

## Physics: Waves and Radiation

**SCQF:** level 5 (6 SCQF credit points)

**Unit code:** H25A 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 waves and radiation. Learners will apply these skills when considering the applications of waves and radiation on our lives, as well as the implications on society/the environment. This can be done by using a variety of approaches, including investigation and problem solving.

The Unit covers the key areas of waves and nuclear radiation. 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*.

## 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:

### Waves

- ◆ wave parameters and behaviours
- ◆ electromagnetic spectrum
- ◆ light

### Nuclear radiation

## **Waves and Radiation**

### **Wave parameters and behaviours**

- ◆ Knowledge that energy can be transferred as waves.
- ◆ Determination of frequency, period, wavelength, amplitude and wave speed for longitudinal and transverse waves.
- ◆ Use of appropriate relationships to solve problems involving wave speed, frequency, period, wavelength, distance and time.
- ◆ Awareness of the practical limitations of demonstrating diffraction.
- ◆ Comparison of long wave and short-wave diffraction.

### **Electromagnetic spectrum**

- ◆ Knowledge of the relative frequency and wavelength of bands of the electromagnetic spectrum with reference to typical sources, detectors and applications.
- ◆ Knowledge of the qualitative relationship between the frequency and energy associated with a form of radiation.
- ◆ Knowledge that all radiations in the electromagnetic spectrum travel at the speed of light.

### **Light**

- ◆ In ray diagrams showing refraction, identification of the normal, angle of incidence and angle of refraction.
- ◆ Description of refraction in terms of change of wave speed, change of wavelength and change of direction (where the angle of incidence is greater than  $0^\circ$ ).

### **Nuclear radiation**

- ◆ Knowledge of the nature of alpha, beta and gamma radiation, the relative effect of their ionisation, and their relative penetration.
- ◆ Use of an appropriate relationship to solve problems involving activity, number of nuclear disintegrations and time.
- ◆ Knowledge of background radiation sources.
- ◆ Use of appropriate relationships to solve problems involving absorbed dose, equivalent dose, energy, mass and radiation weighting factor.
- ◆ Comparison of equivalent dose due to a variety of natural and artificial sources.
- ◆ Awareness of equivalent dose rate and exposure safety limits for the public and for workers in radiation industries in terms of annual effective equivalent dose.
- ◆ Use of an appropriate relationship to carry out calculations involving equivalent dose rate, equivalent dose and time.
- ◆ Awareness of applications of nuclear radiation.
- ◆ Definition of *half-life*.
- ◆ Use of graphical or numerical data to determine the half-life of a radioactive material.
- ◆ Qualitative description of fission and fusion, with emphasis on the importance of these processes in the generation of energy.

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: <ul style="list-style-type: none"> <li>◆ an aim</li> <li>◆ a dependent and independent variable</li> <li>◆ variables to be kept constant</li> <li>◆ measurements/observations to be made</li> <li>◆ the resources</li> <li>◆ the method, including safety considerations if appropriate</li> </ul>
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: <ul style="list-style-type: none"> <li>◆ make predictions</li> <li>◆ select information</li> <li>◆ process information including calculations as appropriate</li> <li>◆ analyse information</li> </ul>
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 H256 75 *Physics: Electricity and Energy* and H258 75 *Dynamics and Space*.

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 H256 75 *Physics: Electricity and Energy* and H258 75 *Dynamics and Space*.

**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

This specification may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged. Additional copies of this Unit can be downloaded from SQA's website at [www.sqa.org.uk](http://www.sqa.org.uk).

Note: readers are advised to check SQA's website: [www.sqa.org.uk](http://www.sqa.org.uk) to ensure they are using the most up-to-date version of the Unit Specification.

© Scottish Qualifications Authority 2018