# PHYSICAL SETTING PHYSICS 

Wednesday, June 16, $2004-1: 15$ to $4: 15$ p.m., only

The answer sheet for Part $A$ and Part B-1 is the last page of this examination booklet. Turn to the last page and fold it along the perforations. Then, slowly and carefully, tear off the answer sheet and fill in the heading.

The answer booklet for Part B-2 and Part C is stapled in the center of this examination booklet. Open the examination booklet, carefully remove the answer booklet, and close the examination booklet. Then fill in the heading of your answer booklet.

You are to answer all questions in all parts of this examination according to the directions provided in the examination booklet. Record your answers to the Part $A$ and Part B-1 multiple-choice questions on your separate answer sheet. Write your answers to the Part B-2 and Part C questions in your answer booklet. All work should be written in pen, except for graphs and drawings, which should be done in pencil. You may use scrap paper to work out the answers to the questions, but be sure to record all your answers on the answer sheet and in the answer booklet.

When you have completed the examination, you must sign the statement printed at the end of your separate answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet and answer booklet cannot be accepted if you fail to sign this declaration.

## Notice. . .

A scientific or graphing calculator, a centimeter ruler, a protractor, and a copy of the 2002 Edition Reference Tables for Physical Setting/Physics, which you may need to answer some questions in this examination, must be available for your use while taking this examination.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

## Part A

## Answer all questions in this part.

Directions (1-35): For each statement or question, write on the separate answer sheet the number of the word or expression that, of those given, best completes the statement or answers the question.

1 Velocity is to speed as displacement is to
(1) acceleration
(3) momentum
(2) time
(4) distance

2 The diagram below shows a resultant vector, $R$.


Which diagram best represents a pair of component vectors, $A$ and $B$, that would combine to form resultant vector $R$ ?


## Note that question 4 has only three choices.

4 The diagram below represents the path of an object after it was thrown.


What happens to the object's acceleration as it travels from $A$ to $B$ ? [Neglect friction.]
(1) It decreases.
(2) It increases.
(3) It remains the same.

5 A 0.2 -kilogram red ball is thrown horizontally at a speed of 4 meters per second from a height of 3 meters. A 0.4 -kilogram green ball is thrown horizontally from the same height at a speed of 8 meters per second. Compared to the time it takes the red ball to reach the ground, the time it takes the green ball to reach the ground is
(1) one-half as great
(3) the same
(2) twice as great
(4) four times as great

6 The acceleration due to gravity on the surface of planet $X$ is 19.6 meters per second ${ }^{2}$. If an object on the surface of this planet weighs 980 . newtons, the mass of the object is
(1) 50.0 kg
(3) $490 . \mathrm{N}$
(2) $100 . \mathrm{kg}$
(4) 908 N

7 A basketball player jumped straight up to grab a rebound. If she was in the air for 0.80 second, how high did she jump?
(1) 0.50 m
(3) 1.2 m
(2) 0.78 m
(4) 3.1 m

8 The force required to start an object sliding across a uniform horizontal surface is larger than the force required to keep the object sliding at a constant velocity. The magnitudes of the required forces are different in these situations because the force of kinetic friction
(1) is greater than the force of static friction
(2) is less than the force of static friction
(3) increases as the speed of the object relative to the surface increases
(4) decreases as the speed of the object relative to the surface increases

9 A 50.-kilogram student threw a 0.40-kilogram ball with a speed of 20 . meters per second. What was the magnitude of the impulse that the student exerted on the ball?
(1) $8.0 \mathrm{~N} \cdot \mathrm{~s}$
(3) $4.0 \times 10^{2} \mathrm{~N} \cdot \mathrm{~s}$
(2) $78 \mathrm{~N} \cdot \mathrm{~s}$
(4) $1.0 \times 10^{3} \mathrm{~N} \cdot \mathrm{~s}$

10 A man is pushing a baby stroller. Compared to the magnitude of the force exerted on the stroller by the man, the magnitude of the force exerted on the man by the stroller is
(1) zero
(2) smaller, but greater than zero
(3) larger
(4) the same

11 The work done in moving a block across a rough surface and the heat energy gained by the block can both be measured in
(1) watts
(3) newtons
(2) degrees
(4) joules

## Note that question 12 has only three choices.

12 Two weightlifters, one 1.5 meters tall and one 2.0 meters tall, raise identical 50.-kilogram masses above their heads. Compared to the work done by the weightlifter who is 1.5 meters tall, the work done by the weightlifter who is 2.0 meters tall is
(1) less
(2) greater
(3) the same

13 A 45.0-kilogram boy is riding a 15.0-kilogram bicycle with a speed of 8.00 meters per second. What is the combined kinetic energy of the boy and the bicycle?
(1) 240 . J
(3) 1440 J
(2) 480 . J
(4) 1920 J

14 A 5-newton force causes a spring to stretch 0.2 meter. What is the potential energy stored in the stretched spring?
(1) 1 J
(3) 0.2 J
(2) 0.5 J
(4) 0.1 J

15 A 40.-kilogram student runs up a staircase to a floor that is 5.0 meters higher than her starting point in 7.0 seconds. The student's power output is
(1) 29 W
(3) $1.4 \times 10^{3} \mathrm{~W}$
(2) 280 W
(4) $1.4 \times 10^{4} \mathrm{~W}$

16 Which type of field is present near a moving electric charge?
(1) an electric field, only
(2) a magnetic field, only
(3) both an electric field and a magnetic field
(4) neither an electric field nor a magnetic field

17 A negatively charged plastic comb is brought close to, but does not touch, a small piece of paper. If the comb and the paper are attracted to each other, the charge on the paper
(1) may be negative or neutral
(2) may be positive or neutral
(3) must be negative
(4) must be positive

18 If a 1.5-volt cell is to be completely recharged, each electron must be supplied with a minimum energy of
(1) 1.5 eV
(3) $9.5 \times 10^{18} \mathrm{eV}$
(2) 1.5 J
(4) $9.5 \times 10^{18} \mathrm{~J}$

19 The current traveling from the cathode to the screen in a television picture tube is $5.0 \times 10^{-5}$ ampere. How many electrons strike the screen in 5.0 seconds?
(1) $3.1 \times 10^{24}$
(3) $1.6 \times 10^{15}$
(2) $6.3 \times 10^{18}$
(4) $1.0 \times 10^{5}$

20 A moving electron is deflected by two oppositely charged parallel plates, as shown in the diagram below.


The electric field between the plates is directed from
(1) $A$ to $B$
(3) $C$ to $D$
(2) $B$ to $A$
(4) $D$ to $C$

21 The diagram below shows two identical metal spheres, $A$ and $B$, separated by distance $d$. Each sphere has mass $m$ and possesses charge $q$.


Which diagram best represents the electrostatic force $F_{e}$ and the gravitational force $F_{g}$ acting on sphere $B$ due to sphere $A$ ?


22 The table below lists various characteristics of two metallic wires, $A$ and $B$.

| Wire | Material | Temperature <br> $\left({ }^{\circ} \mathrm{C}\right)$ | Length <br> $(\mathrm{m})$ | Cross- <br> Sectional Area <br> $\left(\mathrm{m}^{2}\right)$ | Resistance <br> $(\Omega)$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| A | silver | 20. | 0.10 | 0.010 | R |
| B | silver | 20. | 0.20 | 0.020 | $? ? ?$ |

If wire $A$ has resistance $R$, then wire $B$ has resistance
(1) $R$
(3) $\frac{R}{2}$
(2) $2 R$
(4) $4 R$

23 The diagram below represents an electric circuit consisting of a 12 -volt battery, a 3.0 -ohm resistor, $R_{1}$, and a variable resistor, $R_{2}$.


At what value must the variable resistor be set to produce a current of 1.0 ampere through $R_{1}$ ?
(1) $6.0 \Omega$
(3) $3.0 \Omega$
(2) $9.0 \Omega$
(4) $12 \Omega$

24 The energy of a photon is inversely proportional to its
(1) wavelength
(3) frequency
(2) speed
(4) phase

25 The energy equivalent of the rest mass of an electron is approximately
(1) $5.1 \times 10^{5} \mathrm{~J}$
(3) $2.7 \times 10^{-22} \mathrm{~J}$
(2) $8.2 \times 10^{-14} \mathrm{~J}$
(4) $8.5 \times 10^{-28} \mathrm{~J}$

26 A single vibratory disturbance moving through a medium is called
(1) a node
(3) a standing wave
(2) an antinode
(4) a pulse

27 An electric bell connected to a battery is sealed inside a large jar. What happens as the air is removed from the jar?
(1) The electric circuit stops working because electromagnetic radiation can not travel through a vacuum.
(2) The bell's pitch decreases because the frequency of the sound waves is lower in a vacuum than in air.
(3) The bell's loudness increases because of decreased air resistance.
(4) The bell's loudness decreases because sound waves can not travel through a vacuum.

28 As a sound wave passes from water, where the speed is $1.49 \times 10^{3}$ meters per second, into air, the wave's speed
(1) decreases and its frequency remains the same
(2) increases and its frequency remains the same
(3) remains the same and its frequency decreases
(4) remains the same and its frequency increases

29 Which phenomenon occurs when an object absorbs wave energy that matches the object's natural frequency?
(1) reflection
(3) resonance
(2) diffraction
(4) interference

30 A ray of monochromatic light $\left(f=5.09 \times 10^{14}\right.$ hertz $)$ in air is incident at an angle of $30 .^{\circ}$ on a boundary with corn oil. What is the angle of refraction, to the nearest degree, for this light ray in the corn oil?
(1) $6^{\circ}$
(3) $30 .{ }^{\circ}$
(2) $20 .{ }^{\circ}$
(4) $47^{\circ}$

31 A wave is diffracted as it passes through an opening in a barrier. The amount of diffraction that the wave undergoes depends on both the
(1) amplitude and frequency of the incident wave
(2) wavelength and speed of the incident wave
(3) wavelength of the incident wave and the size of the opening
(4) amplitude of the incident wave and the size of the opening

32 A source of waves and an observer are moving relative to each other. The observer will detect a steadily increasing frequency if
(1) he moves toward the source at a constant speed
(2) the source moves away from him at a constant speed
(3) he accelerates toward the source
(4) the source accelerates away from him

33 Which wave diagram has both wavelength $(\lambda)$ and amplitude (A) labeled correctly?

(1)

( 2 )

( 3 )

(4)

34 A laser beam is directed at the surface of a smooth, calm pond as represented in the diagram below.


Which organisms could be illuminated by the laser light?
(1) the bird and the fish
(3) the crab and the seaweed
(2) the bird and the seaweed
(4) the crab and the fish

35 The diagram below represents two waves of equal amplitude and frequency approaching point $P$ as they move through the same medium.


As the two waves pass through each other, the medium at point $P$ will
(1) vibrate up and down
(3) vibrate into and out of the page
(2) vibrate left and right
(4) remain stationary

## Part B-1

## Answer all questions in this part.

Directions (36-46): For each statement or question, write on the separate answer sheet the number of the word or expression that, of those given, best completes the statement or answers the question.

36 A constant unbalanced force is applied to an object for a period of time. Which graph best represents the acceleration of the object as a function of elapsed time?

(1)

(2)

(3)

(4)

37 The graph below represents the kinetic energy, gravitational potential energy, and total mechanical energy of a moving block.

## Energy vs. Distance Moved



Which best describes the motion of the block?
(1) accelerating on a flat horizontal surface
(3) falling freely
(2) sliding up a frictionless incline
(4) being lifted at constant velocity

38 The diameter of a United States penny is closest to
(1) $10^{0} \mathrm{~m}$
(3) $10^{-2} \mathrm{~m}$
(2) $10^{-1} \mathrm{~m}$
(4) $10^{-3} \mathrm{~m}$

Base your answers to questions 39 and 40 on the data table below. The data table lists the energy and corresponding frequency of five photons.

| Photon | Energy (J) | Frequency (Hz) |
| :---: | :---: | :---: |
| A | $6.63 \times 10^{-15}$ | $1.00 \times 10^{19}$ |
| B | $1.99 \times 10^{-17}$ | $3.00 \times 10^{16}$ |
| C | $3.49 \times 10^{-19}$ | $5.26 \times 10^{14}$ |
| D | $1.33 \times 10^{-20}$ | $2.00 \times 10^{13}$ |
| E | $6.63 \times 10^{-26}$ | $1.00 \times 10^{8}$ |

39 In which part of the electromagnetic spectrum would photon $D$ be found?
(1) infrared
(3) ultraviolet
(2) visible
(4) x ray

40 The graph below represents the relationship between the energy and the frequency of photons.

## Energy vs. Frequency



The slope of the graph would be
(1) $6.63 \times 10^{-34} \mathrm{~J} \bullet \mathrm{~s}$
(2) $6.67 \times 10^{-11} \mathrm{~N} \bullet \mathrm{~m}^{2} / \mathrm{kg}^{2}$
(3) $1.60 \times 10^{-19} \mathrm{~J}$
(4) $1.60 \times 10^{-19} \mathrm{C}$

41 Which combination of quarks could produce a neutral baryon?
(1) $c d t$
(3) $c d b$
(2) $c t s$
(4) $c d u$

Base your answers to questions 42 through 44 on the information and diagram below.

A 20.-ohm resistor and a 30 .-ohm resistor are connected in parallel to a 12 -volt battery as shown. An ammeter is connected as shown.


42 What is the equivalent resistance of the circuit?
(1) $10 . \Omega$
(3) $25 \Omega$
(2) $12 \Omega$
(4) $50 . \Omega$

43 What is the current reading of the ammeter?
(1) 1.0 A
(3) 0.40 A
(2) 0.60 A
(4) 0.20 A

44 What is the power of the 30 -ohm resistor?
(1) 4.8 W
(3) $30 . \mathrm{W}$
(2) 12 W
(4) 75 W

45 Which graph best represents the relationship between the magnitude of the electric field strength, $E$, around a point charge and the distance, $r$, from the point charge?

(1)

(2)

( 3 )

(4)

46 Several pieces of copper wire, all having the same length but different diameters, are kept at room temperature. Which graph best represents the resistance, $R$, of the wires as a function of their cross-sectional areas, $A$ ?

(1)

(2)

( 3 )

( 4 )

## Part B-2

## Answer all questions in this part.

Directions (47-59): Record your answers in the spaces provided in your answer booklet.

Base your answers to questions 47 through 49 on the information below.

The combined mass of a race car and its driver is 600 . kilograms. Traveling at constant speed, the car completes one lap around a circular track of radius 160 meters in 36 seconds.

47 Calculate the speed of the car. [Show all work, including the equation and substitution with units.] [2]

48 On the diagram on your answer sheet, draw an arrow to represent the direction of the net force acting on the car when it is in position $A$. [1]

49 Calculate the magnitude of the centripetal acceleration of the car. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 50 and 51 on the information below.

An 8.00 -kilogram ball is fired horizontally from a $1.00 \times 10^{3}$-kilogram cannon initially at rest. After having been fired, the momentum of the ball is $2.40 \times 10^{3}$ kilogram $\bullet$ meters per second east. [Neglect friction.]

50 Calculate the magnitude of the cannon's velocity after the ball is fired. [Show all work, including the equation and substitution with units.] [2]

51 Identify the direction of the cannon's velocity after the ball is fired. [1]

52 During a 5.0-second interval, an object's velocity changes from 25 meters per second east to 15 meters per second east. Determine the magnitude and direction of the object's acceleration. [2]

Base your answers to questions 53 through 55 on the information and graph below.

A student conducted an experiment to determine the resistance of a lightbulb. As she applied various potential differences to the bulb, she recorded the voltages and corresponding currents and constructed the graph below.

Current vs. Potential Difference


53 The student concluded that the resistance of the lightbulb was not constant. What evidence from the graph supports the student's conclusion? [1]

## Note that question 54 has only three choices.

54 According to the graph, as the potential difference increased, the resistance of the lightbulb
(1) decreased
(2) increased
(3) changed, but there is not enough information to know which way

55 While performing the experiment the student noticed that the lightbulb began to glow and became brighter as she increased the voltage. Of the factors affecting resistance, which factor caused the greatest change in the resistance of the bulb during her experiment? [1]

Base your answers to questions 56 and 57 on the information below.

A student plucks a guitar string and the vibrations produce a sound wave with a frequency of 650 hertz.

56 The sound wave produced can best be described as a
(1) transverse wave of constant amplitude
(2) longitudinal wave of constant frequency
(3) mechanical wave of varying frequency
(4) electromagnetic wave of varying wavelengths

57 Calculate the wavelength of the sound wave in air at STP. [Show all work, including the equation and substitution with units.] [2]

58 A beam of light travels through medium $X$ with a speed of $1.80 \times 10^{8}$ meters per second. Calculate the absolute index of refraction of medium $X$. [Show all work, including the equation and substitution with units.] [2]

59 A projectile has an initial horizontal velocity of 15 meters per second and an initial vertical velocity of 25 meters per second. Determine the projectile's horizontal displacement if the total time of flight is 5.0 seconds. [Neglect friction.] [1]

## Part C

## Answer all questions in this part.

Directions (60-73): Record your answers in the spaces provided in your answer booklet.

Base your answers to questions 60 through 62 on the information and data table below.

In an experiment, a student applied various forces to a spring and measured the spring's corresponding elongation. The table below shows his data.

| Force <br> (newtons) | Elongation <br> (meters) |
| :---: | :---: |
| 0 | 0 |
| 1.0 | 0.30 |
| 3.0 | 0.67 |
| 4.0 | 1.00 |
| 5.0 | 1.30 |
| 6.0 | 1.50 |

60 On the grid provided in your answer booklet, plot the data points for force versus elongation. [1]

61 Draw the best-fit line. [1]

62 Using your graph, calculate the spring constant of the spring. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 63 and 64 on the information below.

A physics class is to design an experiment to determine the acceleration of a student on inline skates coasting straight down a gentle incline. The incline has a constant slope. The students have tape measures, traffic cones, and stopwatches.

63 Describe a procedure to obtain the measurements necessary for this experiment. [2]

64 Indicate which equation(s) they should use to determine the student's acceleration. [1]

Base your answers to questions 65 through 68 on the information below.

The driver of a car made an emergency stop on a straight horizontal road. The wheels locked and the car skidded to a stop. The marks made by the rubber tires on the dry asphalt are 16 meters long, and the car's mass is 1200 kilograms.

65 Determine the weight of the car. [1]

66 Calculate the magnitude of the frictional force the road applied to the car in stopping it. [Show all work, including the equation and substitution with units.] [2]

67 Calculate the work done by the frictional force in stopping the car. [Show all work, including the equation and substitution with units.] [2]

68 Assuming that energy is conserved, calculate the speed of the car before the brakes were applied. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 69 and 70 on the information and graph below.

Sunlight is composed of various intensities of all frequencies of visible light. The graph represents the relationship between light intensity and frequency.


69 Based on the graph, which color of visible light has the lowest intensity? [1]

70 It has been suggested that fire trucks be painted yellow green instead of red. Using information from the graph, explain the advantage of using yellow-green paint. [1]

Base your answers to questions 71 through 73 on the information below.

The alpha line in the Balmer series of the hydrogen spectrum consists of light having a wavelength of $6.56 \times 10^{-7}$ meter.

71 Calculate the frequency of this light. [Show all work, including the equation and substitution with units.] [2]

72 Determine the energy in joules of a photon of this light. [1]

73 Determine the energy in electronvolts of a photon of this light. [1]

## PHYSICAL SETTING PHYSICS

Wednesday, June 16, $2004-1: 15$ to 4:15 p.m., only

ANSWER SHEET


Record your answers to Part A and Part B-1 on this answer sheet.


Write your answers to Part B-2 and Part C in your answer booklet.
The declaration below should be signed when you have completed the examination.

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination and that $I$ have neither given nor received assistance in answering any of the questions during the examination.

The University of the State of New York Regents High School Examination

## PHYSICAL SETTING PHYSICS

Wednesday, June 16, $2004-1: 15$ to $4: 15$ p.m., only
ANSWER BOOKLET

| Student | Sex: | Male <br> Female |
| :---: | :---: | :---: |
| Teacher |  |  |
| School . | Grade |  |

Answer all questions in Part B-2 and Part C. Record your answers in this booklet.

| Part | Maximum <br> Score <br> A | Student's <br> Score |
| :--- | :---: | :---: |
| B-1 | 35 |  |
| B-2 | 11 |  |
| C | 19 |  |

Total Written Test Score
(Maximum Raw Score: 85)
Final Score
(From Conversion Chart)


Raters' Initials:
Rater 1........... Rater $2 . . . . . .$. . . .


## Part B-2


$\square$

## Part C

60-61
Force vs. Elongation


62

63 $\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$
[c]

[d]

# FOR TEACHERS ONLY 

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

## PS-P

## PHYSICAL SETTING/PHYSICS

Wednesday, June 16, 2004 - 1:15 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 |  |  |  |  |  | Part B-1 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 4 | 13 | 4 | 25 | 2 | 36 | 4 | 42 | 2 |
| 2 | 1 | 14 | 2 | 26 | 4 | 37 | 3 | 43 | 2 |
| 3 | 4 | 15 | 2 | 27 | 4 | 38 | 3 | 44 | 1 |
| 4 | 3 | 16 | 3 | 28 | 1 | 39 | 1 | 45 | 4 |
| 5 | 3 | 17 | 2 | 29 | 3 | 40 | 1 | 46 | 4 |
| 6 | 1 | 18 | 1 | 30 | 2 | 41 | 3 |  |  |
| 7 | 2 | 19 | 3 | 31 | 3 |  |  |  |  |
| 8 | 2 | 20 | 3 | 32 | 3 |  |  |  |  |
| 9 | 1 | 21 | 2 | 33 | 3 |  |  |  |  |
| 10 | 4 | 22 | 1 | 34 | 1 |  |  |  |  |
| 11 | 4 | 23 | 2 | 35 | 4 |  |  |  |  |
| 12 | 2 |  | 1 |  |  |  |  |  |  |

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. Visit the site http://www.emsc.nysed.gov/osa/ and select the link "Latest Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and at least one more time before the final scores for the examination are recorded.

## 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.

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 scaled score by using the conversion chart that will be posted on the Department's web site: http://www.emsc.nysed.gov/osa/ on Wednesday, June 16, 2004. 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 for that administration be used to determine the student's final score.

Please refer to the Department publication Regents Examination in Physical Setting/Physics: Rating Guide for Parts B-2 and C. This publication can be found on the NYS Education Department web site at http://www.emsc.nysed.gov/osa/scire/phyratg02.pdf. 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

47 Allow a maximum of 2 credits for calculating the speed of the car. Refer to Scoring Criteria for Calculations in this scoring key.

## Example of an Acceptable Response

$$
\begin{aligned}
& \bar{v}=\frac{d}{t} \\
& \bar{v}=\frac{2 \pi r}{t} \\
& \bar{v}=\frac{2 \pi(160 \mathrm{~m})}{36 \mathrm{~s}} \\
& \bar{v}=28 \mathrm{~m} / \mathrm{s} \text { or } 27.9 \mathrm{~m} / \mathrm{s}
\end{aligned}
$$

48 Allow 1 credit for drawing an arrow directed toward the center of the circle.

## Example of an Acceptable Response



49 Allow a maximum of 2 credits for calculating the magnitude of the acceleration of the car. Refer to Scoring Criteria for Calculations in this scoring key.

## Example of an Acceptable Response

$$
\begin{aligned}
& a_{c}=\frac{v^{2}}{r} \\
& a_{c}=\frac{(28 \mathrm{~m} / \mathrm{s})^{2}}{160 \mathrm{~m}} \\
& a_{c}=4.9 \mathrm{~m} / \mathrm{s}^{2}
\end{aligned}
$$

Allow credit for an answer that is consistent with the student's response to question 47.

50 Allow a maximum of 2 credits for calculating the magnitude of the cannon's velocity. Refer to Scoring Criteria for Calculations in this scoring key.

Example of an Acceptable Response

$$
\begin{aligned}
& p=m v \\
& v=\frac{p}{m} \\
& v=\frac{2.40 \times 10^{3} \mathrm{~kg} \cdot \mathrm{~m} / \mathrm{s}}{1.00 \times 10^{3} \mathrm{~kg}} \\
& v=2.40 \mathrm{~m} / \mathrm{s}
\end{aligned}
$$

51 Allow 1 credit for identifying the direction of the cannon's velocity. Acceptable responses include, but are not limited to:

- west
- opposite
- backward

52 Allow a maximum of 2 credits, 1 credit for the magnitude and 1 credit for the direction.

## Examples of 2-Credit Responses

$$
\begin{aligned}
& 2.0 \mathrm{~m} / \mathrm{s}^{2} \text { west } \\
& -2.0 \mathrm{~m} / \mathrm{s}^{2} \text { east }
\end{aligned}
$$

## Examples of 1-Credit Responses

$$
2.0 \mathrm{~m} / \mathrm{s}^{2} \text { east }
$$

$-2.0 \mathrm{~m} / \mathrm{s}^{2}$ west

53 Allow 1 credit for indicating that the slope is not constant. Acceptable responses include, but are not limited to:

- The slope changes.
- The line (or graph) curves.
- The graph is not a straight line.

Note: Do not allow credit for "slope" only.

54 Allow 1 credit for 2.

55 Allow 1 credit for indicating that the temperature changed, or the resistivity changed. Acceptable responses include, but are not limited to:

- As the voltage increased, the temperature increased, causing a higher resistance.
- The bulb got hotter.
- the temperature of the bulb
- resistivity

56 Allow 1 credit for 2.

57 Allow a maximum of 2 credits for calculating the wavelength of the sound wave. Refer to Scoring Criteria for Calculations in this scoring key.

## Example of an Acceptable Response

$$
\begin{aligned}
& v=f \lambda \\
& \lambda=\frac{v}{f} \\
& \lambda=\frac{331 \mathrm{~m} / \mathrm{s}}{650 \mathrm{~Hz}} \\
& \lambda=0.51 \mathrm{~m} \text { or } 0.509 \mathrm{~m}
\end{aligned}
$$

58 Allow a maximum of 2 credits for calculating the absolute index of refraction of medium $X$. Refer to Scoring Criteria for Calculations in this scoring key.

## Example of an Acceptable Response

$$
\begin{aligned}
n & =\frac{c}{v} \\
n & =\frac{3.00 \times 10^{8} \mathrm{~m} / \mathrm{s}}{1.80 \times 10^{8} \mathrm{~m} / \mathrm{s}} \\
n & =1.67 \text { or } 1.7
\end{aligned}
$$

59 Allow 1 credit for 75 m .

## Part C

60 Allow 1 credit for correctly plotting all points $\pm 0.3$ grid space.

61 Allow 1 credit for drawing the best-fit line.

## 60-61 Example of a 2-Credit Graph

Force vs. Elongation


62 Allow a maximum of 2 credits for calculating the spring constant of the spring. Refer to Scoring Criteria for Calculations in this scoring key.

## Example of an Acceptable Response

$$
\begin{aligned}
& k=\text { slope } \\
& k=\frac{\Delta F}{\Delta x} \\
& k=\frac{4.0 \mathrm{~N}-2.0 \mathrm{~N}}{1.0 \mathrm{~m}-0.5 \mathrm{~m}} \\
& k=4.0 \mathrm{~N} / \mathrm{m}
\end{aligned}
$$

Allow credit for an answer that is consistent with the student's response to questions 60 and 61 .
Note: The slope may be determined by direct substitution of data points only if the data values are on the best-fit line, or if the student failed to draw a best-fit line.

63 Allow a maximum of 2 credits for describing a procedure to obtain the necessary measurements, allocated as follows:

Allow 1 credit for setting up a measured distance.
and
Allow 1 credit for measuring the time to travel that distance.

64 Allow 1 credit for an equation or equations that could be used to correctly determine the student's acceleration.

## Examples of Acceptable Responses

$$
\begin{aligned}
& d=v_{i} t+\frac{1}{2} a t^{2} \\
& \quad \text { or } \\
& a=\frac{2 d}{t^{2}}
\end{aligned}
$$

65 Allow 1 credit for $\mathbf{1 2 , 0 0 0} \mathrm{N}$ or $\mathbf{1 1 , 8 0 0} \mathrm{N}$.

66 Allow a maximum of 2 credits for calculating the frictional force the road applied to the car in stopping it. Refer to Scoring Criteria for Calculations in this scoring key.

## Example of an Acceptable Response

$$
\begin{aligned}
& F_{f}=\mu F_{N} \\
& F_{f}=(0.67)(12,000 \mathrm{~N}) \\
& F_{f}=8,000 \mathrm{~N} \text { or } 8,040 \mathrm{~N}
\end{aligned}
$$

Allow credit for an answer that is consistent with the student's response to question 65.

67 Allow a maximum of 2 credits for calculating the work done by the frictional force in stopping the car. Refer to Scoring Criteria for Calculations in this scoring key.

## Example of an Acceptable Response

$$
\begin{aligned}
& W=F d \\
& W=(8,000 \mathrm{~N})(16 \mathrm{~m}) \\
& W=1.3 \times 10^{5} \mathrm{~J} \quad \text { or } \quad 128,000 \mathrm{~J}
\end{aligned}
$$

Allow credit for an answer that is consistent with the student's response to question 66.

68 Allow a maximum of 2 credits for calculating the speed of the car before the brakes were applied. Refer to Scoring Criteria for Calculations in this scoring key.

## Examples of Acceptable Responses

$$
\begin{array}{rlrl}
W & =K E=\frac{1}{2} m v^{2} & a & =\frac{F_{n e t}}{m} \\
v & =\sqrt{\frac{2 K E}{m}} & a & =6.7 \mathrm{~m} / \mathrm{s}^{2} \\
v & =\sqrt{\frac{2\left(1.3 \times 10^{5} \mathrm{~J}\right)}{1.2 \times 10^{3} \mathrm{~kg}}} & \text { or } & v_{f}^{2}
\end{array}=v_{i}^{2}+2 a d ~\left(v_{i}\right)=\sqrt{v_{f}^{2}-2 a d} .
$$

Allow credit for an answer that is consistent with the student's responses to questions 66 and/or 67.

69 Allow 1 credit for indicating the color with the lowest intensity.

## Examples of Acceptable Responses

violet
the one with the greatest frequency

70 Allow 1 credit for using information from the graph to explain the advantage of using yellowgreen paint.

## Examples of Acceptable Responses

Yellow green has a higher intensity.
Yellow green is brighter than red.

71 Allow a maximum of 2 credits for calculating the frequency of this light. Refer to Scoring Criteria for Calculations in this scoring key.

## Example of an Acceptable Response

$$
\begin{aligned}
& v=f \lambda \\
& f=\frac{v}{\lambda} \\
& f=\frac{3.00 \times 10^{8} \mathrm{~m} / \mathrm{s}}{6.56 \times 10^{-7} \mathrm{~m}} \\
& f=4.57 \times 10^{14} \mathrm{~Hz} \quad \text { or } \quad 4.6 \times 10^{14} \mathrm{~Hz}
\end{aligned}
$$

72 Allow 1 credit for $\mathbf{3 . 0 3} \times \mathbf{1 0}^{-19} \mathrm{~J}$ or an answer that is consistent with the student's response to question 71.

73 Allow 1 credit for $\mathbf{1 . 8 9} \mathrm{eV}$ or an answer that is consistent with the student's response to question 72.

# Regents Examination in Physical Setting/Physics 

June 2004
Chart for Converting Total Test Raw Scores to Final Examination Scores (Scaled Scores)

The Chart for Determining the Final Examination Score for the June 2004 Regents Examination in Physical Setting/Physics will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Wednesday, June 16, 2004. 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.

## Map to Core Curriculum

| June 2004 Physical Setting/Physics |  |  |  |
| :---: | :---: | :---: | :---: |
| Question Numbers |  |  |  |
| Key Ideas | Part A | Part B | Part C |
| Standard 1 |  |  |  |
| Math Key Idea 1 |  | $\begin{aligned} & 47,49,50,52,57,58, \\ & 59 \end{aligned}$ | $\begin{aligned} & \text { 60,61,65,66,67, } \\ & \text { 68,71,72,73 } \end{aligned}$ |
| Math Key Idea 2 |  |  |  |
| Math Key Idea 3 |  | 40 |  |
| Sci. Inq. Key Idea 1 |  |  |  |
| Sci. Inq. Key Idea 2 |  |  | 63 |
| Sci. Inq. Key Idea 3 |  | 36,39,45 | 64,69,70 |
| Eng. Des. Key Idea 1 |  |  |  |
| Standard 2 |  |  |  |
| Key Idea 1 |  |  |  |
| Key Idea 2 |  |  |  |
| Standard 6 |  |  |  |
| Key Idea 1 |  |  |  |
| Key Idea 2 |  | 51 |  |
| Key Idea 3 |  | 38 |  |
| Key Idea 4 |  |  |  |
| Key Idea 5 |  | 37 |  |
| Key Idea 6 |  |  |  |
| Standard 7 |  |  |  |
| Key Idea 1 |  |  |  |
| Key Idea 2 |  |  |  |
| Standard 4 Process Skills |  |  |  |
| 4.1 |  | $\begin{aligned} & 42,43,44,46,53,54, \\ & 55 \end{aligned}$ |  |
| 4.3 |  | 56 |  |
| 5.1 |  | 48 | 62 |
| 5.3 |  | 41 |  |
| Standard 4 |  |  |  |
| 4.1 | $\begin{aligned} & 11,12,13,14,15,16,18,19 \\ & 22,23 \end{aligned}$ | $\begin{aligned} & 37,42,43,44,46,53, \\ & 54,55 \end{aligned}$ |  |
| 4.3 | $\begin{aligned} & 26,27,28,29,30,31,32,33, \\ & 34,35 \end{aligned}$ | 39,56,57,58, | 69,70,71 |
| 5.1 | 1,2,3,4,5,6,7,8,9,10,20,21 | $\begin{aligned} & 36,45,47,48,49,50, \\ & 51,52,59 \end{aligned}$ | 60,61,62,63,64 |
| 5.3 | 17,24,25 | 40,41 | 72,73 |

# Regents Examination in Physical Setting / Physics June 2004 

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

| Raw <br> Score | Scale <br> Score | Raw <br> Score | Scale <br> Score | Raw <br> Score | Scale <br> Score | Raw <br> Score | Scale <br> Score |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 85 | 100 | 63 | 78 | 41 | 57 | 19 | 31 |
| 84 | 99 | 62 | 77 | 40 | 56 | 18 | 29 |
| 83 | 98 | 61 | 76 | 39 | 55 | 17 | 28 |
| 82 | 97 | 60 | 76 | 38 | 54 | 16 | 26 |
| 81 | 96 | 59 | 75 | 37 | 53 | 15 | 25 |
| 80 | 95 | 58 | 74 | 36 | 52 | 14 | 23 |
| 79 | 94 | 57 | 73 | 35 | 50 | 13 | 22 |
| 78 | 93 | 56 | 72 | 34 | 49 | 12 | 20 |
| 77 | 92 | 55 | 71 | 33 | 48 | 11 | 19 |
| 76 | 91 | 54 | 70 | 32 | 47 | 10 | 17 |
| 75 | 90 | 53 | 69 | 31 | 46 | 9 | 16 |
| 74 | 89 | 52 | 68 | 30 | 45 | 8 | 14 |
| 73 | 88 | 51 | 67 | 29 | 43 | 7 | 12 |
| 72 | 87 | 50 | 66 | 28 | 42 | 6 | 11 |
| 71 | 86 | 49 | 65 | 27 | 41 | 5 | 9 |
| 70 | 85 | 48 | 64 | 26 | 40 | 4 | 7 |
| 69 | 84 | 47 | 63 | 25 | 38 | 3 | 5 |
| 68 | 83 | 46 | 62 | 24 | 37 | 2 | 4 |
| 67 | 82 | 45 | 61 | 23 | 36 | 1 | 2 |
| 66 | 81 | 44 | 60 | 22 | 35 | 0 | 0 |
| 65 | 80 | 43 | 59 | 21 | 33 |  |  |
| 64 | 79 | 42 | 58 | 20 | 32 |  |  |

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 for that 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.

