description of the problem to be solved.
- a statement of the name of the input device
- a statement of the name of the output device
- a statement of the name of the processor.

PC (b)

The choice of each subsystem should be justified by:

- a clear sentence indicating why the input device was chosen
- a clear sentence indicating why the output device was chosen
- a clear sentence indicating why the processor was chosen.

PC (d)

A few concise sentences describing how the system works should be provided.

The references under each performance criterion give an indication of what should be provided as evidence in order to achieve the criterion. These references are intended to assist the teacher/lecturer in making a judgement of the candidate's achievement against the performance criteria. It is appropriate to support candidates in producing their reports. Re-drafting of reports after necessary supportive criticism is to be encouraged, both as part of the learning and teaching process and to produce evidence for assessment.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

National Unit Specification: support notes (cont)

UNIT Electronics (Access 3)

The Content Statements given in the left-hand column of the table below describe in detail what the candidate should be able to do in demonstrating knowledge and understanding associated with Electronics.

The right-hand column gives suggested contexts, applications, illustrations and activities associated with the Content Statements.

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>6.1 Input, process and output</p> <ol style="list-style-type: none"> 1 State that an electronic system consists of three parts: input, process and output. 2 Identify from a block diagram the input, process and output subsystems of an electronic system. 3 Draw a block diagram showing the input, process and output subsystems of an electronic system. 4 State that the microphone, thermistor, LDR and switch are examples of input devices. 5 State that a microphone changes sound energy to electrical energy. 6 State that the resistance of a thermistor changes with temperature. 7 State that the resistance of an LDR decreases as the light gets brighter. 8 Identify from a list an appropriate input device for a given application. 9 State that an output device changes electrical energy into another form of energy. 10 State that the loudspeaker, buzzer, lamp, LED and electric motor are examples of output devices. 11 State the energy transformations involved for a given output device. 12 Identify from a list an appropriate output device for a given application. 	<p>Discuss practical systems in terms of input, process and output.</p> <p>Carry out experiments to investigate the behaviour of the input devices listed.</p> <p>Use ohmmeter to measure resistance of thermistor at different temperatures. Use ohmmeter to measure resistance of LDR at different light intensities. Examine uses of input devices.</p> <p>Examine a range of output devices.</p> <p>Examine uses of output devices.</p>

National Unit Specification: support notes (cont)

UNIT Electronics (Access 3)

CONTENT STATEMENTS	CONTEXTS, APPLICATIONS, ILLUSTRATIONS AND ACTIVITIES
<p>6.2 Digital logic gates</p> <ol style="list-style-type: none">1 Draw and identify the symbols for two input AND and OR gates, and a NOT gate.2 State that: high voltage = logic 1; and low voltage = logic 0.3 State that for a NOT gate the output is the opposite of the input.4 State that for an AND gate both inputs must be high for the output to be high.5 State that for an OR gate either input must be high for the output to be high.6 Explain how to use combinations of digital logic gates for control in simple situations.	<p>Use oscilloscope to examine digital signals. Investigate the truth for a NOT gate and two input AND and OR gates using an LED as detector.</p> <p>Examine simple applications of NOT, AND and OR gates using digital inputs in solving electronic problems, eg alarms, warning devices, etc.</p>