SCQF level 5
Unit Specification

Physics: Waves and Radiation

SCQF: level 5 (6 SCQF credit points)

Unit code: J2CL 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 wave parameters and behaviours; electromagnetic spectrum; light; 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*.

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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

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

The *Unit Support* Notes (Appendix) provide details of skills, knowledge and understanding sampled in the Unit assessment.

The following table describes the evidence for the Assessment Standards.

Assessment Standard	Evidence Requirements
Planning an experiment or practical investigation	A plan that must include: ♦ a clear statement of the aim ♦ a dependent and independent variable ♦ variables to be kept constant ♦ observations and measurements to be made ♦ necessary equipment and/or materials ♦ a clear and detailed description of how the experiment or practical investigation should be carried out, including safety considerations
Following procedures safely	Record showing that the learner was observed following procedures safely
Making and recording observations/measurements correctly	Raw data recorded in a relevant format, for example a table Repeated measurements, where appropriate Where measurements are repeated, averages must be calculated.
Presenting results in an appropriate format	Results presented in a scatter graph
Drawing a valid conclusion	A conclusion that includes reference to the aim, and is supported by the data
Evaluating experimental procedures	An evaluative statement, with justification, about the procedures used
Making accurate statements and solving problems	Achievement of at least 50% of the total marks available in a holistic assessment The assessment must **not** be split into smaller sections, such as individual key areas.

♦ Exemplification of assessment is provided in the *Unit Assessment Support pack.*

Assessment Standards thresholds

Outcome 1
Learners are not required to show full mastery of the Assessment Standards to achieve Outcome 1. Instead, five out of the six Assessment Standards for Outcome 1 must be met to achieve a pass. Learners must be given the opportunity to meet all Assessment Standards.

Outcome 2
Learners are assessed using a holistic test that covers Assessment Standards 2.1 and 2.2. To gain a pass for Outcome 2, learners must achieve 50% or more of the total marks available in the assessment.

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 SCQF level 5 Units: *Physics: Dynamics and Space* (J2CK 75) and *Physics Electricity and Energy* (J26L 75).

Evidence for the achievement of Outcome 2 for this Unit is **not** transferable between the SCQF level 5 Units: *Physics: Dynamics and Space* (J2CK 75) and *Physics Electricity and Energy* (J26L 75)

Exemplification of assessment is provided in *Unit Assessment Support*.

Re-assessment

SQA's guidance on re-assessment is that there should be only one or, in exceptional circumstances, two re-assessment opportunities. Re-assessment must be carried out under the same conditions as the original assessment and must be of equal demand.

Outcome 1
Learners can either re-draft their original Outcome 1 report or carry out a new experiment and/or practical investigation.

Outcome 2
Learners must have a full re-assessment opportunity that consists of a holistic assessment. For Outcome 2, learners must achieve 50% of the total marks available in the re-assessment.

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.*

Appendix: Unit Support Notes

Introduction

These support notes provide advice and guidance on skills, knowledge and understanding for the Unit Assessment. They should be read in conjunction with:

- the *Unit Assessment Support* pack

Developing skills, knowledge and understanding

Teachers and lecturers are free to select the skills, knowledge and understanding, and contexts that are most appropriate for delivery in their centres.

Skills, knowledge and understanding for the Unit Assessment

The following information provides details of skills, knowledge and understanding sampled in the Unit Assessment:

Waves

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, number of waves, and time.

$$v = \frac{d}{t}$$

$$f = \frac{N}{t}$$

$$v = f\lambda$$

$$T = \frac{1}{f}$$

- 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 in wavelength, and change of direction (where the angle of incidence is greater than 0º).

Nuclear radiation

- Knowledge of the nature of alpha (α), beta (β) and gamma (γ) 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.

$$A = \frac{N}{t}$$

- Knowledge of background radiation sources.

- Use of appropriate relationships to solve problems involving absorbed dose, equivalent dose, energy, mass, and radiation weighting factor.

$$D = \frac{E}{m}$$

$$H = Dw_r$$

- Comparison of equivalent dose due to a variety of natural and artificial sources.
- Knowledge 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 solve problems involving equivalent dose rate, equivalent dose, and time.

$$\dot{H} = \frac{H}{t}$$

- 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

Administrative information

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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
2.1	Assessment standard threshold added.	Qualifications Manager	September 2018
3.0	Unit code updated	Qualifications Manager	July 2019
4.0	Refined guidance on Evidence Requirements; removed option for assessment-standard-specific evidence for Outcome 2. Added 'Assessment Standards thresholds' heading to existing information. Refined guidance on re-assessment. Relationships associated with content statements added. Some changes made to the format throughout the document to improve accessibility. **What you need to do differently** ♦ If you are already assessing outcome 2 holistically at the end of the unit, by using the assessment as a single test with marks and a cut-off score, you don't need to do anything differently.	Qualifications Manager	August 2025

Version	Description of change	Authorised by	Date
4.0 (cont)	♦ If you have been assessing outcome 2 atomistically, by assessing each key area and each problem-solving skill separately, you must change to using the holistic approach for outcome 2. You must do this by administering the test in a single sitting, at the end of the unit, and applying the marks and cut-off score in the unit assessment support pack.	Qualifications Manager	August 2025