SCQF level 5
Unit Specification

Physics: Dynamics and Space

SCQF: level 5 (6 SCQF credit points)

Unit code: J2CK 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 velocity and displacement – vectors and scalars; velocity-time graphs; acceleration; Newton's laws; projectile motion; space exploration; cosmology.

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

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:

- velocity and displacement – vectors and scalars
- velocity-time graphs
- acceleration
- Newton's laws
- projectile motion
- space exploration
- cosmology

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: Electricity and Energy* (J26L 75) and *Physics: Waves and Radiation* (J2CL 75).

Evidence for the achievement of Outcome 2 for this Unit is **not** transferable between the SCQF level 5 Units: *Physics: Electricity and Energy* (J26L 75) and *Physics: Waves and Radiation* (J2CL 75).

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:

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.

$$\overline{v} = \frac{s}{t}$$

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

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.

s = area under v-t graph

Acceleration

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

$$a = \frac{v - u}{t}$$

- 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.

$$F = ma$$

- Use of an appropriate relationship to solve problems involving work done, unbalanced force and distance or displacement.

$W = Fd$ or $E_w = Fd$

- Use of an appropriate relationship to solve problems involving weight, mass, and gravitational field strength, including on different planets.

$W = mg$

- 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.

  Area under v_h-t graphs for horizontal range, and area under v_v-t graphs for vertical height.

  $v_h = \frac{s}{t}$ (constant horizontal velocity)

  $v_v = u + at$ (constant vertical acceleration)

- 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 challenges of space travel, including, for example:
  - travelling large distances with the possible solution of attaining high velocity by using ion drive (producing a small unbalanced force over an extended period of time) or using a 'slingshot' from a fast-moving asteroid, moon, or planet
  - manoeuvring a spacecraft in a zero friction environment, possibly to dock with the ISS
  - maintaining sufficient energy to operate life support systems in a spacecraft with the possible solution of using solar cells with area that varies with distance from the Sun
- Awareness of the risks associated with crewed space exploration, for example:
  - fuel load on takeoff
  - potential exposure to radiation
  - pressure differential
  - 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.

$$E_h = ml$$

$$E_p = mgh$$

$$E_k = \frac{1}{2}mv^2$$

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.

Administrative information

Published: August 2025 (version 4.0)

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
2.1	Assessment standard threshold added	Qualifications Manager	September 2018
3.0	Unit code updated	Qualifications Manager	July 2019
4.0	Some changes made to the format throughout the document to improve accessibility. 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