FOR TEACHERS ONLY

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

PS–P

PHYSICAL SETTING/PHYSICS

Wednesday, January 29, 2003 — 9:15 a.m. to 12:15 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			Part B–1	
1 . . . 3 . . .	13 . . . 3 . . .	25 . . . 2 . . .	36 . . . 4 . . .	48 . . . 1 . . .
2 . . . 1 . . .	14 . . . 1 . . .	26 . . . 4 . . .	37 . . . 1 . . .	49 . . . 3 . . .
3 . . . 3 . . .	15 . . . 3 . . .	27 . . . 4 . . .	38 . . . 3 . . .	50 . . . 4 . . .
4 . . . 4 . . .	16 . . . 2 . . .	28 . . . 2 . . .	39 . . . 2 . . .	
5 . . . 2 . . .	17 . . . 3 . . .	29 . . . 1 . . .	40 . . . 2 . . .	
6 . . . 1 . . .	18 . . . 3 . . .	30 . . . 4 . . .	41 . . . 2 . . .	
7 . . . 4 . . .	19 . . . 4 . . .	31 . . . 3 . . .	42 . . . 1 . . .	
8 . . . 2 . . .	20 . . . 1 . . .	32 . . . 2 . . .	43 . . . 4 . . .	
9 . . . 2 . . .	21 . . . 1 . . .	33 . . . 2 . . .	44 . . . 3 . . .	
10 . . . 1 . . .	22 . . . 2 . . .	34 . . . 4 . . .	45 . . . 4 . . .	
11 . . . 3 . . .	23 . . . 4 . . .	35 . . . 4 . . .	46 . . . 2 . . .	
12 . . . 2 . . .	24 . . . 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 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

51 1

52 Allow a maximum of 2 credits for calculating the amount of time the ball was in the air. Refer to *Scoring Criteria for Calculations* in this scoring key.

Examples of Acceptable Responses

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

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

$t = \dfrac{9.80\,\text{m/s}}{9.81\,\text{m/s}^2}$

$t = 1.00\ \text{s}$

$t = 2.00\ \text{s}$

or

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

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

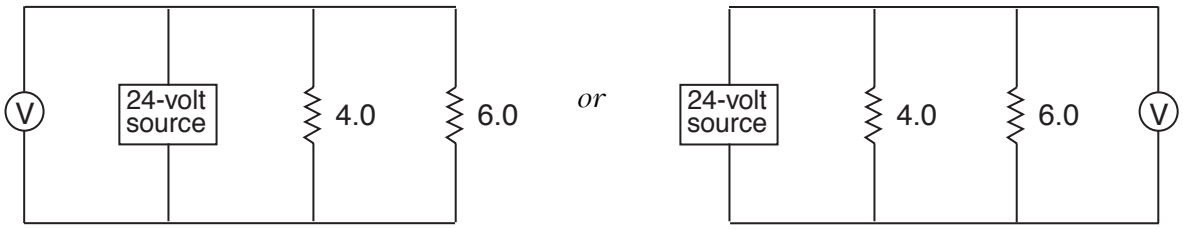
$t = \dfrac{\left(-9.80\,\text{m/s}\right) - \left(9.80\,\text{m/s}\right)}{-9.81\,\text{m/s}^2}$

$t = \dfrac{-19.6\,\text{m/s}}{-9.81\,\text{m/s}^2}$

$t = 2.00\ \text{s}$

53 Allow 1 credit for indicating the correct placement of the voltmeter.

Examples of Acceptable Responses

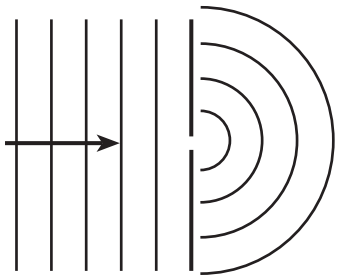


Allow credit for any appropriate parallel connection.

54 2

55 Allow 1 credit for sketching four wavefronts that extend beyond the opening in the barrier and are circular.

Example of Acceptable Response



56 Allow 1 credit for indicating that the strong force or the strong nuclear force prevents the nucleus of a helium atom from flying apart.

Note: Do not allow this credit for nuclear force only.

57 Allow a maximum of 2 credits for calculating the resistance of the wire. Refer to *Scoring Criteria for Calculations* in this scoring key.

Example of Acceptable Response

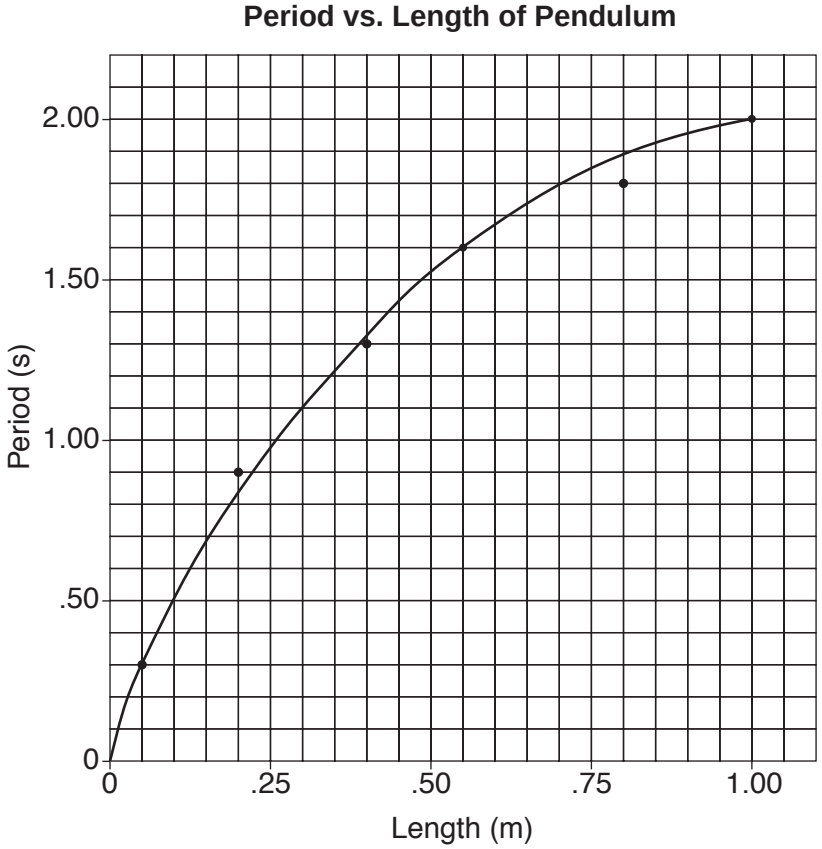
$$R = \frac{\rho L}{A}$$

$$R = \frac{\left(150 \times 10^{-8}\,\Omega \bullet \mathrm{m}\right)\left(1.00\,\mathrm{m}\right)}{\left(7.85 \times 10^{-7}\,\mathrm{m}^2\right)}$$

$$R = 1.91\Omega$$

58 Allow 1 credit for indicating that the current in the wire is **0.785** A *or* an answer consistent with the student's response to question 57.

59-61 Example of Acceptable Response



59 Allow a maximum of 2 credits for scales that are linear and appropriate with one axis labeled "Length (m)" and the other axis labeled "Period (s)."

Allow 1 credit if both scales are linear and appropriate.

Allow 1 credit if both axes are labeled with the correct physical quantity and unit.

60 Allow 1 credit for plotting all points accurately (± 0.3 grid space).

61 Allow 1 credit for drawing the best-fit line or curve for the data graphed.

The best-fit line must be a smooth curve. If one or more points are plotted incorrectly in question 60, but a best-fit line is drawn, allow the credit.

62 Allow 1 credit for determining that the period of the pendulum is 1.0 s ± 0.03 s.

Allow credit for an answer that is consistent with the student's graph *unless* the student receives no credit for questions 59 through 61. In that case, credit may be awarded for an answer that is calculated using the formula $T = 2\pi\sqrt{\frac{L}{g}}$.

Part C

63 Allow 1 credit for indicating that the kinetic energy of the system is greatest at position *B* and providing a correct explanation. Acceptable responses include, but are not limited to:

— *B*, because the mass has the greatest speed
— *B*, because the total potential energy is least
— *B*, the speed at *A* and *C* is zero

64 Allow 1 credit for indicating that the gravitational potential energy of the system is at a maximum at position *A*, and providing a correct explanation. Acceptable responses include, but are not limited to:

— *A*, because it is the highest point of travel

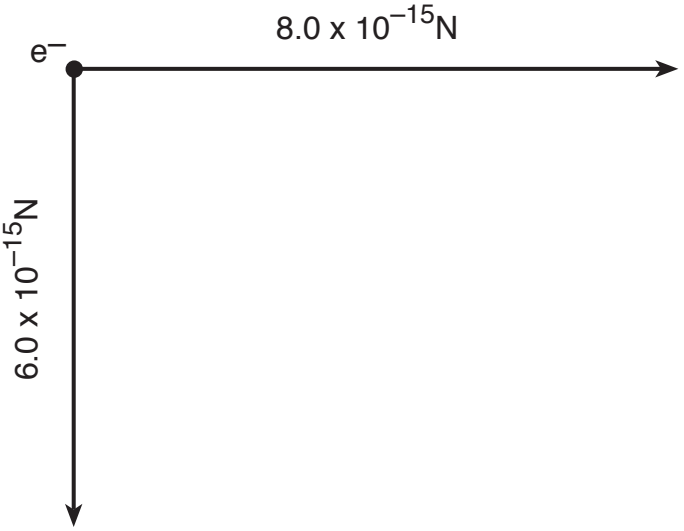
65 Allow 1 credit for indicating that the elastic potential energy of the system is a maximum at position *C*, and providing a correct explanation. Acceptable responses include, but are not limited to:

— *C*, because the spring is stretched the maximum amount
— *C*, because the KE and gravitational PE are a minimum

66 Allow a maximum of 2 credits.

- Allow 1 credit for a 6.0-cm ± 0.2-cm correctly labeled vector originating at the electron and directed south, including an arrowhead at the end.
- Allow 1 credit for an 8.0-cm ± 0.2-cm correctly labeled vector originating at the electron and directed east, including an arrowhead at the end.
- Allow only 1 credit if both vectors are drawn correctly but one or both labels are missing.
- Allow only 1 credit if both vectors are drawn to scale and labeled correctly but one or both arrowheads are missing.

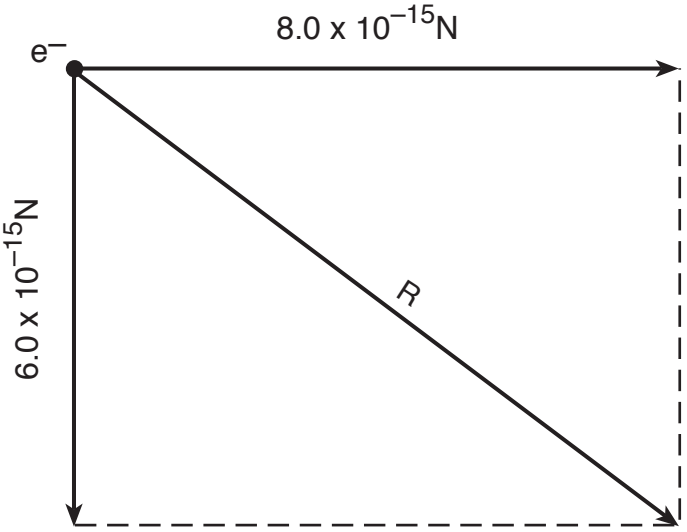
Example of a 2-credit Response



67 Allow 1 credit for determining the resultant force on the electron graphically.

To receive this credit, the 10.0-cm ± 0.2-cm vector must include an arrowhead at the end. Allow credit for an answer that is consistent with the student's response to question 66. Allow this credit even if the vector is not labeled.

Example of Acceptable Response



68 Allow 1 credit for determining the magnitude of the resultant vector.

Examples of Acceptable Responses

10.0×10^{-15} N ± 0.2×10^{-15} N

or

1.00×10^{-14} N ± 0.02×10^{-14} N

Allow credit for an answer that is consistent with the student's response to question 67.

69 Allow 1 credit for determining the angle between the resultant and the 6.0×10^{-15} N vector to be 53° ± 2°.

Allow credit for an answer that is consistent with the student's response to question 67.

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

Example of Acceptable Response

$F_f = \mu F_N$

$F_f = (0.30)(25\,\text{N})$

$F_f = 7.5\,\text{N}$

71 Allow 1 credit for drawing and labeling all vertical forces acting on the crate. Labels may be correct number values, names, or symbols.

Note: Vectors need not be drawn to scale.

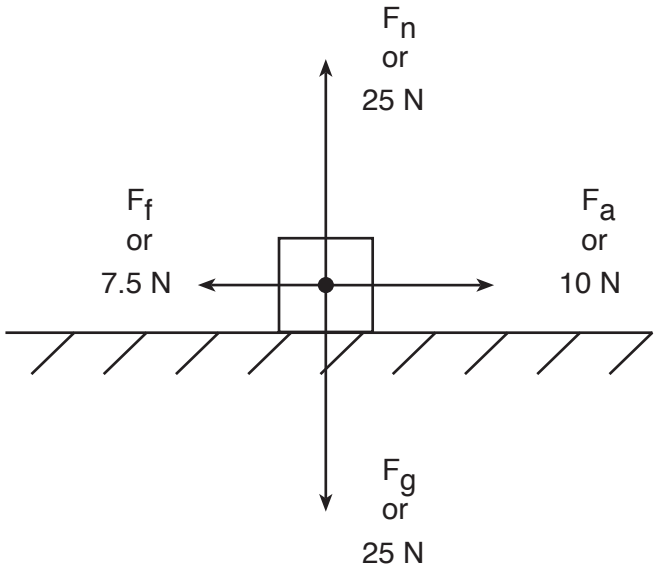
72 Allow 1 credit for drawing and labeling all horizontal forces acting on the crate. Labels may be correct number values, names, or symbols.

Note: Vectors need not be drawn to scale.

Allow credit for an answer that is consistent with the student's response to question 70.

71–72

Example of Acceptable Response



73 Allow 1 credit for indicating that the net force acting on the crate is **2.5** N.

Allow credit for an answer that is consistent with the student's response to question 70.

74 Allow 1 credit for indicating that the crate is accelerating because a net force acts on it.

Allow credit for an answer that is consistent with the student's response to question 73.

75 Allow 1 credit for indicating that the energy in electronvolts is **1.89** eV.

76 Allow 1 credit for indicating that the energy in joules is $\mathbf{3.02 \times 10^{-19}}$ J.

77 Allow a maximum of 2 credits for calculating the frequency of the emitted photon. Refer to *Scoring Criteria for Calculations* in this scoring key.

Example of Acceptable Response

$$E = hf$$
$$f = \frac{E}{h}$$
$$f = \frac{3.02 \times 10^{-19}\ \text{J}}{6.63 \times 10^{-34}\ \text{J} \bullet \text{s}}$$
$$f = 4.56 \times 10^{14}\ \text{Hz}$$

Allow credit for an answer that is consistent with the student's response to question 76.

78 Allow a maximum of 2 credits for calculating the wavelength of the emitted photon. Refer to *Scoring Criteria for Calculations* in this scoring key.

Examples of Acceptable Responses

$$\upsilon = f\lambda$$
$$\lambda = \frac{\upsilon}{f}$$
$$\lambda = \frac{3.00 \times 10^{8}\ \text{m/s}}{4.56 \times 10^{14}\ \text{Hz}}$$
$$\lambda = 6.58 \times 10^{-7}\ \text{m}$$

or

$$E = \frac{hc}{\lambda}$$
$$\lambda = \frac{hc}{E}$$
$$\lambda = \frac{\left(6.63 \times 10^{-34}\ \text{J} \bullet \text{s}\right)\left(3.00 \times 10^{8}\ \text{m/s}\right)}{3.02 \times 10^{-19}\ \text{J}}$$
$$\lambda = 6.59 \times 10^{-7}\ \text{m}$$

Allow credit for an answer that is consistent with the student's response(s) to questions 76 and/or 77.

[12]

Regents Examination in Physical Setting/Physics

January 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	74	41	46	19	20
84	99	62	72	40	45	18	19
83	98	61	71	39	44	17	18
82	97	60	70	38	43	16	17
81	95	59	69	37	41	15	15
80	94	58	67	36	40	14	14
79	93	57	66	35	39	13	13
78	92	56	65	34	38	12	12
77	91	55	64	33	36	11	11
76	90	54	62	32	35	10	10
75	88	53	61	31	34	9	9
74	87	52	60	30	33	8	8
73	86	51	59	29	32	7	7
72	85	50	57	28	30	6	6
71	84	49	56	27	29	5	5
70	82	48	55	26	28	4	4
69	81	47	54	25	27	3	3
68	80	46	52	24	26	2	2
67	79	45	51	23	25	1	1
66	77	44	50	22	23	0	0
65	76	43	49	21	22		
64	75	42	47	20	21		

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

January 2003 Physical Setting/ Physics			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	2, 3, 5, 6, 7, 8, 9, 13, 35	54, 58, 60, 61	70, 76, 77, 78
Math Key Idea 2			
Math Key Idea 3		59	
Sci. Inq Key Idea 1			
Sci. Inq Key Idea 2			
Sci. Inq Key Idea 3			
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	
Key Idea 4			
Key Idea 5		62	
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
4.1		39, 41, 42, 43, 44, 47, 53, 57	63, 64, 65
4.3		48, 49, 50, 55	
5.1		36, 37, 45, 46, 51, 52	66, 67, 68, 69, 71, 72, 73, 74
5.3			75
Standard 4			
4.1	12, 15, 16, 17, 18, 19, 21, 22, 25 ,26, 35	39, 41, 42, 43, 47, 53, 54, 57, 58	63, 64, 65
4.3	24, 27, 28, 29, 30, 31, 32, 33	40, 48, 49, 50, 55	
5.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 20, 23	36, 37, 44, 45, 46, 51, 52	66, 67, 68, 69, 70, 71, 72, 73, 74, 76, 77
5.3	34	56	75, 78