

FOR TEACHERS ONLY

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

PS–P

PHYSICAL SETTING/PHYSICS

Tuesday, June 21, 2016 — 1:15 to 4:15 p.m., only

SCORING KEY AND 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.p12.nysed.gov/assessment/> 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.

Part A and Part B–1

Allow 1 credit for each correct response.

Part A

1 4	10 3	19 4	28 1
2 2	11 3	20 1	29 3
3 4	12 2	21 3	30 2
4 1	13 2	22 4	31 2
5 3	14 2	23 2	32 4
6 2	15 3	24 1	33 3
7 2	16 1	25 2	34 3
8 1	17 3	26 1	35 4
9 2	18 3	27 3	

Part B–1

36 2	40 2	44 1	48 3
37 4	41 3	45 4	49 3
38 4	42 2	46 1	50 3
39 3	43 1	47 2	

Directions to the Teacher

Follow the procedures below for scoring student answer papers for the Physical Setting/Physics examination. Additional information about scoring is provided in the publication *Information for Scoring Regents Examinations in the Sciences*, which may be found on the Department's web site at <http://www.p12.nysed.gov/assessment/science/science-hs.html>.

Do not attempt to correct the student's work by making insertions or changes of any kind. If the student's responses for the multiple-choice questions are being hand scored prior to being scanned, the scorer must be careful not to make any marks on the answer sheet except to record the scores in the designated score boxes. Marks elsewhere on the answer sheet will interfere with the accuracy of the scanning.

For Part A and Part B–1, indicate by means of a check mark each incorrect or omitted answer. In the box provided at the end of each part, record the number of questions the student answered correctly for that part.

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. 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.

Fractional credit is *not* allowed. Only whole-number credit may be given to a response. Units need not be given when the wording of the questions allows such omissions.

Raters should enter the scores earned for Part A, Part B–1, Part B–2, and Part C on the appropriate lines in the box printed on the answer booklet, and then should add these four scores and enter the total in the box labeled "Total Written Test 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.p12.nysed.gov/assessment/> on Tuesday, June 21, 2016. The student's scale score should be entered in the labeled box on the student's answer booklet. The scale score is the student's final examination score. On the front of the student's answer booklet, raters must enter their initials on the lines next to "Rater 1" or "Rater 2."

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.p12.nysed.gov/assessment/science/phyratg02.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:

$$a = \frac{F_{net}}{m}$$

$$F_{net} = ma$$

$$F_{net} = (2.5 \text{ kg})(2.0 \text{ m/s}^2)$$

- 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:

$$F_{net} = 5.0 \text{ N}$$

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

- 53 [1] Allow 1 credit for a correct answer or for an answer that is the difference between 15 N and the student's response to question 52.

Example of a 1-credit response:

$$F_{net} = 10. \text{ N}$$

- 54 [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:

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

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

$$n_1 = \frac{(1.33)(\sin 41^\circ)}{\sin 27^\circ}$$

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

Examples of 1-credit responses:

$$n_1 = 1.9 \quad \text{or} \quad 2.0$$

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

- 56** [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:

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

$$d = \frac{1}{2}(9.81 \text{ m/s}^2)(0.391 \text{ s})^2$$

- 57** [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 56.

Example of a 1-credit response:

$$d = 0.750 \text{ m}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 56–57.

- 58** [1] Allow 1 credit for stating that the measured times are the same.

- 59** [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:

$$a_c = \frac{v^2}{r}$$

$$v = \sqrt{a_c r}$$

$$v = \sqrt{(25 \text{ m/s}^2)(8.0 \text{ m})}$$

- 60** [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 59.

Example of a 1-credit response:

$$v = 14 \text{ m/s}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 59–60.

- 61** [1] Allow 1 credit for indicating the direction of the airplane's velocity is east *or* to the right.

- 62** [1] Allow 1 credit for acceleration *or* rate of change of velocity (speed).

- 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:

$$A = \frac{1}{2} bh \qquad \text{or} \qquad d = \frac{1}{2} at^2 \qquad \text{or} \qquad \bar{v} = \frac{d}{t}$$
$$A = d \qquad d = \frac{1}{2}(1.3 \text{ m/s}^2)(3.0 \text{ m/s})^2 \qquad d = \bar{v}t = (2.0 \text{ m/s})(3.0 \text{ s})$$
$$d = \frac{1}{2}(3.0 \text{ s})(4.0 \text{ m/s})$$

- 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:

$$d = 6.0 \text{ m} \qquad \text{or} \qquad d = 5.9 \text{ m}$$

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

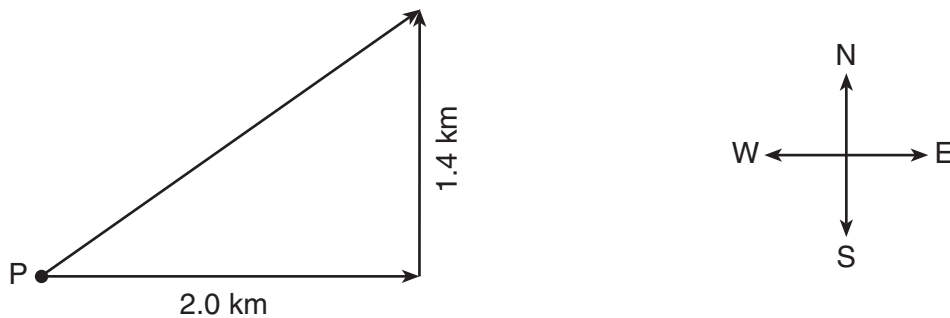
- 65** [1] Allow 1 credit for $3.0 \text{ m/s}^2 \pm 0.25 \text{ m/s}^2$.

Part C

66 [1] Allow 1 credit for $0.40 \text{ km} \pm 0.02 \text{ km}$.

67 [1] Allow 1 credit for constructing an arrow starting at point P and ending with an arrowhead at the top of the 1.4 km vector *or* for a vector $6.1 \text{ cm} \pm 0.2 \text{ cm}$ long at an angle of 35° north of the 2.0 km vector.

Example of a 1-credit response:



68 [1] Allow 1 credit for $2.4 \text{ km} \pm 0.2 \text{ km}$ *or* for an answer that is the product of the length of the resultant (in cm) drawn by the student for question 67 and the student's response to question 66.

69 [1] Allow 1 credit for $35^\circ \pm 2^\circ$ *or* for an answer that is the angle between the 2.0-km vector and the student's response to question 67.

70 [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:

$$F_s = kx$$

$$k = \frac{F_s}{x}$$

$$k = \frac{12.0 \text{ N}}{0.070 \text{ m}}$$

71 [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 70.

Example of a 1-credit response:

$$k = 170 \text{ N/m}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 70 and 71.

- 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 questions 71. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

$$PE_s = \frac{1}{2} kx^2$$

or

$$W = \Delta E_T$$

$$\Delta PE_s = \bar{F}d$$

$$PE_s = \frac{1}{2}(170 \text{ N/m})(0.070 \text{ m})^2$$

$$PE_s = (6.0 \text{ N})(0.070 \text{ m})$$

- 73 [1] Allow 1 credit for 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:

$$PE_s = 0.42 \text{ J}$$

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

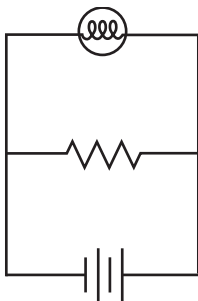
- 74 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- kinetic energy
- sound
- internal energy (thermal energy)
- gravitational potential energy (potential energy)

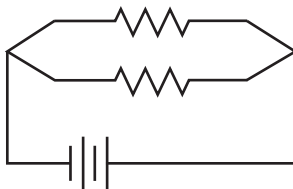
Note: Do *not* allow credit for elastic potential energy.

- 75 [1] Allow 1 credit for a correct circuit diagram.

Examples of 1-credit responses:



or



Note: Allow credit if student uses a cell symbol instead of a battery symbol.

- 76 [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:

$$P = VI$$

$$I = \frac{P}{V}$$

$$I = \frac{6.0 \text{ W}}{12 \text{ V}}$$

- 77 [1] Allow 1 credit for the correct response with units *or* for an answer, with units, that is consistent with the student's response to questions 75 and 76.

Example of a 1-credit response:

$$I = 0.50 \text{ A}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 76 and 77.

- 78 [1] Allow 1 credit for 0.10 A *or* for an answer that is the difference between the student's response to question 77 and 0.60 A *or* for an answer that is consistent with the student's response to question 75.

- 79 [1] Allow 1 credit for the equation and substitution with units *or* for an answer that is consistent with the student's response to question 78. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

$$R = \frac{V}{I} \quad \text{or} \quad P = \frac{V^2}{R} \quad \text{or} \quad \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R = \frac{12 \text{ V}}{0.10 \text{ A}} \quad R = \frac{V^2}{P} \quad \frac{1}{R_2} = \frac{1}{R_{eq}} - \frac{1}{R_1}$$

$$R = \frac{(12 \text{ V})^2}{1.2 \text{ W}} \quad \frac{1}{R_2} = \frac{1}{20. \Omega} - \frac{1}{24 \Omega}$$

- 80 [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 79.

Example of a 1-credit response:

$$R = 120 \Omega$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 79 and 80.

81 [1] Allow 1 credit for 1.89 eV.

82 [1] Allow 1 credit for $3.02 \times 10^{-19} \text{ J}$ *or* for an answer that is the product of the student's response to question 81 and $1.60 \times 10^{-19} \text{ J/eV}$.

83 [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 82. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

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

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

$$f = \frac{3.02 \times 10^{-19} \text{ J}}{6.63 \times 10^{-34} \text{ J}\cdot\text{s}}$$

84 [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 83.

Example of a 1-credit response:

$$f = 4.56 \times 10^{14} \text{ Hz}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 83 and 84.

85 [1] Allow 1 credit for red *or* for an answer that is consistent with the student's response to question 84.

Regents Examination in Physical Setting/Physics

June 2016

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

The *Chart for Determining the Final Examination Score for the June 2016 Regents Examination in Physical Setting/Physics* will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Tuesday, June 21, 2016. 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.forms2.nysed.gov/emsc/osa/exameval/reexameval.htm>.
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 2016 Physical Setting/Physics			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	2, 5, 7, 8, 12, 13, 14, 15, 17, 18, 23, 30, 31, 32, 33	38, 39, 41, 42, 43, 45, 46, 48, 51, 52, 53, 54, 55, 56, 57, 59, 60, 63, 64, 65	66, 68, 70, 71, 72, 73, 76, 77, 78, 79, 80, 81, 82, 83, 84
Math Key Idea 2		37, 40, 44, 45	
Math Key Idea 3		46, 62, 65	
Science Inquiry Key Idea 1			
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3		37	
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2			
Key Idea 3		36	
Key Idea 4			
Key Idea 5			
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
4.1		45, 50	72, 73, 74, 75, 76, 77
4.3	34	47, 49, 54, 55	
5.1		39, 40, 51, 52, 62	66, 67, 68, 69, 70, 71
5.3			81, 85
Standard 4			
4.1	10, 12, 13, 14, 15, 17, 18, 22, 32, 33	38, 42, 44, 45, 46, 50	72, 73, 74, 75, 76, 77, 78, 79, 80
4.3	6, 16, 19, 20, 21, 23, 24, 26, 34	47, 48, 49, 54, 55	
5.1	1, 2, 3, 4, 5, 7, 8, 9, 11, 25, 31, 35	36, 37, 39, 40, 41, 43, 51, 52, 53, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65	66, 67, 68, 69, 70, 71
5.3	27, 28, 29, 30		81, 82, 83, 84, 85