

National Unit Specification: general information

UNIT Mechanics and Properties of Matter (Higher)

NUMBER D383 12

COURSE Physics (Higher)

SUMMARY

The unit seeks to develop the candidate's knowledge and understanding of concepts and principles related to mechanics and properties of matter. It also provides an opportunity for developing the ability to apply these concepts and principles in the analysis of a wide variety of motion, and interpreting of the macroscopic and microscopic behaviour of matter.

OUTCOMES

- 1 Demonstrate knowledge and understanding related to mechanics and properties of matter.
- 2 Solve problems related to mechanics and properties of matter.
- 3 Collect and analyse information related to Higher Physics obtained by experiment.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates will normally be expected to have attained the following.

- Standard Grade Physics with Knowledge and Understanding and Problem Solving at grade 1 or 2
- or**
- Intermediate 2 Physics **or** the unit Mechanics and Heat (Intermediate 2)
- and**
- Standard Grade Mathematics at 1 or 2 **or** Intermediate 2 Mathematics

CREDIT VALUE

1 credit at Higher.

Administrative Information

Superclass: RC

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CORE SKILLS

Core skills for this qualification remain subject to confirmation and details will be available at a later date.

Additional information about core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001).

National Unit Specification: statement of standards

UNIT Mechanics and Properties of Matter (Higher)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

OUTCOME 1

Demonstrate knowledge and understanding related to mechanics and properties of matter.

Performance criteria

- (a) Quantities and their units are used correctly in relation to mechanics and properties of matter.
- (b) Relationships and mathematical techniques are used correctly in relation to mechanics and properties of matter.
- (c) Principles are used correctly in relation to mechanics and properties of matter.
- (d) Models are described correctly in relation to mechanics and properties of matter.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed book test with items covering all the above performance criteria. The test must sample the Content Statements (see Physics (Higher) Course Content) in each of the following areas:

- Vectors
- Equations of motion
- Newton's Second Law, energy and power
- Momentum and impulse
- Density and pressure
- Gas laws.

OUTCOME 2

Solve problems related to mechanics and properties of matter.

Performance criteria

- (a) Relevant information is selected and presented appropriately.
- (b) Information is accurately processed using calculations, where appropriate.
- (c) Conclusions drawn are valid and explanations given are supported by evidence.
- (d) Experimental procedures are planned, designed and evaluated appropriately.

Evidence requirements

Evidence of an appropriate level of achievement must be generated from a closed book test with items covering all the above performance criteria. The test must sample the areas shown below.

- Vectors
- Equations of motion
- Newton's Second Law, energy and power
- Momentum and impulse
- Density and pressure
- Gas laws.

National Unit Specification: statement of standards (cont)

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OUTCOME 3

Collect and analyse information related to Higher Physics obtained by experiment.

Performance criteria

- (a) The information is collected by active participation in the experiment.
- (b) The experimental procedures are described accurately.
- (c) Relevant measurements and observations are recorded in an appropriate format.
- (d) Recorded information is analysed and presented in an appropriate format.
- (e) Uncertainties are treated appropriately.
- (f) Conclusions drawn are valid.
- (g) The experimental procedures are evaluated with supporting argument.

Evidence requirements

A report of one experimental activity related to Higher Physics covering the above performance criteria is required. Evidence submitted in support of PC (d) must be in the format of a table or graph as appropriate. The teacher/lecturer responsible must attest that the report is the individual work of the candidate derived from active participation in an experiment involving the candidate in planning the experiment; deciding how it is managed; identifying and obtaining the necessary resources, some of which must be unfamiliar; carrying out the experiment. The report must provide evidence in respect of a sample of the Content Statements for uncertainties (see Physics (Higher), Course Content). Depending on the activity, the collection of the information may be through group work.

An Outcome 3 report of practical work in this unit may be used as evidence of the achievement of Outcome 3 of the Higher Physics units D380 12 Electricity and Electronics and D384 12 Radiation and Matter. An Outcome 3 report of practical work in the Higher Physics unit D380 12 Electricity and Electronics or D384 12 Radiation and Matter may be used as evidence of the achievement of Outcome 3 of this unit.

National Unit Specification: support notes

UNIT Mechanics and Properties of Matter

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

The content and suggested contexts, applications, illustrations and activities for this unit are detailed in the National Course Specification: course details. The subheadings in the tables correspond to the areas mentioned in the evidence requirements for Outcome 1 and Outcome 2. The practical activities chosen for Outcome 3 must relate to the content of Higher Physics and must allow opportunity for all the performance criteria for this outcome to be demonstrated within any single report.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

The learning and teaching of this unit are most effective when the concepts, principles and theories are set in relevant context, eg by making reference to applications of physics and to real-world situations. Suitable approaches to learning and teaching are detailed in the National Course Specification.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Outcomes 1 and 2

It is recommended that a holistic approach is taken for assessment of Outcomes 1 and 2. These outcomes can be assessed by an end of unit test with questions covering all of the associated performance criteria. Within one question, assessment of knowledge and understanding and problem solving can occur. Each question can assess achievement of a number of performance criteria from either Outcome 1 or 2. Assessment items are available from the National Assessment Bank.

Outcome 3

The teacher/lecturer should ensure that the experimental activity to be undertaken in connection with Outcome 3 affords opportunity for the candidate to demonstrate the ability to undertake the planning and organising of an experimental activity at an appropriate level of demand. The activity must relate to the content of Higher Physics and candidates should be made aware of the range of skills which must be demonstrated to ensure attainment of Outcome 3.

In relation to PC (a), the teacher/lecturer should check by observation that the candidate participates in the collection of the experimental information by playing an active part in planning the experiment, deciding how it will be managed, identifying and obtaining resources (some of which must be unfamiliar to the candidate), and carrying out the experiment.

In relation to PCs (b) to (g) the following provides an indication of what may be included in a candidate's report.

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PC (b)

Many experiments will follow a given procedure or method hence there is no need for a detailed description. The procedure may be described briefly in outline. The impersonal passive voice should be encouraged. The following should be included, as appropriate:

- aim of the experiment
- a labelled diagram, description of apparatus, instruments used
- how the independent variable was altered
- how measurements were taken or observations made.

PC (c)

Readings or observations should be recorded in a clear table. The table must include:

- correct headings
- appropriate units
- correctly entered readings/observations.

PC (d)

Readings should be analysed/presented using the following, as appropriate:

- a table with suitable headings and units
- a table with ascending or descending independent variable
- a table showing appropriate computations
- a graph with independent and dependent variables plotted
- a graph with suitable scales and axes labelled with quantities and units
- a graph with data correctly plotted with a line or a curve of best fit.

PC (e)

Depending on the activity the following may be included:

- uncertainties in individual readings
- a mean value and an approximate random uncertainty in the mean
- uncertainties expressed in absolute or percentage form.

PC (f)

Conclusions should contain, as appropriate, a statement relating to:

- overall pattern to readings or observations
- trends in analysed information or results
- connection between variables
- measurement of a physical quantity.

PC (g)

The experimental procedures should be evaluated with supporting argument by including a few brief sentences, as appropriate, commenting on:

- effectiveness of procedures
- control of variables
- limitations of equipment
- possible improvements
- possible sources of error.

National Unit Specification: support notes (cont)

UNIT Mechanics and Properties of Matter (Higher)

The references under each performance criterion give an indication of what should be provided as evidence in order to achieve the criterion. The relevance of these will vary according to the experiment. These references are intended to assist the teacher/lecturer in making a judgement of the candidate's achievement against the performance criteria. It is appropriate to give limited support to candidates in producing their reports. Re-drafting of reports after necessary supportive criticism is to be encouraged both as part of the learning and teaching process and to produce evidence for assessment.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (SQA, 2004).