SCQF level 5
Unit Specification

Physics: Electricity and Energy

SCQF: level 5 (6 SCQF credit points)

Unit code: H256 75

Unit outline

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

The Unit covers the key areas of energy transfer, heat and the gas laws. Learners will research issues, apply scientific skills and communicate information related to their findings, which will develop skills of scientific literacy.

Learners who complete this Unit will be able to:

1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment/practical investigation

2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills

This Unit is available as a free-standing Unit. The Unit Specification should be read in conjunction with the *Unit Support Notes*, which provide advice and guidance on delivery, assessment approaches and development of skills for learning, skills for life and skills for work. Exemplification of the standards in this Unit is given in *Unit Assessment Support*.

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Recommended entry

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

- National 4 Physics Course or relevant component Units
- National 4 Science Course or relevant component Units

Equality and inclusion

This Unit Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. For further information, please refer to the *Unit Support Notes.*

Standards

Outcomes and Assessment Standards

Outcome 1

The learner will:

1 Apply skills of scientific inquiry and draw on knowledge and understanding of the key areas of this Unit to carry out an experiment/practical investigation by:

1.1 Planning an experiment/practical investigation
1.2 Following procedures safely
1.3 Making and recording observations/measurements correctly
1.4 Presenting results in an appropriate format
1.5 Drawing valid conclusions
1.6 Evaluating experimental procedures

Outcome 2

The learner will:

2 Draw on knowledge and understanding of the key areas of this Unit and apply scientific skills by:

2.1 Making accurate statements
2.2 Solving problems

Evidence Requirements for the Unit

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners, to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used. The key areas covered in this Unit are:

Energy transfer

- conservation of energy
- electrical charge carriers and electric fields
- potential difference (voltage)
- practical electrical and electronic circuits
- Ohm's law
- electrical power

Heat

- specific heat capacity

Gas laws

- gas laws and the kinetic model

Electricity and Energy
Conservation of energy

- Knowledge of the principle of 'conservation of energy' applied to examples where energy is transferred between stores. Identification and explanation of 'loss' of energy where energy is transferred.
- Use of an appropriate relationship to solve problems involving potential energy, mass, gravitational field strength and height.
- Use of an appropriate relationship to solve problems involving kinetic energy, mass and speed.
- Use of appropriate relationships to solve problems involving conservation of energy.

Electrical charge carriers and electric fields

- Definition of electrical current as the electric charge transferred per unit time.
- Use of an appropriate relationship to solve problems involving charge, current and time.
- Knowledge of the difference between alternating and direct current.

Potential difference (voltage)

- Awareness of the effect of an electric field on a charged particle.
- Knowledge that the potential difference (voltage) of the supply is a measure of the energy given to the charge carriers in a circuit.

Ohm's Law

- Use of a V-I graph to determine resistance.
- Use of an appropriate relationship to solve problems involving potential difference (voltage), current and resistance.
- Knowledge of the qualitative relationship between the temperature and the resistance of a conductor.

Practical electrical and electronic circuits

- Measurement of current, voltage and resistance, using appropriate meters in complex circuits.
- Knowledge of the circuit symbol, function and application of standard electrical and electronic components including cell, battery, lamp, switch, resistor, variable resistor, voltmeter, ammeter, LED, motor, microphone, loudspeaker, photovoltaic cell, fuse, diode, capacitor, thermistor, LDR, relay, transistor.
- For transistors, familiarity with the symbols for an npn transistor and an n-channel enhancement mode MOSFET. Explanation of their function as a switch in transistor switching circuits.
- Knowledge of current and voltage relationships in series and parallel circuits.
- Use of appropriate relationships to solve problems involving the total resistance of resistors in series and in parallel circuits, and circuits with a combination of series and parallel resistors.

Electrical power

- Use of an appropriate relationship to solve problems involving energy, power and time.
- Use of appropriate relationships to solve problems involving power, potential difference (voltage), current and resistance in electrical circuits.

- Selection of an appropriate fuse rating given the power rating of an electrical appliance.

Specific heat capacity

- Knowledge that different materials require different quantities of heat to raise the temperature of unit mass by one degree celsius.
- Knowledge that the temperature of a substance is a measure of the mean kinetic energy of its particles.
- Explanation of the connection between temperature and heat energy.
- Use of an appropriate relationship to solve problems involving mass, heat energy, temperature change and specific heat capacity.
- Use of the principle of conservation of energy to determine heat transfer.

Gas laws and the kinetic model

- Knowledge that pressure is the force per unit area exerted on a surface.
- Description of how the kinetic model accounts for the pressure of a gas.
- Use of an appropriate relationship to carry out calculations involving pressure, force and area.
- Knowledge of the relationship between kelvin and degrees celsius and the absolute zero of temperature.
- Explanation of the pressure-volume, pressure-temperature and volume-temperature laws qualitatively in terms of a kinetic model.
- Use of appropriate relationships to solve problems involving the volume, pressure and kelvin temperature of a fixed mass of gas.

Evidence can be drawn from a variety of sources and presented in a variety of formats. The table below describes the evidence for the Assessment Standards which require exemplification. Evidence may be presented for individual Outcomes, or gathered for the Unit. If the latter approach is used, it must be clear how the evidence covers each Outcome.

Assessment Standard	Evidence Requirements
Planning an experiment/practical investigation	The plan should include: ♦ an aim ♦ a dependent and independent variable ♦ key variables to be kept constant ♦ measurements/observations to be made ♦ the resources ♦ the method, including safety considerations if appropriate
Presenting results in an appropriate format	One format from: table, line graph, chart, key, diagram, summaries or other appropriate formats.
Drawing valid conclusions	Include reference to the aim.
Evaluating experimental procedures	Suggest an improvement with justification.
Making accurate statements	At least half of the statements should be correct across the key areas of each Unit.
Solving problems	One of each: ♦ make predictions ♦ select information ♦ process information including calculations, as appropriate ♦ analyse information
Outcome 2: Making accurate statements and solving problems may be combined into one holistic assessment, with marks allocated to each question. In this case, to achieve Outcome 2 the candidate must achieve at least 50% of the marks available in the set of questions.	

Outcome 1: Candidates must achieve at least 5 out of the 6 Assessment Standards to achieve a pass.

Transfer of evidence: Evidence for the achievement of Outcome 1 for this unit can be used as evidence for the achievement of Outcome 1 in the Units H258 75 *Physics: Dynamics and Space* and H25A 75 *Waves and Radiation*.

Where Assessment Standard 2.2 is being assessed separately from Assessment Standard 2.1, evidence of achievement of Assessment Standard 2.2 for this Unit can be used as evidence of achievement of Assessment Standard 2.2 in the Units H258 75 *Physics: Dynamics and Space* and H25A 75 *Waves and Radiation*.

Note: this does not apply when Outcome 2 is being assessed holistically.

As Assessment Standard 2.1 (Making accurate statements) relates specifically to the key areas of each Unit, evidence is **not transferable** between the units for this Assessment Standard.

Exemplification of assessment is provided in *Unit Assessment Support*. Advice and guidance on possible approaches to assessment is provided in the *Unit Support Notes*.

Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this Unit. The skills that learners will be expected to improve on and develop through the Unit are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the Unit where there are appropriate opportunities.

2 Numeracy

2.1 Number processes
2.2 Money, time and measurement
2.3 Information handling

5 Thinking skills

5.3 Applying
5.4 Analysing and evaluating

Amplification of these is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work.* The level of these skills should be at the same SCQF level of the Unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the *Unit Support Notes.*

Administrative information

Published: April 2018 (version 2.0)

Superclass: RC

History of changes to National Unit Specification

Version	Description of change	Authorised by	Date
2.0	Added table detailing content to be covered. Transfer of evidence updated. Evidence requirements updated.	Qualifications Manager	April 2018