FOR TEACHERS ONLY

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

PS–P

PHYSICAL SETTING/PHYSICS

Tuesday, June 17, 2003 — 1:15 p.m. to 4:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 3 before rating student papers.

Part A and Part B–1
Allow 1 credit for each correct response

Part A

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

Part B–1

36 . . . 2	43 . . . 4
37 . . . 2	44 . . . 4
38 . . . 3	45 . . . 3
39 . . . 3	46 . . . 2
40 . . . 3	47 . . . 4
41 . . . 3	
42 . . . 4	

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 Administering and Scoring Regents Examinations in the Sciences*.

Use only *red* ink or *red* pencil in rating Regents papers. Do not attempt to *correct* the student's work by making insertions or changes of any kind.

On the detachable answer sheet for Part A and Part B–1, indicate by means of a checkmark 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 all the open-ended questions on a student's answer paper.

Student's 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 scores on the written test should be converted to a scaled score by using the conversion chart printed at the end of this Scoring Key and Rating Guide. The student's scaled score should be entered in the labeled box on the student's answer booklet. The scaled score is the student's final examination score.

All student answer papers that receive a scaled score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions that he/she scored in the first rating of the paper. The school principal is responsible for assuring that the student's final examination score is based on a fair, accurate, and reliable scoring of the student's answer paper.

Because scaled scores corresponding to raw scores in the conversion chart may change from one examination to another, it is crucial that for each administration, the conversion chart provided in the scoring key for that administration be used to determine the student's final score. The chart in this scoring key is usable only for this administration of the examination.

Please refer to the Department publication *Regents Examination in Physical Setting/Physics: Rating Guide for Parts B–2 and C*. Teachers should become familiar with this guide before rating students' papers.

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 1 credit for the correct answer (number and unit). If the number is given without the unit, do not allow this credit.
- Penalize a student only once per equation for omitting units.
- Allow full credit even if the answer is not expressed with the correct number of significant figures.

Part B–2

48 Allow 1 credit for describing the direction in which the wire could be moved to produce the maximum potential difference across its ends, *R* and *S*. Acceptable responses include, but are not limited to:

— horizontally
— left to right
— right to left
— perpendicular to both the length of the wire and the magnetic field
— toward the *x*'s

Note: Do *not* allow this credit for an answer indicating motion perpendicular to *only* the magnetic field *or* the length of the wire.

49 Allow 1 credit for **resonance, standing waves** *or* **sympathetic vibration.**

50 Allow 1 credit for indicating that the photon's energy must match exactly an energy level transition for the photon to be absorbed.

51 Allow 1 credit for **8.60** km *or* **8.6** km.

52 Allow 1 credit for **12.00** km *or* **12.** km *or* **12** km.

53 Allow 1 credit for $\mathbf{4.80 \times 10^{-19}}$ C *or* $\mathbf{4.8 \times 10^{-19}}$ C.

54 Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this scoring guide.

Example of Acceptable Response

$W = VIt$

$W = (120.\ V)(1.25\ A)(35.0\ s)$

$W = 5250\ J$

55 Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this scoring guide.

Example of Acceptable Response

$\nu = f\lambda$

$\lambda = \frac{\nu}{f}$

$\lambda = \frac{3.00 \times 10^8\ m/s}{2.2 \times 10^6\ Hz}$

$\lambda = 1.4 \times 10^2\ m$

or

140 m

or

136 m

56 Allow 1 credit for indicating wave interference. Acceptable responses include, but are not limited to:

— interference
— destructive interference
— principle of superposition

Note: Do *not* allow this credit for any reference to constructive interference.

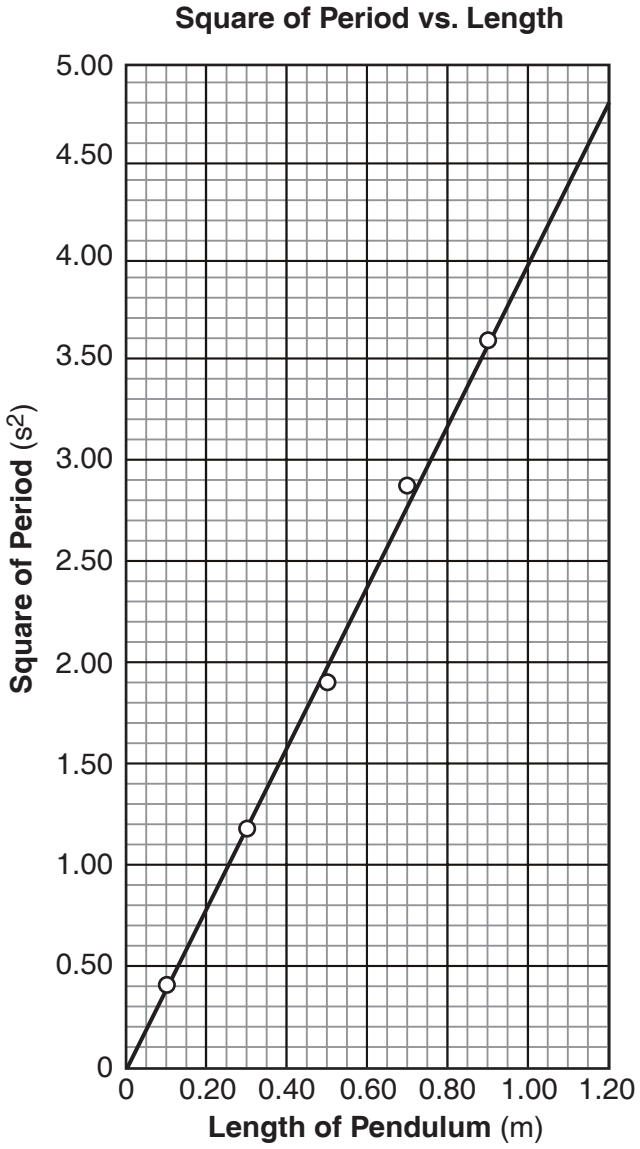
57 Allow 1 credit for stating a reason why exposure to visible light does not damage skin, while exposure to ultraviolet radiation can. Acceptable responses include, but are not limited to:

— Visible light has less energy.
— Visible light has lower frequency.
— Visible light has longer wavelength.
— Ultraviolet has higher energy.
— Ultraviolet has higher frequency.
— Ultraviolet has shorter wavelength.
— Ultraviolet radiation resonates with the cell membrane.

58 Allow 1 credit for plotting all points accurately (±.5 grid spaces).

59 Allow 1 credit for drawing a best-fit line. (This line is the best fit by linear regression.)

Example of an Appropriate Graph



60 Allow 1 credit for **0.89** (± .1) seconds, or an answer consistent with the student's graph.

61 Allow 1 credit for explaining how the graph could be used to calculate the value of g.

Examples of Acceptable Responses

Find the coordinates of a point on the best-fit line and substitute into $T^2 = \frac{4\pi^2 \ell}{g}$ and solve for g.

or

Find the slope and divide it into $4\pi^2$.

Note: Do not allow this credit for a response that refers only to the slope.

62 Allow 1 credit for indicating that one is a magnet. Acceptable responses include, but are not limited to:

at least one is a magnet
one is a magnet

Note: Do *not* allow this credit if the student's answer indicates that both are magnets.

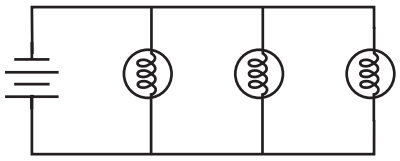
63 Allow 1 credit for **west**.

Part C

64 Allow a maximum of 2 credits for drawing a circuit showing how the lamps and battery are connected, 1 credit for correct type and number of symbols in a complete circuit, and 1 credit for a parallel circuit.

Notes: (1) Do *not* deduct credit if the student includes meters in the circuit.
(2) Do *not* allow credit if the student uses meters in place of lamps.
(3) Do *not* deduct credit if the student uses the resistor symbol in place of the lamp symbol.
(4) Do *not* deduct credit if the student uses a cell instead of a battery.

Example of Acceptable Response



65 Allow 1 credit for **40.1** V or an answer consistent with the student's response to question 64.

66 Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this scoring guide.

Examples of Acceptable Responses

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{89\,\Omega} + \frac{1}{365\,\Omega} + \frac{1}{143\,\Omega}$$

$$R_{eq} = 48\,\Omega \text{ or } 47.7\,\Omega$$

or

$$I = I_1 + I_2 + I_3 = 0.45\text{ A} + 0.11\text{ A} + 0.28\text{ A} = 0.84\text{ A}$$

$$R = \frac{V}{I} = \frac{40.1 V}{0.84\,A} = 48\,\Omega \text{ or } 47.7\Omega$$

Allow credit for an answer consistent with the student's response to question 64.

Note: Do *not* deduct credit if the student does not show the calculation for total current *I*.

67 Allow 1 credit for indicating that the potential difference is **40.1** V, or a response that is consistent with student's response to question 64.

68 Allow 1 credit for indicating that the current is **0.11** A, or a response that is consistent with the student's response to question 64.

69 Allow a maximum of 2 credits, 1 credit for the angle of incidence **45°** (±2°), and 1 credit for the angle of refraction **26°** (±2°).

70 Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this scoring key.

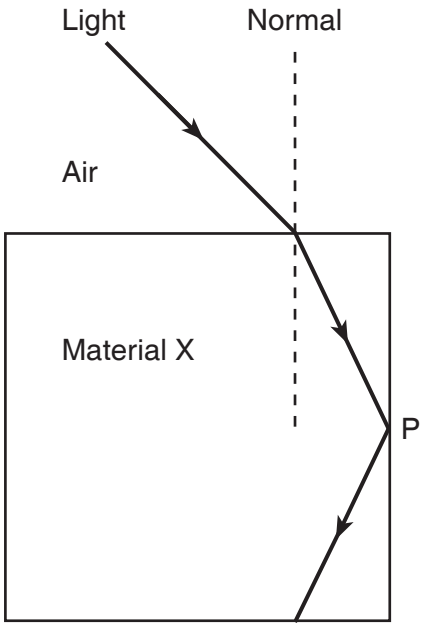
Example of Acceptable Response

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$
$$n_2 = \frac{(1.00)(\sin 45°)}{\sin 26°}$$
$$n_2 = 1.61$$

Allow credit for an answer that is consistent with the student's answer to question 69.

71 Allow 1 credit if the reflected ray is drawn through material *X* at an angle of reflection of 64° (±2°), or an answer consistent with the student's response to question 69. Allow credit no matter how the ray is drawn outside of material *X*.

Example of Acceptable Response:



72 Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this scoring key.

Example of Acceptable Response

$p_{before} = p_{after}$

or

$m_{before}v_{before} = m_{after}v_{after}$

$(50.\ kg)(6.0\ m/s) = (60.\ kg)\ v_{after}$

$v_{after} = (50.\ kg)\ (6.0\ m/s) / (60.\ kg)$

$v_{after} = 5.0\ m/s$

73 Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this scoring key.

Example of Acceptable Response

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

$$KE = \frac{1}{2}(60.\ kg)(5.0\ m/s)^2$$

$$KE = 750\ J$$

Allow credit for an answer that is consistent with the student's answer to question 72.

74 Allow 1 credit for indicating **750** J of work must be done, or an answer consistent with the student's response to question 73.

75 Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this scoring key.

Example of Acceptable Response

$$\lambda = \frac{h}{mv}$$

$$\lambda = \frac{(6.63 \times 10^{-34}\ J \cdot s)}{(6.7 \times 10^{-27}\ kg)(2.0 \times 10^{6}\ m/s)}$$

$$\lambda = 4.9 \times 10^{-14}\ m$$

76 Allow 1 credit for indicating that the wavelength of this particle is of the same order of magnitude as gamma rays, or an answer consistent with the student's response to question 75.

Regents Examination in Physical Setting/Physics

June 2003

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

Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score
85	100	63	72	41	46	19	21
84	99	62	71	40	44	18	19
83	97	61	70	39	43	17	18
82	96	60	68	38	42	16	17
81	95	59	67	37	41	15	16
80	94	58	66	36	40	14	15
79	92	57	65	35	39	13	14
78	91	56	64	34	38	12	13
77	90	55	62	33	36	11	12
76	88	54	61	32	35	10	11
75	87	53	60	31	34	9	10
74	86	52	59	30	33	8	9
73	85	51	58	29	32	7	7
72	83	50	56	28	31	6	6
71	82	49	55	27	30	5	5
70	81	48	54	26	28	4	4
69	80	47	53	25	27	3	3
68	78	46	52	24	26	2	2
67	77	45	50	23	25	1	1
66	76	44	49	22	24	0	0
65	75	43	48	21	23		
64	73	42	47	20	22		

To determine the student's final examination score, find the student's total test raw score in the column labeled "Raw Score" and then locate the scaled score that corresponds to that raw score. The scaled score is the student's final examination score. Enter this score in the space labeled "Final Score" on the student's answer sheet.

All student answer papers that receive a scaled score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions that he/she scored in the first rating of the paper. The school principal is responsible for assuring that the student's final examination score is based on a fair, accurate, and reliable scoring of the student's answer paper.

Because scaled scores corresponding to raw scores in the conversion chart may change from one examination to another, it is crucial that for each administration, the conversion chart provided in the scoring key for the administration be used to determine the student's final score. The chart above is usable only for this administration of the physical setting/physics examination.

Map to Core Curriculum

June 2003 Physical Setting/ Physics			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	10, 13, 24, 27, 35	37, 58, 59	66
Math Key Idea 2		60, 61	
Math Key Idea 3			
Sci. Inq Key Idea 1		38, 62	
Sci. Inq Key Idea 2			
Sci. Inq Key Idea 3			65
Eng. Des. Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2			
Key Idea 3		38, 76	
Key Idea 4			
Key Idea 5			
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
4.1		42, 43, 44, 48, 54	64, 67, 68, 73, 74
4.3		39, 45, 49, 53, 55, 56, 57	69, 70, 71, 75
5.1		36, 40, 41, 46, 47, 51, 52, 63	72
5.3		50	
Standard 4			
4.1	1, 10, 18, 19, 20, 21, 22, 24	39, 40, 42, 43, 44, 48, 53, 54, 58, 59, 60, 61	64, 65, 66, 67, 68, 73, 74
4.3	23, 25, 26, 27, 28, 29, 30	45, 49, 55, 56, 57	69, 70, 71
5.1	2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17	36, 37, 41, 46, 47, 51, 52, 62, 63	72
5.3	31, 32, 33, 34, 35	50	75, 76