

FOR TEACHERS ONLY

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING/PHYSICS

Thursday, June 23, 2022 — 9:15 a.m. to 12:15 p.m., only

RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 2 before rating student papers.

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site at: <http://www.nysed.gov/state-assessment/high-school-regents-examinations> and select the link "Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents Examination period.

Directions to the Teacher

Follow the procedures below for scoring student answer papers for the Regents Examination in Physical Setting/Physics. Additional information about scoring is provided in the publication *Information Booklet for Scoring Regents Examinations in the Sciences*, which may be found on the Department web site at <http://www.nysed.gov/common/nysed/files/programs/state-assessment/info-booklet-sciences-2022.pdf>.

Allow 1 credit for a correct response to each item.

At least two science teachers must participate in the scoring of each student's responses to the Part B–2 and Part C open-ended questions on a student's paper. Each of these teachers should be responsible for scoring a selected number of the open-ended questions on each answer paper. No one teacher is to score more than approximately one-half of the open-ended questions on a student's answer paper. Teachers may not score their own students' answer papers.

Students' responses must be scored strictly according to the Scoring Key and Rating Guide. For open-ended questions, credit may be allowed for responses other than those given in the rating guide if the response is a scientifically accurate answer to the question and demonstrates adequate knowledge, as indicated by the examples in the rating guide. Do not attempt to correct the student's work by making insertions or changes of any kind. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

Fractional credit is *not* allowed. Only whole-number credit may be given for a response. If the student gives more than one answer to a question, only the first answer should be rated. Units need not be given when the wording of the question allows such omissions.

For hand scoring, raters should enter the scores earned in the appropriate boxes printed on the separate answer sheet. Next, the rater should add these scores and enter the total in the box labeled "Total Raw Score." Then the student's raw score on the written test should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: <http://www.nysed.gov/state-assessment/high-school-regents-examinations> on Thursday, June 23, 2022. The student's scale score should be entered in the box labeled "Scale Score" on the student's answer booklet. The scale score is the student's final examination score.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that for each administration, the conversion chart provided for that administration be used to determine the student's final score.

Teachers should become familiar with the Department publication *Regents Examination in Physical Setting/Physics: Rating Guide for Parts B–2 and C*. This publication can be found on the New York State Education Department’s web site <http://www.nysed.gov/common/nysed/files/programs/state-assessment/physics-rating-guide.pdf>. This guide provides a set of directions, along with some examples, to assist teachers in rating parts B–2 and C of the Regents Examination in Physical Setting/Physics.

Scoring Criteria for Calculations

For each question requiring the student to *show all calculations, including the equation and substitution with units*, apply the following scoring criteria:

- Allow 1 credit for the equation and substitution of values with units. If the equation and/or substitution with units is not shown, do *not* allow this credit. Allow credit if the student has listed the values with units and written a correct equation.
 - Allow 1 credit for the correct answer (number and unit). If the number is given without the unit, allow credit if the credit for units was previously deducted for this calculation problem.
 - Penalize a student only once per calculation problem for incorrect or omitted units.
 - Allow credit if the answer is not expressed with the correct number of significant figures.
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Part B–2

- 51 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

$$V = \frac{W}{q}$$

$$W = Vq$$

$$W = (3.70 \text{ V})(3.69 \times 10^3 \text{ C})$$

- 52 [1] Allow 1 credit for a correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 51.

Example of a 1-credit response:

$$W = 1.37 \times 10^4 \text{ J}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 51 and 52.

- 53 [1] Allow 1 credit for 540 N *or* 550 N.

- 54 [1] Allow 1 credit for the equation and substitution with the units *or* for an answer, with units, that is consistent with the student's response to question 53. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

$$F_f = \mu F_N$$

$$\mu = \frac{F_f}{F_N}$$

$$\mu = \frac{11\text{N}}{540\text{N}}$$

- 55 [1] Allow 1 credit for a correct answer, without units, *or* for an answer, without units, that is consistent with the student's response to question 54.

Example of a 1-credit response:

$$\mu = 0.020$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 54 and 55.

56 [1] Allow 1 credit for 0.50 m *or* 0.5 m.

57 [1] Allow 1 credit for 1.5 m.

58 [1] Allow 1 credit for 1.6×10^3 J *or* 1600 J.

59 [1] Allow 1 credit for 1.0×10^3 J *or* 1000 J.

60 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- The work is converted into forms of energy other than gravitational potential energy (e.g. thermal or kinetic energy).
- Friction causes internal energy to increase, so not all the work done becomes gravitational potential energy.
- friction

Note: Allow credit for an answer consistent with the student's responses to questions 58 and 59.

- 61 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} \quad R = \frac{V}{I} \quad R_{eq} = \frac{(R_1)(R_2)}{R_1 + R_2}$$

or

$$\frac{1}{R_{eq}} = \frac{1}{110. \Omega} + \frac{1}{220. \Omega} \quad R = \frac{6.00 \text{ V}}{0.0818 \text{ A}} \quad R_{eq} = \frac{(110. \Omega)(220. \Omega)}{110. \Omega + 220. \Omega}$$

- 62 [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 61.

Example of a 1-credit response:

$$R_{eq} = 73.3 \Omega$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 61 and 62.

- 63 [1] Allow 1 credit for the equation and substitution with units *or* for an answer, with units, that is consistent with the student's response to question 62. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

$$R = \frac{V}{I} \quad I = I_1 + I_2$$

$$I = \frac{V}{R_{eq}} \quad I = 5.45 \times 10^{-2} \text{ A} + 2.73 \times 10^{-2} \text{ A}$$

$$I = \frac{6.00 \text{ V}}{73.3 \Omega}$$

- 64 [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 63.

Examples of 1-credit responses:

$$I = 8.19 \times 10^{-2} \text{ A} \quad \text{or} \quad 8.18 \times 10^{-2} \text{ A}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 63 and 64.

- 65 [1] Allow 1 credit for indicating that the power dissipated by the 110.- Ω resistor is greater than the power dissipated by the 220.- Ω resistor *or* for an answer that is consistent with the student's responses to questions 62 and 64.

Part C

- 66 [1] Allow 1 credit for the equation and substitutions with units. Refer to *Scoring Criteria for Calculations* in the rating guide.

Examples of 1-credit responses:

$$d = v_i t + \frac{1}{2} a t^2$$

$$\bar{v} = \frac{d}{t} \quad \text{or} \quad v_i = \frac{d - \frac{1}{2} a t^2}{t}$$

$$\bar{v} = \frac{2.0 \text{ m}}{0.80 \text{ s}} \quad v_i = \frac{2.0 \text{ m} - \frac{1}{2} (0 \text{ m/s}^2)(0.80 \text{ s})^2}{0.80 \text{ s}}$$

- 67 [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 66.

Example of a 1-credit response:

$$v = 2.5 \text{ m/s}$$

Note: Do *not* penalize a student more than 1 credit for errors in units in questions 66 and 67.

- 68 [1] Allow 1 credit for the equation and substitutions with units. Refer to *Scoring Criteria for Calculations* in the rating guide.

Examples of 1-credit responses:

$$d = v_i t + \frac{1}{2} a t^2$$

$$v_i = \frac{d - \frac{1}{2} a t^2}{t} \quad \text{or} \quad \begin{aligned} v_f &= v_i + at \\ v_i &= v_f - at \\ v_i &= 0 - (-9.81 \text{ m/s}^2)(0.40 \text{ s}) \end{aligned}$$

$$v_i = \frac{0.78 \text{ m} - \frac{1}{2} (-9.81 \text{ m/s}^2)(0.40 \text{ s})^2}{0.40 \text{ s}}$$

$$v_f^2 = v_i^2 + 2ad$$

$$v_i^2 = v_f^2 - 2ad \quad \text{or} \quad \begin{aligned} v_f &= v_i + at \\ -v_i &= v_i + (-9.81 \text{ m/s}^2)(0.80 \text{ s}) \end{aligned}$$

$$v_i = \sqrt{-2(-9.8 \text{ m/s}^2)(0.78 \text{ m})}$$

- 69 [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 68.

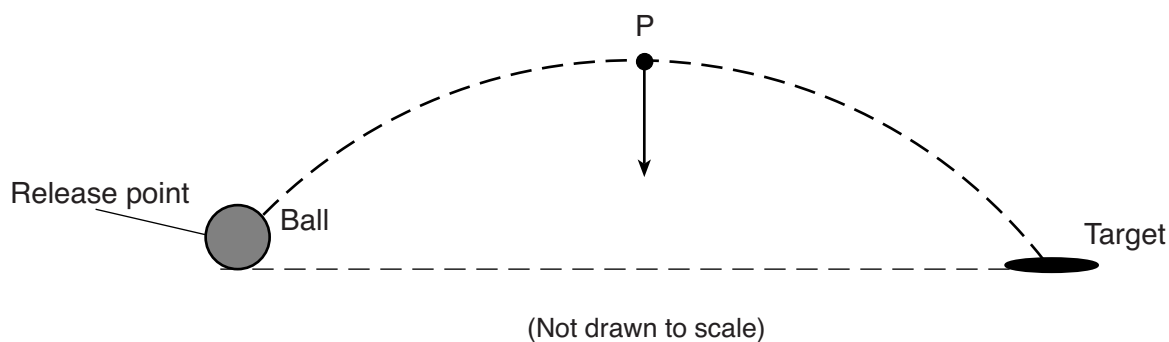
Example of a 1-credit response:

$$v_i = 3.9 \text{ m/s}$$

Note: Do *not* penalize a student more than 1 credit for errors in units for questions 68 and 69.

- 70 [1] Allow 1 credit for drawing an arrow directed straight down.

Example of a 1-credit response:



Note: Do *not* allow credit if the arrowhead is missing. Allow credit if the arrow does *not* begin at point *P*.

71 [1] Allow 1 credit for 13 J.

72 [1] Allow 1 credit for the equation and substitution with units *or* for an answer, with units, that is consistent with the student's response to question 71. Refer to *Scoring Criteria for Calculations* in the rating guide.

Example of a 1-credit response:

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

$$v = \sqrt{\frac{2KE}{m}}$$

$$v = \sqrt{\frac{2(13 \text{ J})}{3.0 \text{ kg}}}$$

73 [1] Allow 1 credit for a correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 72.

Example of a 1-credit response:

$$v = 2.9 \text{ m/s}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 72 and 73.

74 [1] Allow 1 credit for the equation and substitution with units *or* for an answer, with units, that is consistent with the student's response to question 73. Refer to *Scoring Criteria for Calculations* in the rating guide.

Example of a 1-credit response:

$$p_{\text{before}} = p_{\text{after}}$$

$$m_1v_1 = (m_1 + m_2)v_2$$

$$v_2 = \frac{m_1v_1}{m_1 + m_2}$$

$$v_2 = \frac{(3.0 \text{ kg})(2.9 \text{ m/s})}{3.0 \text{ kg} + 1.0 \text{ kg}}$$

75 [1] Allow 1 credit for a correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 74.

Example of a 1-credit response:

$$v_2 = 2.2 \text{ m/s}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 74 and 75.

76 [1] Allow 1 credit for 2.27 eV.

Note: Do *not* allow credit for -2.27 eV because $E_{\text{photon}} = E_i - E_f = -2.68 \text{ eV} - (-4.95 \text{ eV})$.

77 [1] Allow 1 credit for $3.63 \times 10^{-19} \text{ J}$ *or* for an answer that is consistent with the student's response to question 76.

78 [1] Allow 1 credit for the equation and substitution with units *or* for an answer, with units, that is consistent with the student's response to questions 77 or 76. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of 1-credit response:

$$E_{\text{photon}} = hf$$

$$f = \frac{E_{\text{photon}}}{h}$$

$$f = \frac{3.63 \times 10^{-19} \text{ J}}{6.63 \times 10^{-34} \text{ J} \cdot \text{s}}$$

79 [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 78.

Example of 1-credit response:

$$f = 5.48 \times 10^{14} \text{ Hz}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 78 and 79.

80 [1] Allow 1 credit for green *or* visible light *or* for an answer that is consistent with the student's response to question 79.

81 [1] Allow 1 credit for $28^\circ \pm 2^\circ$.

82 [1] Allow 1 credit for the equation and substitution with units *or* for an answer, with units, that is consistent with the student's response to question 81. Refer to *Scoring Criteria for Calculations* in the rating guide.

Example of a 1-credit response:

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

$$\sin \theta_2 = \frac{n_1 \sin \theta_1}{n_2}$$

$$\sin \theta_2 = \frac{1.46(\sin 28^\circ)}{1.00}$$

- 83 [1] Allow 1 credit for a correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 82.

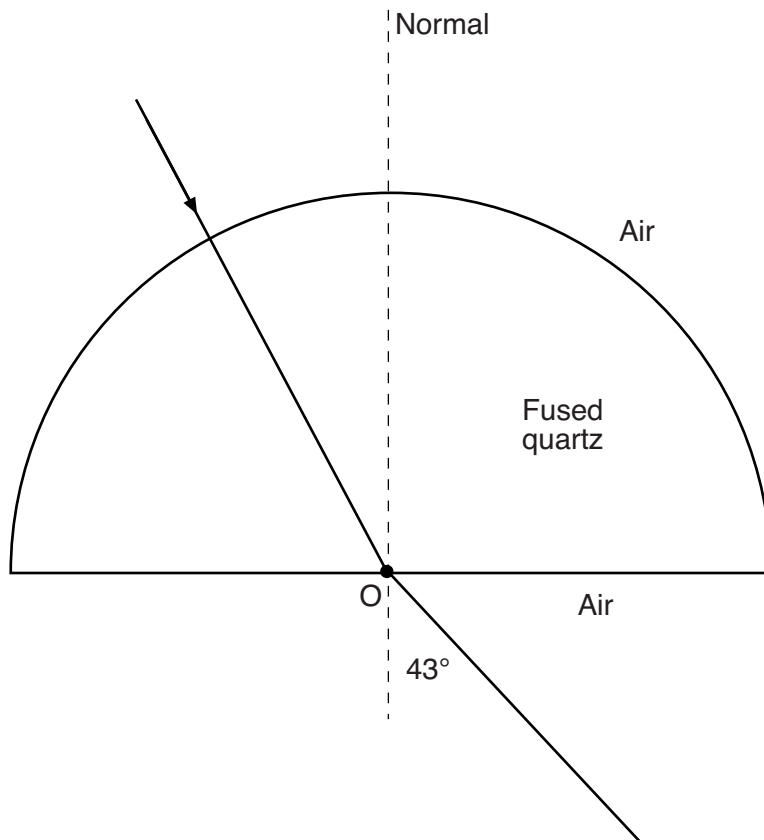
Examples of 1-credit responses:

$$\theta_2 = 43^\circ \text{ or } 44^\circ$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 82 and 83.

- 84 [1] Allow 1 credit for drawing the refracted ray at $43^\circ \pm 2^\circ$ to the normal, *or* for an answer that is consistent with the student's response to question 83.

Example of a 1-credit response:



Note: The refracted angle does *not* have to be labeled in order to receive credit.

- 85 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
- The frequency does not change.
 - The frequencies are the same.

Regents Examination in Physical Setting/Physics

June 2022

Chart for Converting Total Test Raw Scores to Final Examination Scores (Scale Scores)

The *Chart for Determining the Final Examination Score for the June 2022 Regents Examination in Physical Setting/Physics* will be posted on the Department's web site at: <http://www.nysed.gov/state-assessment/high-school-regents-examinations> on Thursday, June 23, 2022. Conversion charts provided for previous administrations of the Regents Examination in Physical Setting/Physics must NOT be used to determine students' final scores for this administration.

Online Submission of Teacher Evaluations of the Test to the Department

Suggestions and feedback from teachers provide an important contribution to the test development process. The Department provides an online evaluation form for State assessments. It contains spaces for teachers to respond to several specific questions and to make suggestions. Instructions for completing the evaluation form are as follows:

1. Go to <http://www.nysed.gov/state-assessment/teacher-feedback-state-assessments>.
2. Select the test title.
3. Complete the required demographic fields.
4. Complete each evaluation question and provide comments in the space provided.
5. Click the SUBMIT button at the bottom of the page to submit the completed form.

Map to Core Curriculum

June 2022 Physical Setting/Physics			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	2, 4, 7, 9, 15, 19, 22, 26, 30, 31, 32	37, 38, 40, 41, 45, 46, 48, 51, 52, 53, 54, 55, 58, 59, 61, 62, 63, 64	66, 67, 68, 69, 71, 72, 73, 74, 75, 76, 77, 78, 79, 82, 83
Math Key Idea 2	6, 14, 17	44, 47, 50, 56, 57, 65	70, 85
Math Key Idea 3		36, 39, 42	
Science Inquiry Key Idea 1			80
Science Inquiry Key Idea 2		60	
Science Inquiry Key Idea 3		43	
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2			
Key Idea 3			
Key Idea 4			
Key Idea 5			
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
4.1	3, 14, 20		71
4.3	34	49	81, 84
5.1	15	36	
5.3			
Standard 4			
4.1	3, 9, 18, 19, 20, 22, 29, 35	45, 46, 51, 52, 58, 59, 60, 61, 62, 63, 64, 65	71, 72, 73
4.3	10, 21, 24, 25, 26, 27, 28, 30, 34	39, 44, 49, 50, 56, 57	81, 82, 83, 84, 85
5.1	1, 2, 4, 5, 6, 7, 8, 12, 13, 14, 15, 16, 17, 23	36, 37, 38, 40, 42, 47, 48, 53, 54, 55	66, 67, 68, 69, 70, 74, 75
5.3	11, 31, 32, 33	41, 43	76, 77, 78, 79, 80