June 2016

BIM
a GRICS product

Information Document

Physics

PHY-500.A11

Theory Examination – Secondary 5

Creation Team: Riverside School Board

Validation Team: Sir Wilfrid Laurier School Board

Portal Validation: English Montreal School Board

Structure

This theory examination evaluates mastery and use of subject-specific knowledge as well as Competencies 2 and 3 of the *Physics* program. It consists of 25 questions in two sections and is worth a total of 100 marks.

The following table provides a distribution of the questions in each content area of the program, a breakdown of the types of questions and the percentage value for the exam.

Content Area	Kinematics	Dynamics	Transformation of Energy	Geometric Optics
Weighting	24 %	28 %	16 %	32 %
Part A Multiple-Choice 40 %	2 questions	3 questions	2 questions	3 questions
Part B Constructed-Response 60 %	4 questions	4 questions	2 questions	5 questions

NOTE: *Each question is worth four marks.*
Significant figures will be evaluated in one question only.

Competencies and Criteria Evaluated

Competencies:

- *Makes the most of his/her knowledge of physics.*
- *Communicates ideas relating to questions involving Physics, using the languages associated with science and technology.*

Criteria:

- *Mastery of subject-specific knowledge targeted in the Progression of Learning:*

  Kinematics, Dynamics, Transformation of Energy, Geometric Optics and Measurement Techniques
- *Relevant use of scientific and technological knowledge*
- *Appropriate formulation of explanations or solutions*

Time Allotted

3 hours (*An additional 15 minutes may be allotted if needed.*)

Provided Documents

Administration and Marking Guide
Question Booklet
Student Booklet

Authorized Materials

The following materials are permitted during the examination:
- Calculators with or without graphic displays*
- Writing instruments
- Rulers

* Calculators with or without graphic displays designed mainly to perform mathematical calculations are authorized during official exams. **Before the exam starts**, data and programs stored in calculators' memories must be deleted. Calculators equipped with formal calculation software are not authorized for the exams. These models are allowed **under the sole condition** that the formal calculation functions are deactivated during the exam. Computers, tablet computers, electronic organizers and calculators with alphanumeric keyboards (QWERTY or AZERTY) are not authorized. All calculator peripherals, such as instruction manuals and memory expansion devices, are forbidden. It is strictly forbidden to use memory expansion cards or chips, as well as data or program libraries. Communication between calculators is not allowed during the exam. Using a calculator containing stored data or programs will be considered as cheating. Students cannot share calculators.

[Adapted from *MELS Information Document, Science and Technology, Applied Science and Technology, June/August 2012/January 2013*, and provided as a recommendation.]

NOTE: *Students may refer to the lists of Formulas and Quantities and Physical Constants included in the Student Booklet (Appendix 2 in this document).*

Appendix 1

Evaluation Tools[1]

In order to determine what is expected of the students and to ensure a uniform understanding of the evaluation tools, it is suggested that teachers in each school form a marking committee to analyze the work of a sample of students.

Guidelines for correcting questions requiring an explanation, a justification or a representation:

Analyze the student's work and determine if it is appropriate.

- An explanation, a justification or a representation is **appropriate** if most of the elements of the answer are correct and if appropriate terminology or symbolism is used.
- An explanation, a justification or a representation is **partially appropriate** if:
  - Most of the elements of the answer are correctly indicated, **but** the terminology or symbolism used is not appropriate.
  - Some elements of the answer are indicated, **and** some of the terminology or symbolism used is appropriate.
- An explanation, a justification or a representation is **inappropriate** if most of the elements of the answer are incorrect or missing, or if the terminology or symbolism used is inappropriate.

Guidelines for correcting questions requiring the use of formal mathematical solutions:

Step 1

Analyze the work to understand the procedure used by the student, and then decide if the procedure is appropriate or not.

A procedure is **appropriate** if most of the steps are relevant and could lead to the correct answer.

A procedure is **partially appropriate** if the steps presented do not lead to the correct answer, but include at least one step that is relevant and correct.

A procedure is **inappropriate** if none of the steps presented are relevant or if the student has not shown any work.

Step 2

If the procedure is deemed **appropriate** or **partially appropriate,** then evaluate the answer. If the answer is incorrect, identify the type of error(s) made.

An **error** is considered **minor** if it is an error in calculation or transcription, or if the unit of measurement is incorrect or missing.

An **error** is considered **major** if a law, rule or formula has been applied incorrectly.

No marks are allotted for a correct answer when the procedure used is **inappropriate**, or no work is shown.

1. Adapted from: *MELS, 555-410, Science and Technology, Marking Guide, June 2012,* and provided as a recommendation.

Appendix 2

Formulas and Quantities

EQUATIONS

OPTICS

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$M = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$n = \frac{c}{v}$$

MECHANICS

$$v_{av} = \frac{\Delta d}{\Delta t}$$

$$a = \frac{\Delta v}{\Delta t}$$

$$\Delta d = \left(\frac{v_1 + v_2}{2}\right)\Delta t$$

$$\Delta d = v_1 \Delta t + \tfrac{1}{2} a \Delta t^2$$

$$v_2 = v_1 + a\Delta t$$

$$v_2^{\,2} = v_1^{\,2} + 2\,a\Delta d$$

$$P = \frac{W}{\Delta t}$$

$$W = F\Delta d$$

$$E_g = mgh$$

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

$$E_e = \tfrac{1}{2} k(\Delta x)^2$$

$$F = ma$$

$$F_g = mg$$

$$F_c = \frac{mv^2}{r}$$

MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

PHYSICAL CONSTANTS

SYMBOL	QUANTITY	VALUE
c	Speed of light in a vacuum	3.00×10^8 m/s
n_{air}	Index of refraction of air	1.00
g	Acceleration due to gravity (Earth)	9.8 m/s^2
g	Gravitational field strength (Earth)	9.8 N/kg