SCQF level 5
Unit Specification

Physics: Dynamics and Space

SCQF: level 5 (6 SCQF credit points)

Unit code: H258 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 dynamics and space. Learners will apply these skills when considering the applications of dynamics and space 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 kinematics, forces and space. 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:

Kinematics

- velocity and displacement
- velocity-time graphs
- acceleration

Forces

- Newton's laws
- projectile motion

Space

- space exploration
- cosmology

Dynamics and Space

Velocity and displacement — vectors and scalars

- Definition of vector and scalar quantities.
- Identification of force, speed, velocity, distance, displacement, acceleration, mass, time and energy as vector or scalar quantities.
- Calculation of the resultant of two vector quantities in one dimension or at right angles.
- Determination of displacement and/or distance using scale diagram or calculation.
- Use of appropriate relationships to solve problems involving velocity, displacement and time.

Velocity–time graphs

- Sketch of velocity–time graphs for objects from recorded or experimental data.
- Interpretation of velocity–time graph to describe the motion of an object.
- Determination of displacement from a velocity–time graph.

Acceleration

- Use of an appropriate relationship to solve problems involving acceleration, initial velocity (or speed), final velocity (or speed) and time.
- Determination of acceleration from a velocity–time graph.

Newton's laws

- Application of Newton's laws and balanced forces to explain constant velocity (or speed), making reference to frictional forces.
- Use of an appropriate relationship to solve problems involving unbalanced force, mass and acceleration for situations where more than one force is acting.
- Use of an appropriate relationship to solve problems involving work done, unbalanced force and distance/displacement.
- Use of an appropriate relationship to solve problems involving weight, mass and gravitational field strength, including on different planets.
- Knowledge of Newton's second law including its application to space travel, rocket launch and landing.
- Knowledge of Newton's third law and its application to explain motion resulting from a 'reaction' force.
- Use of Newton's laws to explain free-fall and terminal velocity.

Projectile motion

- Explanation of projectile motion.
- Use of appropriate relationships to solve problems involving projectile motion from a horizontal launch, including the use of motion graphs.
- Explanation of satellite orbits in terms of projectile motion.

Space exploration

- Awareness of evidence supporting current understanding of the universe from telescopes and space exploration.
- Awareness of the benefits of satellites, for example GPS, weather forecasting, communications and space exploration (Hubble telescope, ISS)
- Qualitative awareness of the relationship between the altitude of a satellite and its period.

- Awareness of the potential benefits of space exploration.
- Awareness of the risks associated with manned space exploration, for example fuel load on take-off, potential exposure to radiation, pressure differential and challenges of re-entry to a planet's atmosphere.
- Use of an appropriate relationship to solve problems involving heat energy, mass and specific latent heat.

Cosmology

- Use of the term 'light year' and conversion between light years and metres.
- Description of the observable universe — origin and age of universe.
- Awareness of the use of different parts of the electromagnetic spectrum in obtaining information about astronomical objects.
- Identification of continuous and line spectra.
- Use of spectral data for known elements, to identify the elements present in stars.

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 ♦ 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 H256 75 *Physics: Electricity and Energy* 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 H256 75 *Physics: Electricity and Energy* 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