-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

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NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- **3171052** **-Session- 1992-93**
-Superclass- **RC**

-Title- **CIRCULAR MOTION ($X^1/_2$)**

-DESCRIPTION-

Purpose

This module is designed to extend the skills and knowledge required in the field of circular motion. It is suitable for candidates in a wide range of occupational areas, and in conjunction with Stage 2 and other Stage 3 Physics modules, could be a preparation for Higher Education.

Preferred Entry Level

3171111 Mechanics (x 1/2) or
Higher Grade Physics and
Higher Grade Mathematics or equivalent.

Outcomes

The candidate should:

1. apply and interpret the concepts of mechanics to explain circular motion;

2. perform, predict and report on experiments relating to circular motion.

Assessment Procedures

Acceptable performance in this module will be satisfactory achievement of all the Performance Criteria specified for each Outcome.

The following abbreviations are used below:

PC Performance Criteria
IA Instrument of Assessment

Note: The Outcomes and PCs are mandatory and cannot be altered. The IA may be altered by arrangement with SQA. (Where a range of performance is indicated, this should be regarded as an extension of the PCs and is therefore mandatory.)

OUTCOME 1 **APPLY AND INTERPRET THE CONCEPTS OF MECHANICS TO EXPLAIN CIRCULAR MOTION**

PCs

(a) The use of the given terms in explanations is correct.
(b) The application of the concepts of circular motion to describe or predict a situation is correct.
(c) The application of the concepts of circular motion to situations involving calculations or equations is correct with respect to the use of units, and obtaining a solution to the appropriate level of significance.
(d) The explanation of angular momentum and its conservation is consistent with the concepts involved.

IA Structured Questions and an Assignment.

3 structured questions under closed book conditions and 1 assignment to assess the candidate's ability to apply and interpret the concepts of circular motion.

The 3 structured questions should be allocated to Performance Criteria (a), (b) and (c) and the assignment should be allocated to Performance Criterion (d).

There should be 1 structured question on each of the following topics:

(i) equations of circular motion;
(ii) central force;
(iii) angular acceleration, inertia, torque, rotational kinetic energy.

(i) (a) terms: angular velocity, angular displacement, angular acceleration.

(c) calculations: test 2 out of 3:

$$\omega = \omega_0 + \alpha t$$

$$\theta = \omega t = 1/2 \, \alpha t^2$$

$$\omega^2 = \omega_0^2 + 2 \alpha \theta$$

(ii) (a) terms: radial acceleration, central force

(c) calculations: test 2 out of 3:

$$v = \omega r$$

$$a = \omega^2 r$$

$$F = m\omega^2 r$$

(iii) (b) concepts: moment of inertia, rotational kinetic energy.
(c) calculations: torque = $1 \propto$ calculations of torque including

at least 2 of the following objects:

disc;
loop;
sphere;
rod.

The assignment for Performance Criterion (d) must cover angular momentum and its conservation from micro to macro situations.

The candidate should produce a report of between 200 and 400 words.

Satisfactory achievement of the Outcome will be demonstrated by the candidate achieving all the Performance Criteria within the 3 questions and the assignment.

OUTCOME 2 PERFORM, PREDICT AND REPORT ON EXPERIMENTS RELATING TO CIRCULAR MOTION

PCs

(a) The setting up of the equipment is in accordance with the given specification.
(b) The experimental procedures carried out are correct and safe.
(c) The recording of the procedures, relevant observations and measurements is complete and accurate with numerical uncertainties where appropriate.
(d) The presented data is in an appropriate format.
(e) The identification of valid experimental errors in absolute and percentage terms is correct.
(f) The calculation and presentation of the overall uncertainty is correct and in the appropriate format.
(g) The conclusion(s) and prediction(s) drawn are valid within the limits of experimental uncertainty.

IA Assignment

An assignment to assess the candidate's ability to perform, predict and report on experiments relating to circular motion.

The candidate will be required to carry out a specified experiment and prepare a scientific report to cover Performance Criteria (c) to (g). The report must be structured and include the following sections: aims, procedures, readings and results, uncertainties and conclusions.

A checklist should be devised to ensure a reliable interpretation of the candidate's practical performance in relation to Performance Criteria (a) and (b).

Satisfactory achievement of the Outcome will be demonstrated by the candidate achieving all the Performance Criteria.

The following sections of the descriptor are offered as guidance.
They are not mandatory.

CONTENT/CONTEXT

Corresponding to Outcomes 1-2:

1. (a) Correct use of the following terms: radians, angular velocity, angular displacement, angular acceleration central force, torque, rotational kinetic energy.

(b) Application of: moment of inertia, conservation of angular momentum, rotational kinetic energy.
moment of inertia of: disc
hoop
sphere
rod
no derivation of I required.

(c) Calculations involving:

$\omega = \omega_0 + \propto t$

$\theta = \omega t + 1/2 \propto t^2$

$\omega^2 = \omega_0^2 + 2 \propto \theta$

$v = \omega r \quad torque = I \propto$

$a = \omega^2 r$

$F = m\omega^2 r$

(d) Situations involving conservation of angular momentum e.g. electron orbits, skaters, mechanical governors, planetary motion.

2. Experiments could include: moment of inertia of a flywheel, $F = m\omega^2 r$.

SUGGESTED LEARNING AND TEACHING APPROACHES

A candidate-centred, resource-based learning approach is recommended. Concepts should be developed and reinforced by practical work integrated throughout the module. Teaching strategies designed to encourage independent study should be employed.

A range of experimental work should be included within the module to allow a selection of an assignment to be presented for summative assessment purposes. The candidate should be encouraged to document all observations and results of experiments in a folio of work.

During the work of the module candidates should have several opportunities to develop their practical and problem-solving skills. Each candidate should be assessed at appropriate points throughout the module. Where the candidate is unsuccessful in achieving an Outcome, provision should be made for remediation and reassessment.

Safety should be given due consideration at all times.