Regents Examination In Physical Setting/Physics Rating Guide

For Parts B-2 and C

2002 Edition

The University of the State of New York
THE STATE EDUCATION DEPARTMENT
Albany, New York, 12234

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To: Regents Physical Setting/Physics Teachers

From: Gerald DeMauro, Coordinator of State Assessment

The attached rating guide is intended to provide assistance to teachers in rating the answers to Parts B-2 and C of the Regents Examination in Physical Setting/Physics. It is designed for use as a supplement to the official scoring key and rating guide provided with the examination. It should be saved and referred to for future rating sessions. Rating instructions included in the scoring key and rating guide or in the examination booklet take precedence over the suggestions made in this guide.

An informational copy of the rating guide is also being sent to district superintendents and superintendents and principals of public and nonpublic schools.

Any questions concerning the information provided in the rating guide should be directed to the Office of Curriculum and Instruction (518) 474-5922 or the Office of State Assessment (518) 474-5900.

INTRODUCTION

This guide provides a set of directions, along with some examples, to assist teachers in rating the answers to Parts B-2 and C of the Regents Examination in Physical Setting/Physics. While it is not possible to anticipate all the possible questions that may arise, the suggestions and examples in this guide deal with those that tend to occur most frequently.

In all work in Physical Setting/Physics, the aim should be accuracy—not only in the mechanical aspects but also in the aspects that require concept understanding, reasoning, judgment, and application. In every instance where an error occurs, allowing proper credit requires that careful consideration be given to the relative importance of these aspects in the question.

The principal of each school administering the examination is responsible for establishing rating procedures that will assure reasonable confidence in the accuracy of the scores assigned to the Part B-2 and C answers by individual teachers. The criterion in all cases is that the rating assigned to a student's answers is a fair and accurate rating of those answers.

The scoring key and rating guide provided by the Department is the official key and teachers must rate according to this key. Credit may be allowed for other answers only if they are equivalent to the key answer. Any special ruling or rating that is indicated on the Regents examination or scoring key and rating guide takes precedence over any suggestion made in this guide and is not considered to be conflicting. If you have questions about this publication, call or write the Office of Curriculum and Instruction (518) 474-5922, or the Office of State Assessment (518) 474-5900, New York State Education Department, Albany, New York 12234.

The material in this rating guide is divided into two sections: general suggestions for rating and specific rating criteria—calculations, graphs, and teacher discretion. The specific rating criteria section presents examples of rating problems and acceptable solutions to these problems.

GENERAL SUGGESTIONS FOR RATING

1. Follow all instructions in the *Information Booklet for Administering and Scoring Regents Examinations in the Sciences*, available on the State Education Department website at http://www.emsc.nysed.gov/ciai/testing/scire/infobooksci.pdf, and on the scoring key and rating guide, printed on yellow paper, that is provided with the examination. Teacher discretion is allowed in those situations not covered by the official scoring key and rating guide. However, do not allow any credit for incorrect physics.
2. Use only red pencil or red ink for rating the students' answers to questions in Parts B-2 and C.
3. Do not correct a student's work by making insertions or changes of any kind.
4. Do not make any marks on a Regents answer paper for Parts B-2 and C other than to indicate the number of credits given the student's answers and to place checkmarks next to student errors.
5. In scoring Parts B-2 and C, enter the total cumulative score for that part in red in the margin to the right of each question. Enter the total Part B-2 and Part C score in the proper spaces on the first page of the answer paper.
6. First work through the questions in Parts B-2 and C and construct your own answer key. Compare this answer key with the official scoring key and rating guide. This process will give you a valuable "feel" for the questions and indicate potential trouble spots before the rating begins.
7. Accept any equivalent form to the correct answer, unless a specific form is indicated in the question.
8. Allow credit in whole numbers only on Parts B-2 and C; that is, do not allow fractional credits.
9. Be especially careful when rating answers to latter parts of a question that are based on former parts. A seemingly incorrect response may receive credit if it is based on a mistake the student made previously. The rationale is that students should not be penalized more than once for the same mistake in the same question.
10. In their answers to questions in Parts B-2 and C, students should show all work where indicated.
11. Do not allow or deduct more credit than is allowed for each part of a question.

SPECIFIC RATING CRITERIA

The examples presented and discussed in the following section of this guide contain references to these general suggestions for rating, where appropriate.

Calculations:

To receive credit for performing a calculation, the student must provide the equation, the substitution with units into the equation, and the final answer with units.

Generally, a calculation is worth a maximum of 2 credits. Allow the first credit if the student shows the equation and substitution with units into the equation. Allow the second credit if the correct answer is recorded with appropriate units.

When rating calculations, review all the student's work to be certain that the physics concepts are applied correctly. At times, a student may make two or more errors that cancel each other out, resulting in a correct answer based on erroneous physics.

Allow 1 credit if a student records the equation, substitutes with numbers only, and records the correct answer without units. Penalize a student only once per question for leaving out units. However, allow no credit if another error was made, such as recording an incorrect equation (or no equation) or making a calculation error.

Examples:

Calculations allowed two credits

- $p = mv$
  p = (5.0 kg)(3.0 m/s)
  p = 15 kg • m/s

- p = mv m = 5.0 kg, v = 3.0 m/s
  p = (5)(3)
  p = 15 kg • m/s

Calculations allowed one credit

- $p = mv$
  p = (5.0)(3.0)
  p = 15 kg • m/s
  (+1: all work correct no units in substitution)

- p = 15 kg • m/s
  (+1: no equation or substitution)

- $p = mv$
  p = 15 kg • m/s
  (+1: no substitution)

- $p = mv$
  p = (5.0)(3.0)
  p = 15
  (+1: all work correct, no units in substitution or in final answer)

- $p = mv$
  p = (5.0 kg)(3.0m/s)
  p = 15
  (+1: no units in answer)

Calculations allowed no credit

- $p = mv$
  $p = (5.0)(3.0)$
  $p = 8$ kg • m/s
  (+0: calculations incorrect, no units in substitution)
- $p = 15$
  (+0: no equation, no units in substitution or answer, no substitution)

Allow partial credit if a student copies the equation incorrectly, but then follows the calculation through to a correct answer based on the incorrect equation. Allow partial credit if a student substitutes incorrectly into the correct equation and follows the calculation through to an appropriate answer based on an incorrect substitution.

Examples:
Calculations allowed one credit, based on the correct calculations shown above, where $p = mv = 15$ kg • m/s

- $p = 2mv$
  $p = 2(5\text{ kg})(3\text{m/s})$
  $p = 30$ kg • m/s
  (+1: incorrect equation)
- $p = mv$
  $p = (5\text{kg})(2\text{m/s})$
  $p = 10$ kg • m/s
  (+1: incorrect substitution)

Allow no credit if a student uses an inappropriate equation to solve the problem. For example, a student who attempts to use the equation $F\Delta t = m\Delta v$ to solve the problem above would receive no credit, even if the calculations are correct.

Do not penalize students for not using significant figures, unless the question refers to the precise reading of an instrument.

Often calculations may be performed using equations and/or solution strategies other than those provided in the scoring key and rating guide. In such cases, allow full credit if the physics and the solution are correct. Also, since texts use various symbols for physical quantities, students may write equations with different letters than those on the *Reference Tables for Physical Setting/Physics.*

The SI (International System) units are used in the Physical Setting/Physics Core Curriculum and in the Regents examinations. However, students are expected to have an understanding of metric units. Where more appropriate, cgs units will be used. Although students are generally expected to record answers in the correct SI unit, also allow credit for the use of correct non-SI units.

Examples:
Hertz (Hz) is the accepted SI unit for frequency, but cycles per second (cps) is equivalent and acceptable.

$f = 10$ Hz; allow full credit; units are SI
$f = 10$ cps; allow full credit; units are equivalent to Hz

Often when large distances are expressed, the use of kilometers is conceptually more appropriate than the use of meters. Similarly, expressing a small mass as 2 grams may have more meaning for the student than 0.002 kilogram.

Example:
d = 50 km; allow full credit for 50 km, even though 50,000 m expresses the answer in the correct SI unit.

Graphs

To receive full credit for constructing a graph, the student must be able to:

1. label both axes with appropriate variables and units
2. mark linear scales with appropriate scale divisions
3. plot all points accurately
4. draw a best-fit line
5. calculate the slope of the best fit line at a point

Requirements vary according to the graphing questions. A partially completed graph may be provided for the student to finish according to directions given in the question(s).

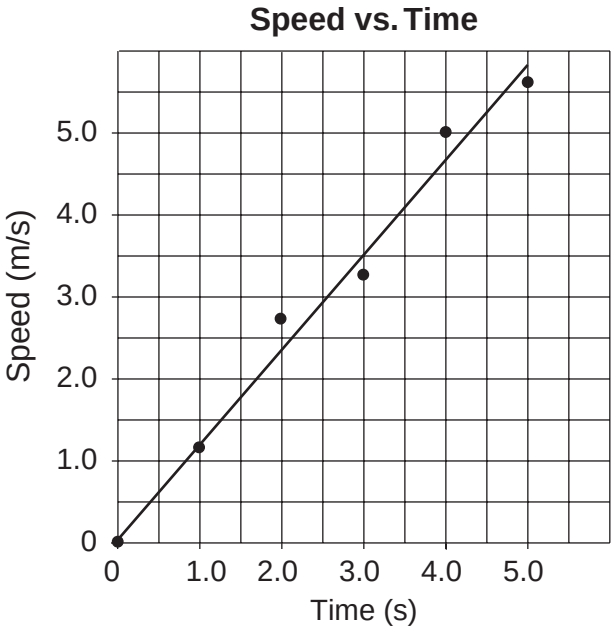
1. Axes: By convention, the dependent variable should be placed on the y-axis. However, do not penalize students for not following this convention on graphs constructed for the Regents Examination in Physical Setting/Physics, unless they are specifically instructed to do so. A graph constructed without following this convention is not wrong; at times the data being analyzed are better presented by placing the dependent variable on the x-axis.

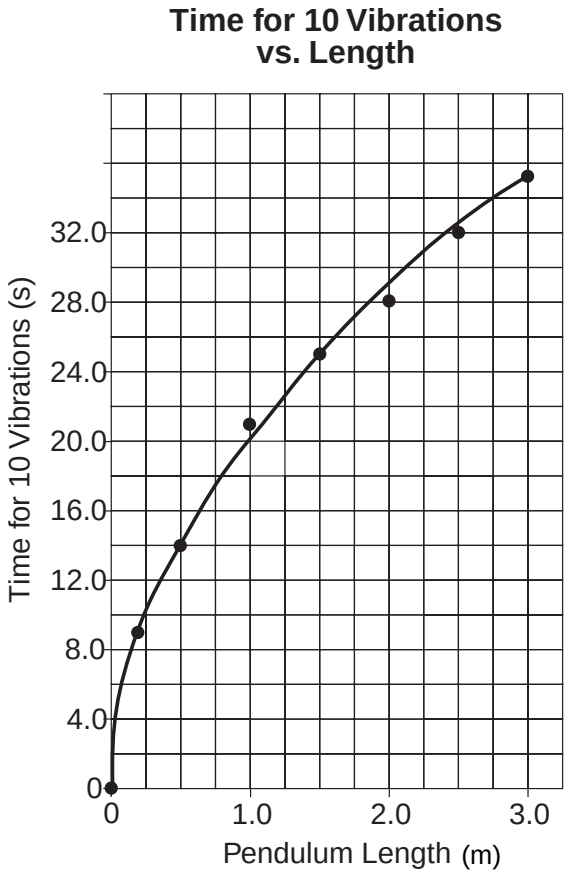
2. Scales: When a question requires students to develop the scale for one or both axis, they are expected to select appropriate scale divisions. The term “appropriate” means that **most** (not necessarily all) of the grid provided is used and that scale divisions allow for relatively simple estimation between lines.

3. Points: All data points should be plotted within +/- 0.3 grid space of their true positions. Single points are clearest, but points emphasized with circles or crosses are acceptable. Points or empty circles drawn larger than 0.3 grid space in diameter should be not be accepted.

4. Best-fit line: When the best-fit line is a straight line, students must draw it with a straight-edge. When the best-fit line is a curve, students should draw it as accurately as possible, and the teacher must understand that they will be doing so freehand. A best-fit line should be continuous and have the data points distributed evenly around it if they do not fall exactly upon it. It may or may not pass through the origin, depending on the distribution of points, and it need not pass through the first and last data points on the graph. Students should **not** merely connect the dots, whether with straight or curved line segments.

Examples of appropriate best fit line and curve:





5. Slope of a graph: To find the slope of a straight line graph, the student must pick two points on the best-fit line and use the slope formula $m = \Delta y/\Delta x$ to determine the value, with units, of the slope. Values taken from the data table may be used *only if* the student's best-fit line passes through those data points. Credit for the slope calculation should be allowed according to the *Scoring Criteria for Calculations* that appear in the scoring key.

   To find the slope of a curve at a particular point, the student should draw the tangent to the curve at that point and determine the slope of the tangent line as described above for a straight line. The use of analysis (e.g., derivative of a function) may not be used to determine a slope unless the graph was derived from a specific function or is shown by the student to be derived from that function. Generally, graphs drawn from experimental data should not be assumed to represent any particular mathematical function.

Generally, a graph should have a title. Students may be required to provide a title for a graph constructed for the Regents examination in Physical Setting/Physics. However, if no title is required in the question, credit should not be deducted if it is missing.

TEACHER DISCRETION

Teacher discretion is permitted, provided students are not allowed credit for incorrect physics.

It is *not* possible to anticipate all possible rating questions and each teacher's individual rating practices. As a result, you may encounter student solutions to questions not discussed in the scoring key and rating guide. When this situation occurs, you have the discretion to determine what credit should be allowed, but only if credit is not allowed for errors in physics.