

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).

Administrative Information

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Additional copies of this unit specification can be purchased from the Scottish Qualifications Authority. The cost for each unit specification is £2.50 (minimum order £5).

National Unit Specification: statement of standards

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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

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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.

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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

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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)

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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)

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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>