

# FOR TEACHERS ONLY

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

# PS-P

## PHYSICAL SETTING/PHYSICS

Tuesday, August 13, 2002 — 12:30 to 3:30 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 ..... <b>4</b> .....	13 ..... <b>2</b> .....	25 ..... <b>4</b> .....	36 ..... <b>2</b> .....
2 ..... <b>2</b> .....	14 ..... <b>4</b> .....	26 ..... <b>3</b> .....	37 ..... <b>2</b> .....
3 ..... <b>3</b> .....	15 ..... <b>1</b> .....	27 ..... <b>3</b> .....	38 ..... <b>3</b> .....
4 ..... <b>4</b> .....	16 ..... <b>4</b> .....	28 ..... <b>1</b> .....	39 ..... <b>3</b> .....
5 ..... <b>3</b> .....	17 ..... <b>2</b> .....	29 ..... <b>1</b> .....	40 ..... <b>2</b> .....
6 ..... <b>3</b> .....	18 ..... <b>3</b> .....	30 ..... <b>4</b> .....	41 ..... <b>1</b> .....
7 ..... <b>1</b> .....	19 ..... <b>3</b> .....	31 ..... <b>3</b> .....	42 ..... <b>2</b> .....
8 ..... <b>1</b> .....	20 ..... <b>2</b> .....	32 ..... <b>2</b> .....	43 ..... <b>4</b> .....
9 ..... <b>1</b> .....	21 ..... <b>3</b> .....	33 ..... <b>1</b> .....	44 ..... <b>2</b> .....
10 ..... <b>2</b> .....	22 ..... <b>2</b> .....	34 ..... <b>1</b> .....	45 ..... <b>1</b> .....
11 ..... <b>2</b> .....	23 ..... <b>3</b> .....	35 ..... <b>1</b> .....	46 ..... <b>4</b> .....
12 ..... <b>1</b> .....	24 ..... <b>1</b> .....		47 ..... <b>1</b> .....



**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 Booklet for Administering and Scoring Regents Examinations in the Sciences*.

Use only *red* ink or *red* pencil in rating Regents papers. Do *not* 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.

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. In the student's answer booklet, record the number of credits earned for each answer in the box printed to the right of the answer lines or spaces for that question.

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

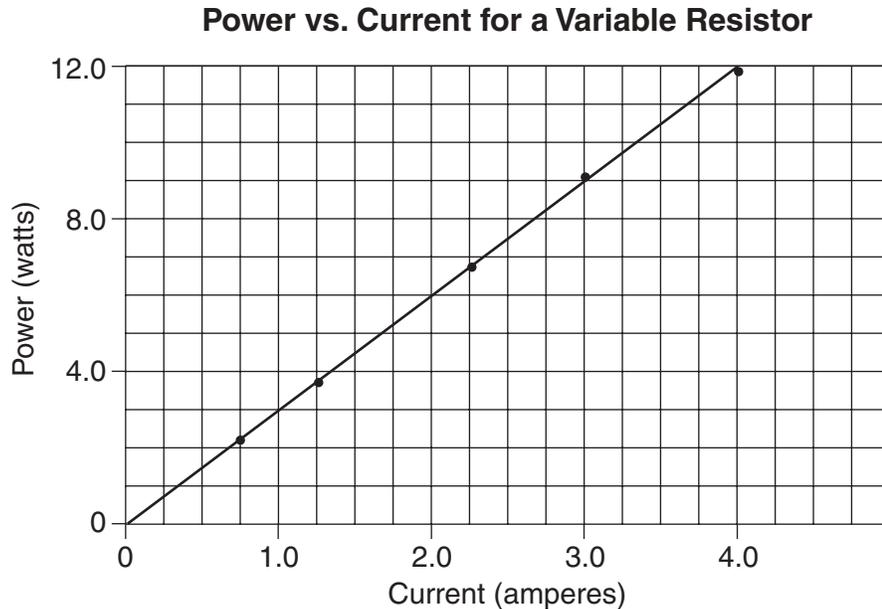
For each question requiring the student to show *all calculations, including the equation and substitution with units*, apply the following scoring criteria:

- 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 accurately plotting the data points ( $\pm 0.3$  grid space) for power vs. current.
- 49 Allow 1 credit for drawing a straight best-fit line. If one or more points are plotted incorrectly in question 48, but a best-fit line is drawn, allow this credit.

### 48–49 Example of Acceptable Response



- 50** Allow 1 credit for determining the power delivered to the circuit.

**Example of Acceptable Response**

$$10.5 \text{ W} \pm 0.3 \text{ W}$$

Allow credit for an answer that is consistent with the student's answer to question 49.

- 51** Allow a maximum of 2 credits for determining the slope of the graph. Refer to *Scoring Criteria for Calculations* in this scoring key. Allow credit for an answer that is consistent with the student's graph, unless the student receives no credit for questions 49 and 50. In that case, credit may be awarded if the student correctly calculates the slope using data in the table.

**Note:** The slope may be determined by direct substitution of data points only if the data values are on the best-fit line.

**Examples of Acceptable Responses**

$$\text{slope} = \frac{\Delta P}{\Delta I}$$

*or*

$$\text{slope} = \frac{\Delta Y}{\Delta X}$$

$$\text{slope} = \frac{10.5 \text{ W} - 0.0 \text{ W}}{3.5 \text{ A} - 0.0 \text{ A}}$$

$$\text{slope} = 3.0 \text{ V}$$

*or*

$$\text{slope} = 3 \frac{\text{W}}{\text{A}}$$

- 52** Allow 1 credit for stating the physical significance of the slope of the graph.

**Examples of acceptable responses include, but are not limited to:**

- voltage
- potential difference

- 53** Allow a maximum of 2 credits for calculating the angle of refraction. Refer to *Scoring Criteria for Calculations* in this scoring key.

**Example of Acceptable Response**

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

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

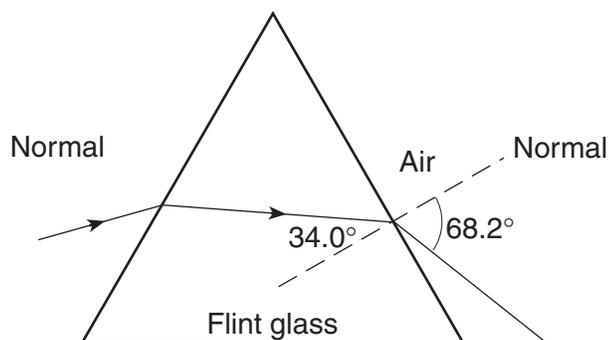
$$\sin \theta_2 = \frac{1.66 \sin 34.0^\circ}{1.00}$$

$$= 68.2^\circ \text{ or } 68^\circ$$

- 54** Allow a maximum of 2 credits for constructing the refracted light ray.

- Allow 1 credit if the angle between the normal and the ray is equal to the angle ( $\pm 2^\circ$ ) the student calculated in question 53.
- Allow 1 credit for a straight line originating at the point where the ray inside the flint glass meets the right side of the prism drawn to the right of the normal in air.

**Example of Acceptable Response**



- 56** Allow a maximum of 2 credits for calculating the initial energy of the photon. Refer to *Scoring Criteria for Calculations* in this scoring key.

**Example of Acceptable Response**

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

$$E = (6.63 \times 10^{-34} \text{ J}\cdot\text{s})(2.00 \times 10^{19} \text{ Hz})$$

$$E = 1.33 \times 10^{-14} \text{ J} \text{ or } E = 13.3 \times 10^{-15} \text{ J}\cdot\text{s}\cdot\text{Hz}$$

- 57** Allow 1 credit for stating the total energy of the two-particle system after the collision.

**Examples of acceptable responses include, but are not limited to:**

— The energy of the system after the collision is  $1.3 \times 10^{-14} \text{ J}$ , or a value consistent with the student's answer to question 56.

**Note:** Do *not* deduct credit if the unit is not included.

— It is the same as the energy of the system before the collision.

— Energy is conserved.

— The energy is the same as before the collision.

- 58** Allow 1 credit for **orange**.

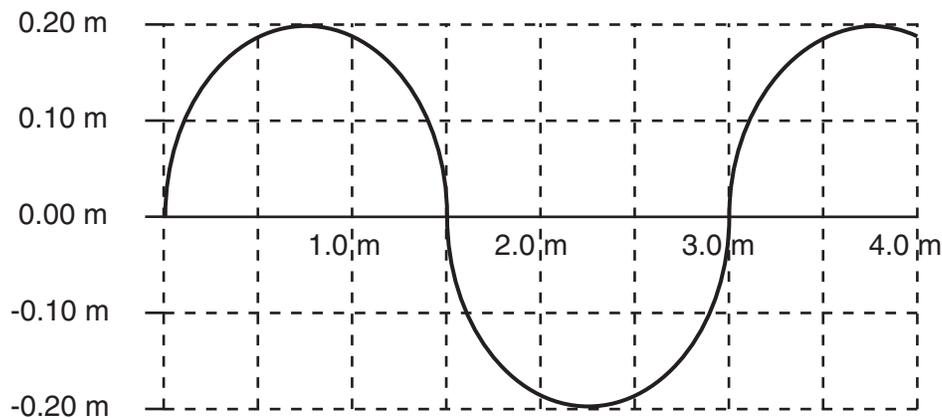
- 59** Allow a maximum of 2 credits for drawing at least one complete cycle of the periodic wave.

• Allow 1 credit for a wavelength of 3 meters ( $\pm 0.2$  grid space).

• Allow 1 credit for an amplitude of .2 meter ( $\pm 0.2$  grid space).

**Note:** The waveform may be another shape (e.g. triangular), provided that it is periodic and has the required amplitude and wavelength ( $\pm 0.2$  grid space).

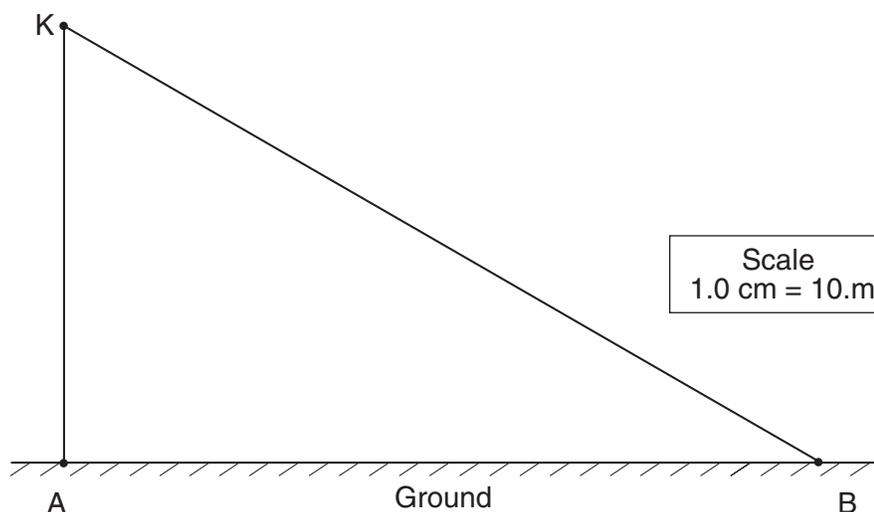
**Example of Acceptable Response**



**Part C**

- 61** Allow a maximum of 2 credits for drawing and labeling the triangle.
- Allow 1 credit for a straight line segment 10.0 cm ( $\pm 0.2$  cm) drawn from point *B* and a  $30.^\circ$  ( $\pm 2^\circ$ ) angle at point *B*.
  - Allow 1 credit for a properly drawn right triangle with *A* and *K* labeled correctly.

**Example of Acceptable Response**



- 62** Allow 1 credit for determining the height, *AK*, of the kite to be a value consistent with the student's answer to question 61. The answer should be 58 m ( $\pm 2$  m) if the answer to question 61 is drawn correctly. Do *not* allow credit for an answer of 58 m if the answer to question 61 is drawn incorrectly or missing.
- 63** Allow a maximum of 2 credits for calculating the amount of time required for the sphere to fall to the ground. Refer to *Scoring Criteria for Calculations* in this scoring key.

**Example of Acceptable Response**

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

$$t = \sqrt{\frac{2d}{a}}$$

$$t = \sqrt{\frac{2(58 \text{ m})}{9.81 \text{ m/s}^2}}$$

$$t = 3.4 \text{ s}$$

Allow credit for an answer that is consistent with the student's answer to question 62.

**Note:** The use of 9.8 m/s<sup>2</sup> in the equation is also acceptable.

- 64** Allow a maximum of 4 credits for finding the minimum coefficient of friction.

**Examples of acceptable responses and allocation of credits include, but are not limited to:**

Formulas:  $F_f = \mu F_N$      $F_N = mg$      $F_c = \frac{mv^2}{r}$     [1]

Rearrangement:  $\mu = \frac{v^2}{rg}$     [1]

Substitution:  $\mu = \frac{(20. \text{ m/s})^2}{(80. \text{ m})(9.8 \text{ m/s}^2)}$     [1]

Answer:  $\mu = 0.51$     [1]

*or*

$$F_c = ma_c \quad a_c = \frac{v^2}{r}$$

$$F_c = \frac{mv^2}{r} = \frac{(1,600 \text{ kg})(20. \text{ m/s})^2}{80. \text{ m}} = 8.0 \times 10^3 \text{ N} \quad [1]$$

$$F_N = mg = (1,600 \text{ kg})(9.81 \text{ m/s}^2) = 1.6 \times 10^4 \text{ N} \quad [1]$$

$$F_f = F_c \quad [1]$$

$$F_f = \mu F_N \quad \mu = \frac{F_f}{F_N} = \frac{8.0 \times 10^3 \text{ N}}{1.6 \times 10^4 \text{ N}} = 0.50 \quad [1]$$

- 65** Allow 1 credit for indicating that changing the mass of the car would have no effect on the maximum speed at which it could round the curve.
- 66** Allow a maximum of 3 credits, 1 for each correct energy conversion.

**Examples of Acceptable Responses**

work into  
 potential energy (spring) into  
 kinetic energy into  
 potential energy (gravity)

- 67** Allow a maximum of 2 credits.
- Allow 1 credit for indicating the toy has less mass.
  - Allow 1 credit for indicating the toy has the same energy.

**Examples of acceptable responses include, but are not limited to:**

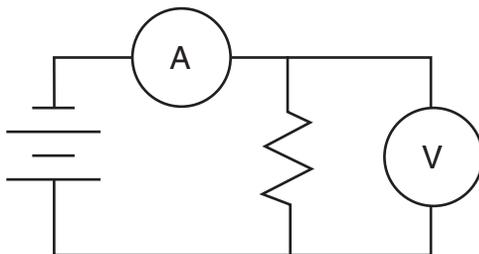
- The toy has less mass without the base but the same energy. Therefore it can go higher.
- The work put into the toy is the same but the mass is less. With less mass the toy could go higher because it is moving faster.

**68** Allow a maximum of 5 credits for explaining how to find the resistance of an unknown resistor, allocated as follows:

- a* Allow 1 credit for listing the necessary measurements (voltage and current).
- b* Allow 1 credit for listing the necessary equipment (ammeter, voltmeter, battery or power supply, and wires).
- c* Allow a maximum of 2 credits for completing the circuit diagram.
  - Allow 1 credit for drawing the ammeter in series with the resistor.
  - Allow 1 credit for drawing the voltmeter in parallel with the resistor.
- d* Allow 1 credit for listing the necessary formula ( $R = V/I$ ).

**Example of Acceptable Response**

- a* To determine the resistance of an unknown resistor, I would need to measure the current and potential difference for the resistor in a circuit.
- b* The equipment I would need would be the resistor, an ammeter, a voltmeter, a battery or power supply, and connecting wires.
- c* The circuit would be connected as in the diagram below.



- d* Once I measured the current and potential for the resistor, I would use the formula for Ohm's law ( $R = V/I$ ) to calculate the resistance.

**Regents Examination in Physical Setting/Physics  
August 2002  
Chart for Converting Total Raw Scores to  
Final Examination Scores (Scaled Scores)**

Raw Score	NYSED Scaled						
85	100	63	73	41	47	19	22
84	99	62	72	40	46	18	20
83	98	61	71	39	45	17	19
82	96	60	70	38	44	16	18
81	95	59	68	37	42	15	17
80	94	58	67	36	41	14	16
79	93	57	66	35	40	13	15
78	91	56	65	34	39	12	14
77	90	55	64	33	38	11	12
76	89	54	62	32	37	10	11
75	88	53	61	31	35	9	10
74	86	52	60	30	34	8	9
73	85	51	59	29	33	7	8
72	84	50	58	28	32	6	7
71	83	49	56	27	31	5	6
70	82	48	55	26	30	4	5
69	80	47	54	25	29	3	3
68	79	46	53	24	27	2	2
67	78	45	52	23	26	1	1
66	77	44	51	22	25	0	0
65	76	43	49	21	24		
64	74	42	48	20	23		

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

<b>August 2002 Physical Setting/ Physics</b>			
<b>Question Numbers</b>			
Key Ideas	Part A	Part B	Part C
<b>Standard 1</b>			
Math Key Idea 1	1-4, 6, 8, 9, 12, 15, 21, 25, 26-29, 32, 34, 35	36, 42, 43, 45, 46, 48-53, 55, 56, 58, 59,60	61-65, 67
Math Key Idea 2		50	
Math Key Idea 3		52	
Sci. Inq Key Idea 1			
Sci. Inq Key Idea 2			
Sci. Inq Key Idea 3	17, 19, 20, 30	44, 47, 58	65
Eng. Des. Key Idea 1			
<b>Standard 2</b>			
Key Idea 1			
Key Idea 2			
<b>Standard 6</b>			
Key Idea 1			
Key Idea 2			66
Key Idea 3	22, 28		
Key Idea 4	31		
Key Idea 5	11		
Key Idea 6			
<b>Standard 7</b>			
Key Idea 1			66
Key Idea 2			
<b>Standard 4 Process Skills</b>			
4.1	10, 12-14, 30, 34	41, 46, 57	66, 67, 68a, 68b, 68c, 68d
4.3	16, 19, 20	42, 53 - 55, 59	
5.1	5	37-40	64
5.3	23		
<b>Standard 4</b>			
4.1	8, 9, 12-14, 21, 29, 34	41, 43,45,46,48-52	
4.3	15-20, 32, 33	42, 53-55, 58-60	66-68
5.1	1-7, 10, 11, 25-28, 30, 31, 35	36-40	61-65
5.3	22-24	44, 47, 56, 57	