The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
PHYSICS

Tuesday, June 17, 2003 — 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 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.

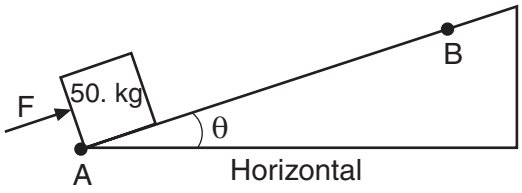
DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

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 The diagram below shows a 50.-kilogram crate on a frictionless plane at angle θ to the horizontal. The crate is pushed at constant speed up the incline from point *A* to point *B* by force *F*.



If angle θ were increased, what would be the effect on the magnitude of force *F* and the total work *W* done on the crate as it is moved from *A* to *B*?

(1) *W* would remain the same and the magnitude of *F* would decrease.
(2) *W* would remain the same and the magnitude of *F* would increase.
(3) *W* would increase and the magnitude of *F* would decrease.
(4) *W* would increase and the magnitude of *F* would increase.

2 A vector makes an angle, θ, with the horizontal. The horizontal and vertical components of the vector will be equal in magnitude if angle θ is

(1) 30° (3) 60°
(2) 45° (4) 90°

3 A car initially traveling at a speed of 16 meters per second accelerates uniformly to a speed of 20. meters per second over a distance of 36 meters. What is the magnitude of the car's acceleration?

(1) 0.11 m/s^2 (3) 0.22 m/s^2
(2) 2.0 m/s^2 (4) 9.0 m/s^2

4 A ball is thrown at an angle of 38° to the horizontal. What happens to the magnitude of the ball's vertical acceleration during the total time interval that the ball is in the air?

(1) It decreases, then increases.
(2) It decreases, then remains the same.
(3) It increases, then decreases.
(4) It remains the same.

5 A man standing on a scale in an elevator notices that the scale reads 30 newtons greater than his normal weight. Which type of movement of the elevator could cause this greater-than-normal reading?

(1) accelerating upward
(2) accelerating downward
(3) moving upward at constant speed
(4) moving downward at constant speed

Base your answers to questions 6 and 7 on the information below.

Projectile *A* is launched horizontally at a speed of 20. meters per second from the top of a cliff and strikes a level surface below, 3.0 seconds later. Projectile *B* is launched horizontally from the same location at a speed of 30. meters per second.

6 The time it takes projectile *B* to reach the level surface is

(1) 4.5 s (3) 3.0 s
(2) 2.0 s (4) 10. s

7 Approximately how high is the cliff?

(1) 29 m (3) 60. m
(2) 44 m (4) 104 m

8 A 60-kilogram skydiver is falling at a constant speed near the surface of Earth. The magnitude of the force of air friction acting on the skydiver is approximately

(1) 0 N
(2) 6 N
(3) 60 N
(4) 600 N

9 An astronaut weighs 8.00×10^2 newtons on the surface of Earth. What is the weight of the astronaut 6.37×10^6 meters above the surface of Earth?

(1) 0.00 N
(2) 2.00×10^2 N
(3) 1.60×10^3 N
(4) 3.20×10^3 N

10 A 10.-newton force is required to hold a stretched spring 0.20 meter from its rest position. What is the potential energy stored in the stretched spring?

(1) 1.0 J
(2) 2.0 J
(3) 5.0 J
(4) 50. J

11 When a 12-newton horizontal force is applied to a box on a horizontal tabletop, the box remains at rest. The force of static friction acting on the box is

(1) 0 N
(2) between 0 N and 12 N
(3) 12 N
(4) greater than 12 N

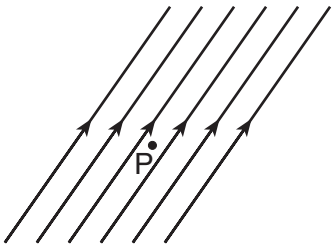
12 Ball *A* of mass 5.0 kilograms moving at 20. meters per second collides with ball *B* of unknown mass moving at 10. meters per second in the same direction. After the collision, ball *A* moves at 10. meters per second and ball *B* at 15 meters per second, both still in the same direction. What is the mass of ball *B*?

(1) 6.0 kg
(2) 2.0 kg
(3) 10. kg
(4) 12 kg

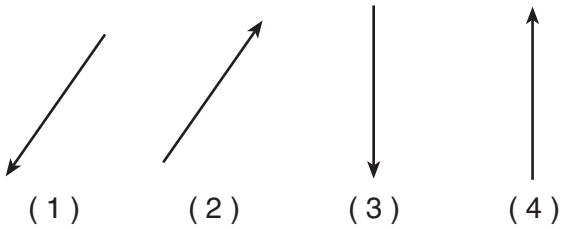
13 A 1.5-kilogram lab cart is accelerated uniformly from rest to a speed of 2.0 meters per second in 0.50 second. What is the magnitude of the force producing this acceleration?

(1) 0.70 N
(2) 1.5 N
(3) 3.0 N
(4) 6.0 N

14 The diagram below represents the magnetic field near point *P*.



If a compass is placed at point *P* in the same plane as the magnetic field, which arrow represents the direction the north end of the compass needle will point?



15 Which person has the greatest inertia?

(1) a 110-kg wrestler resting on a mat
(2) a 90-kg man walking at 2 m/s
(3) a 70-kg long-distance runner traveling at 5 m/s
(4) a 50-kg girl sprinting at 10 m/s

16 A child is riding on a merry-go-round. As the speed of the merry-go-round is doubled, the magnitude of the centripetal force acting on the child

(1) remains the same
(2) is doubled
(3) is halved
(4) is quadrupled

17 The magnitude of the electrostatic force between two point charges is *F*. If the distance between the charges is doubled, the electrostatic force between the charges will become

(1) $\frac{F}{4}$
(2) $2F$
(3) $\frac{F}{2}$
(4) $4F$

Note that question 18 has only three choices.

18 As a ball falls freely (without friction) toward the ground, its total mechanical energy

(1) decreases
(2) increases
(3) remains the same

19 A 0.50-kilogram ball is thrown vertically upward with an initial kinetic energy of 25 joules. Approximately how high will the ball rise? [Neglect air resistance.]

(1) 2.6 m
(2) 5.1 m
(3) 13 m
(4) 25 m

20 What is the average power developed by a motor as it lifts a 400.-kilogram mass at constant speed through a vertical distance of 10.0 meters in 8.0 seconds?

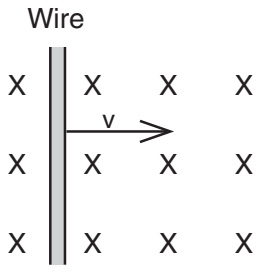
(1) 320 W
(2) 500 W
(3) 4,900 W
(4) 32,000 W

21 If 4.8×10^{-17} joule of work is required to move an electron between two points in an electric field, what is the electric potential difference between these points?

(1) 1.6×10^{-19} V
(2) 4.8×10^{-17} V
(3) 3.0×10^{2} V
(4) 4.8×10^{2} V

Note that question 22 has only three choices.

22 The diagram below shows a wire moving to the right at speed v through a uniform magnetic field that is directed into the page.



Magnetic field directed into page

As the speed of the wire is increased, the induced potential difference will

(1) decrease
(2) increase
(3) remain the same

23 A change in the speed of a wave as it enters a new medium produces a change in

(1) frequency
(2) period
(3) wavelength
(4) phase

24 Two identical resistors connected in parallel have an equivalent resistance of 40. ohms. What is the resistance of each resistor?

(1) 20. Ω
(2) 40. Ω
(3) 80. Ω
(4) 160 Ω

25 A tuning fork oscillates with a frequency of 256 hertz after being struck by a rubber hammer. Which phrase best describes the sound waves produced by this oscillating tuning fork?

(1) electromagnetic waves that require no medium for transmission
(2) electromagnetic waves that require a medium for transmission
(3) mechanical waves that require no medium for transmission
(4) mechanical waves that require a medium for transmission

26 In a vacuum, all electromagnetic waves have the same

(1) wavelength
(2) frequency
(3) speed
(4) amplitude

27 The speed of light ($f = 5.09 \times 10^{14}$ Hz) in a transparent material is 0.75 times its speed in air. The absolute index of refraction of the material is approximately

(1) 0.75
(2) 1.3
(3) 2.3
(4) 4.0

28 Waves pass through a 10.-centimeter opening in a barrier without being diffracted. This observation provides evidence that the wavelength of the waves is

(1) much shorter than 10. cm
(2) equal to 10. cm
(3) longer than 10. cm, but shorter than 20. cm
(4) longer than 20. cm

29 Standing waves in water are produced most often by periodic water waves

(1) being absorbed at the boundary with a new medium
(2) refracting at a boundary with a new medium
(3) diffracting around a barrier
(4) reflecting from a barrier

Note that question 30 has only three choices.

30 A sound of constant frequency is produced by the siren on top of a firehouse. Compared to the frequency produced by the siren, the frequency observed by a firefighter approaching the firehouse is

(1) lower
(2) higher
(3) the same

31 White light is passed through a cloud of cool hydrogen gas and then examined with a spectroscope. The dark lines observed on a bright background are caused by

(1) the hydrogen emitting all frequencies in white light
(2) the hydrogen absorbing certain frequencies of the white light
(3) diffraction of the white light
(4) constructive interference

32 Compared to a photon of red light, a photon of blue light has a

(1) greater energy
(2) longer wavelength
(3) smaller momentum
(4) lower frequency

33 Protons and neutrons are examples of

(1) positrons
(2) baryons
(3) mesons
(4) quarks

34 The strong force is the force of

(1) repulsion between protons
(2) attraction between protons and electrons
(3) repulsion between nucleons
(4) attraction between nucleons

35 If a deuterium nucleus has a mass of 1.53×10^{-3} universal mass units less than its components, this mass represents an energy of

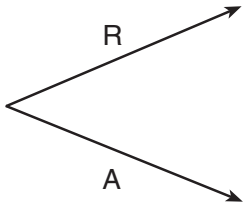
(1) 1.38 MeV
(2) 1.42 MeV
(3) 1.53 MeV
(4) 3.16 MeV

Part B–1

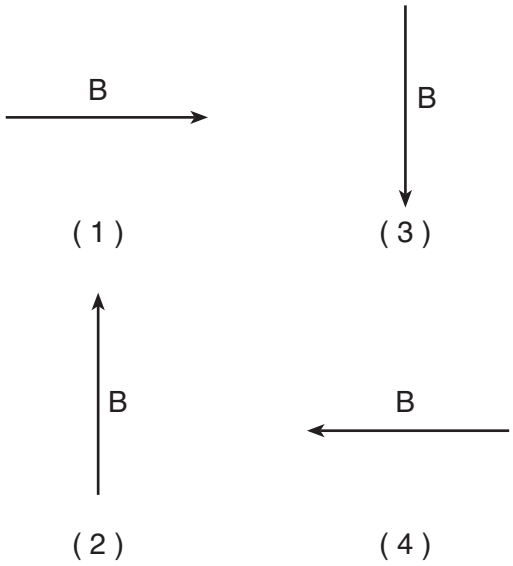
Answer all questions in this part.

Directions (36–47): 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 Forces *A* and *B* have a resultant *R*. Force *A* and resultant *R* are represented in the diagram below.



Which vector best represents force *B*?



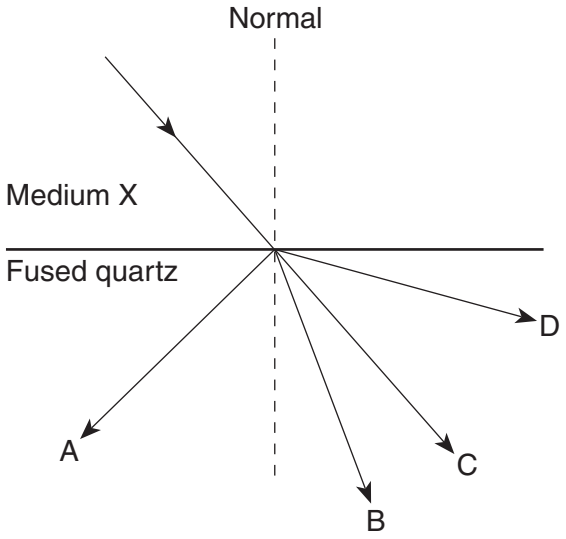
37 An object with a net charge of 4.80×10^{-6} coulomb experiences an electrostatic force having a magnitude of 6.00×10^{-2} newton when placed near a negatively charged metal sphere. What is the electric field strength at this location?

(1) 1.25×10^{4} N/C directed away from the sphere
(2) 1.25×10^{4} N/C directed toward the sphere
(3) 2.88×10^{-8} N/C directed away from the sphere
(4) 2.88×10^{-8} N/C directed toward the sphere

38 What is the approximate width of a person's little finger?

(1) 1 m
(2) 0.1 m
(3) 0.01 m
(4) 0.001 m

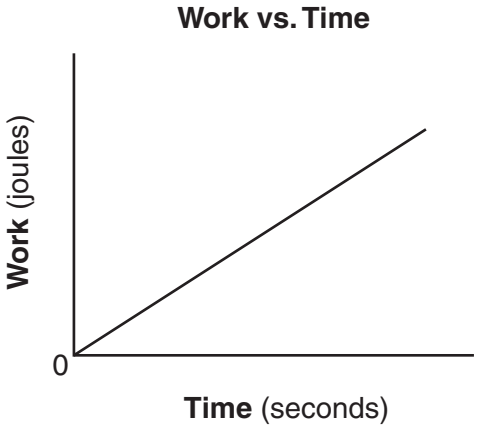
39 The diagram below represents a ray of monochromatic light ($f = 5.09 \times 10^{14}$ Hz) passing from medium X ($n = 1.46$) into fused quartz.



Which path will the ray follow in the quartz?

(1) A
(2) B
(3) C
(4) D

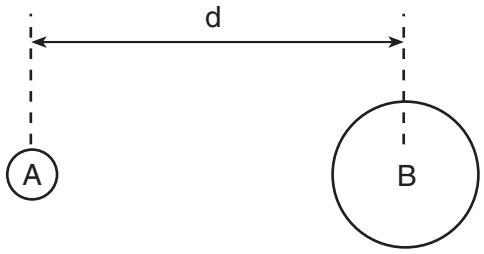
40 The graph below shows the relationship between the work done by a student and the time of ascent as the student runs up a flight of stairs.



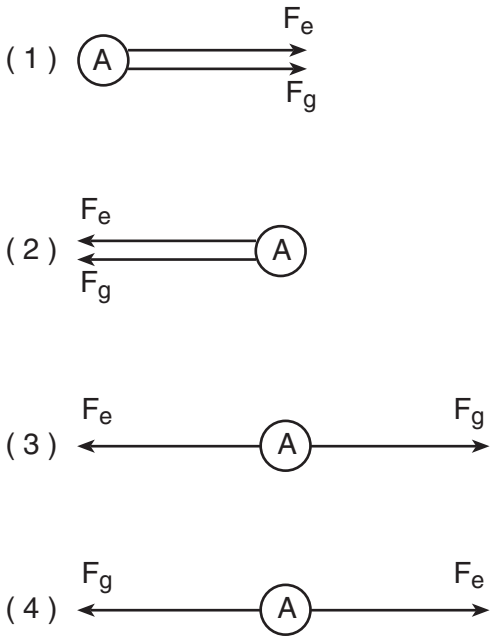
The slope of the graph would have units of

(1) joules
(2) seconds
(3) watts
(4) newtons

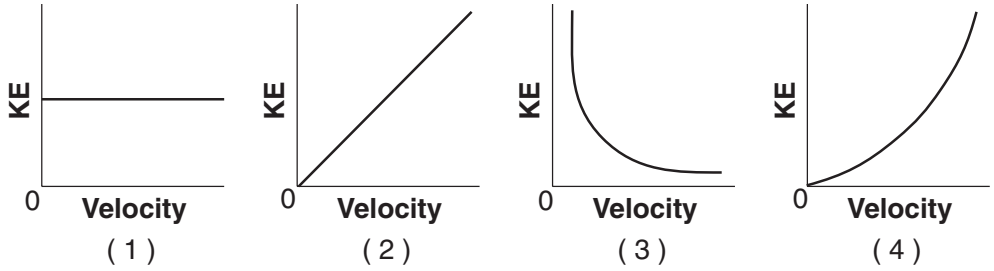
41 In the diagram below, two positively charged spheres, A and B, of masses m_A and m_B are located a distance d apart.



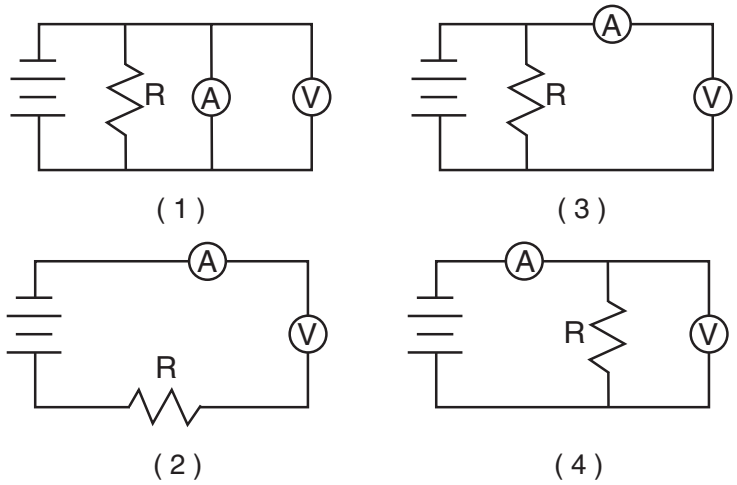
Which diagram best represents the directions of the gravitational force, F_g, and the electrostatic force, F_e, acting on sphere A due to the mass and charge of sphere B? [Vectors are not drawn to scale.]



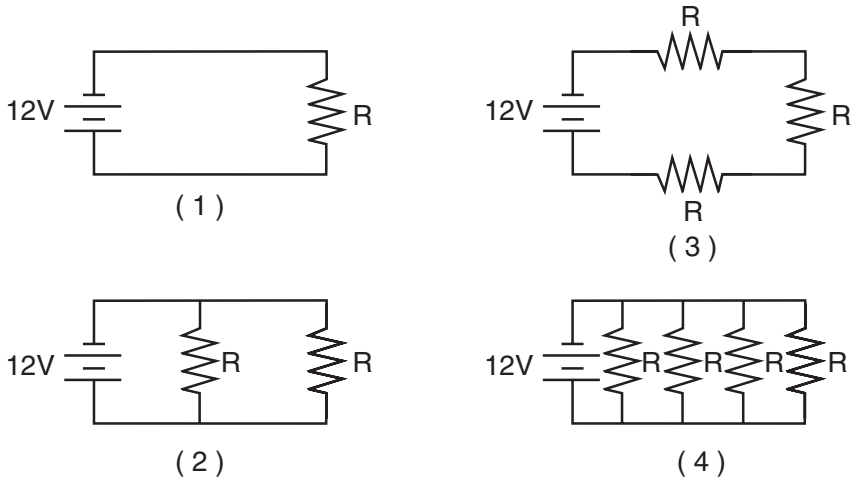
42 Which graph best represents the relationship between the kinetic energy, *KE*, and the velocity of an object accelerating in a straight line?



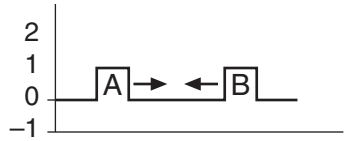
43 Which circuit diagram below correctly shows the connection of ammeter *A* and voltmeter *V* to measure the current through and potential difference across resistor *R*?



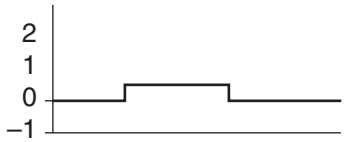
44 Identical resistors (*R*) are connected across the same 12-volt battery. Which circuit uses the greatest power?



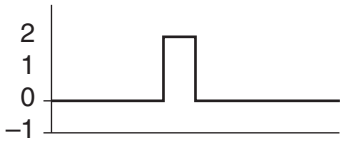
45 The diagram below shows two pulses, *A* and *B*, approaching each other in a uniform medium.



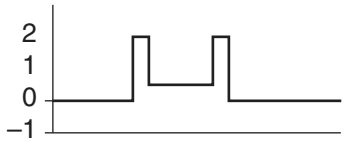
Which diagram best represents the superposition of the two pulses?



(1)



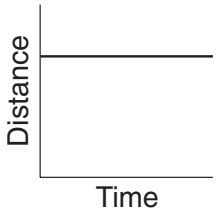
(3)



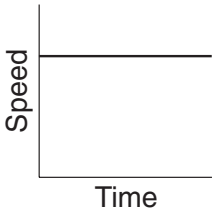
(2)

(4)

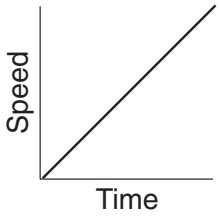
46 Which graph best represents the motion of an object that is *not* in equilibrium as it travels along a straight line?



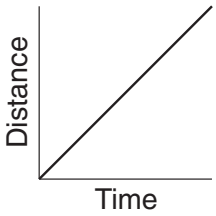
(1)



(3)

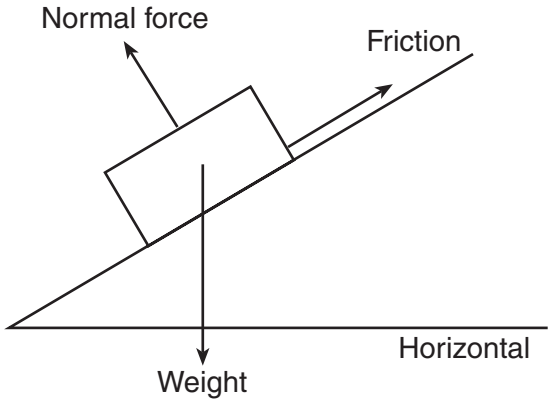


(2)



(4)

47 Three forces act on a box on an inclined plane as shown in the diagram below. [Vectors are not drawn to scale.]



If the box is at rest, the net force acting on it is equal to

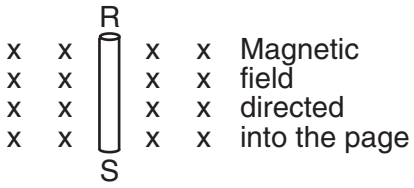
(1) the weight
(2) the normal force
(3) friction
(4) zero

Part B–2

Answer all questions in this part.

Directions (48–63): Record your answers in the spaces provided in your answer booklet.

48 The diagram below represents a wire conductor, *RS*, positioned perpendicular to a uniform magnetic field directed into the page.



Describe the direction in which the wire could be moved to produce the maximum potential difference across its ends, *R* and *S*. [1]

49 Rubbing a moistened finger around the rim of a water glass transfers energy to the glass at the natural frequency of the glass. Which wave phenomenon is responsible for this effect? [1]

50 Explain why a hydrogen atom in the ground state can absorb a 10.2-electronvolt photon, but can *not* absorb an 11.0-electronvolt photon. [1]

Base your answers to questions 51 and 52 on the information below.

A hiker walks 5.00 kilometers due north and then 7.00 kilometers due east.

51 What is the magnitude of her resultant displacement? [1]

52 What total distance has she traveled? [1]

53 What is the magnitude of the charge, in coulombs, of a lithium nucleus containing three protons and four neutrons? [1]

54 A light bulb attached to a 120.-volt source of potential difference draws a current of 1.25 amperes for 35.0 seconds. Calculate how much electrical energy is used by the bulb. [Show all work, including the equation and substitution with units.] [2]

55 Calculate the wavelength in a vacuum of a radio wave having a frequency of 2.2×10^6 hertz. [Show all work, including the equation and substitution with units.] [2]

56 Two monochromatic, coherent light beams of the same wavelength converge on a screen. The point at which the beams converge appears dark. Which wave phenomenon best explains this effect? [1]

57 Exposure to ultraviolet radiation can damage skin. Exposure to visible light does not damage skin. State *one* possible reason for this difference. [1]

Base your answers to questions 58 through 61 on the information and data table below.

In an experiment, a student measured the length and period of a simple pendulum. The data table lists the length (ℓ) of the pendulum in meters and the square of the period (T^2) of the pendulum in seconds^2.

Length (ℓ) (meters)	**Square of Period** (T^2) (seconds^2)
0.100	0.410
0.300	1.18
0.500	1.91
0.700	2.87
0.900	3.60

Directions (58–59): Using the information in the data table, construct a graph on the grid *provided in your answer booklet*, following the directions below.

58 Plot the data points for the square of period versus length. [1]

59 Draw the best-fit straight line. [1]

60 Using your graph, determine the time in seconds it would take this pendulum to make one complete swing if it were 0.200 meter long. [1]

61 The period of a pendulum is related to its length by the formula: $T^2 = \left(\frac{4\pi^2}{g}\right) \cdot \ell$ where g represents the acceleration due to gravity. Explain how the graph you have drawn could be used to calculate the value of g. [You do *not* need to perform any actual calculations.] [1]

62 A student is given two pieces of iron and told to determine if one or both of the pieces are magnets. First, the student touches an end of one piece to one end of the other. The two pieces of iron attract. Next, the student reverses one of the pieces and again touches the ends together. The two pieces attract again. What does the student definitely know about the initial magnetic properties of the two pieces of iron? [1]

63 When a child squeezes the nozzle of a garden hose, water shoots out of the hose toward the east. What is the compass direction of the force being exerted on the child by the nozzle? [1]

Part C

Answer all questions in this part.

Directions (64–76): Record your answers in the spaces provided in your answer booklet.

Base your answers to questions 64 through 68 on the information and data table below.

Three lamps were connected in a circuit with a battery of constant potential. The current, potential difference, and resistance for each lamp are listed in the data table below. [There is negligible resistance in the wires and the battery.]

	Current (A)	**Potential Difference** (V)	**Resistance** (Ω)
lamp 1	0.45	40.1	89
lamp 2	0.11	40.1	365
lamp 3	0.28	40.1	143

64 Using the circuit symbols found in the *Reference Tables for Physical Setting/Physics,* draw a circuit showing how the lamps and battery are connected. [2]

65 What is the potential difference supplied by the battery? [1]

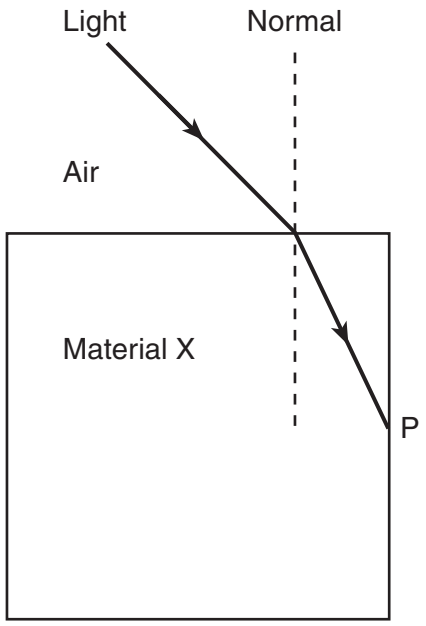
66 Calculate the equivalent resistance of the circuit. [Show all work, including the equation and substitution with units.] [2]

67 If lamp 3 is removed from the circuit, what would be the value of the potential difference across lamp 1 after lamp 3 is removed? [1]

68 If lamp 3 is removed from the circuit, what would be the value of the current in lamp 2 after lamp 3 is removed? [1]

Base your answers to questions 69 through 71 on the information and diagram below.

A ray of light passes from air into a block of transparent material *X* as shown in the diagram below.



69 Measure the angles of incidence and refraction to the nearest degree for this light ray at the air into material *X* boundary and write your answers in the appropriate spaces *in your answer booklet*. [2]

70 Calculate the absolute index of refraction of material *X*. [Show all work, including the equation and substitution with units.] [2]

71 The refracted light ray is reflected from the material *X*–air boundary at point *P*. Using a protractor and straightedge, on the diagram *in your answer booklet,* draw the reflected ray from point *P*. [1]

Base your answers to questions 72 through 74 on the information below.

A 50.-kilogram child running at 6.0 meters per second jumps onto a stationary 10.-kilogram sled. The sled is on a level frictionless surface.

72 Calculate the speed of the sled with the child after she jumps onto the sled. [Show all work, including the equation and substitution with units.] [2]

73 Calculate the kinetic energy of the sled with the child after she jumps onto the sled. [Show all work, including the equation and substitution with units.] [2]

74 After a short time, the moving sled with the child aboard reaches a rough level surface that exerts a constant frictional force of 54 newtons on the sled. How much work must be done by friction to bring the sled with the child to a stop? [1]

Base your answers to questions 75 and 76 on the information below.

Louis de Broglie extended the idea of wave-particle duality to all of nature with his matter-wave equation, $\lambda = \frac{h}{mv}$, where λ is the particle's wavelength, m is its mass, v is its velocity, and h is Planck's constant.

75 Using this equation, calculate the de Broglie wavelength of a helium nucleus (mass = 6.7×10^{-27} kg) moving with a speed of 2.0×10^{6} meters per second. [Show all work, including the equation and substitution with units.] [2]

76 The wavelength of this particle is of the same order of magnitude as which type of electromagnetic radiation? [1]

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The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
PHYSICS

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

ANSWER SHEET

Student ..... Sex: ☐ Male ☐ Female Grade .....

Teacher ..... School .....

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

Part A

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

Part A Score

Part B–1

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

Part B–1 Score

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.

Signature

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
PHYSICS

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

ANSWER BOOKLET

Student ..... Sex: ☐ Male ☐ Female

Teacher .....

School ..... Grade .....

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

Part	Maximum Score	Student's Score
A	35	
B–1	12	
B–2	18	
C	20	

Total Written Test Score (Maximum Raw Score: 85)

Final Score (From Conversion Chart)

Raters' Initials:

Rater 1 ..... **Rater 2** .....

Part B–2

48 _____

_____

49 _____

50 _____

_____

51 _____km

52 _____km

53 _____C

54

55

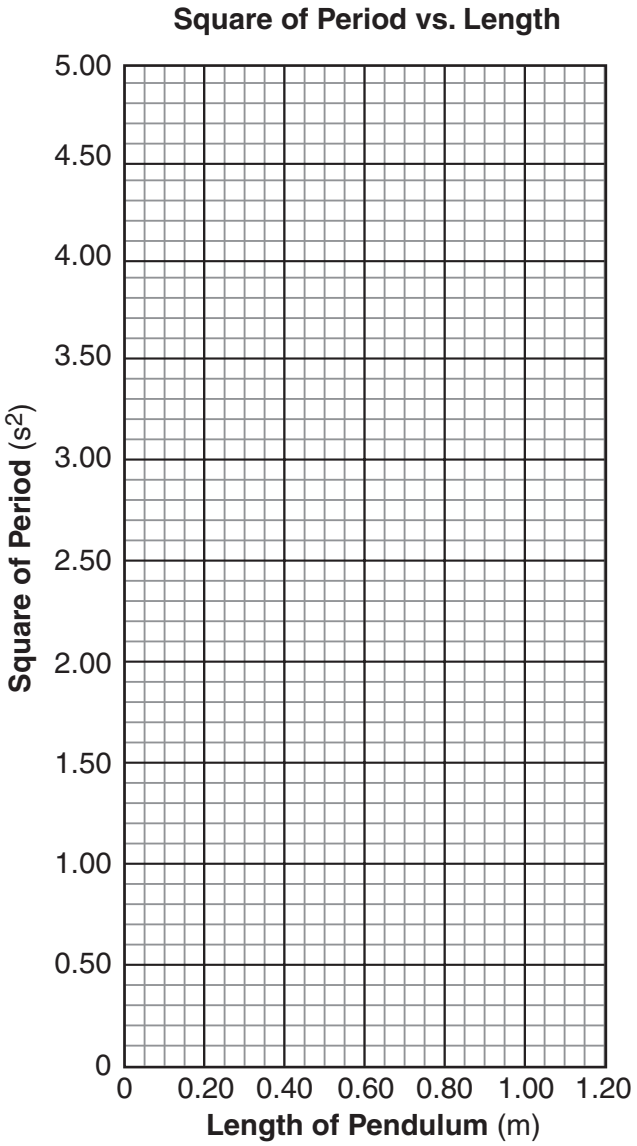
[OVER]

56 _____

57 _____

_____

58–59



60 _____ **s**

61 _____

_____

_____

_____

62 _____

_____

63 _____

Part C

64

65 _____**v**

66

67 _____**v**

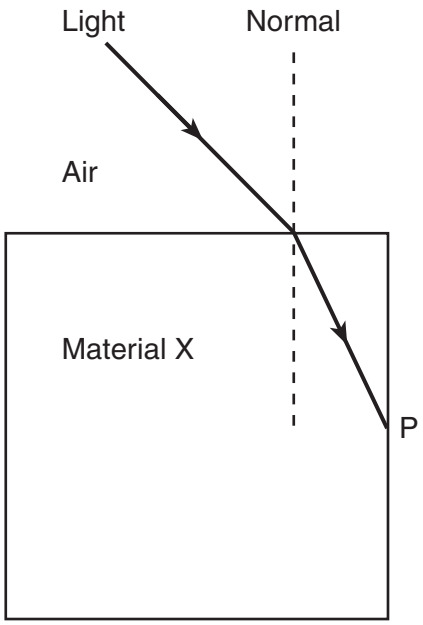
68 _____**A**

69 **angle of incidence =** _____°

angle of refraction = _____°

70

71



72

73

74 _____**J**

75

76 _____

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.

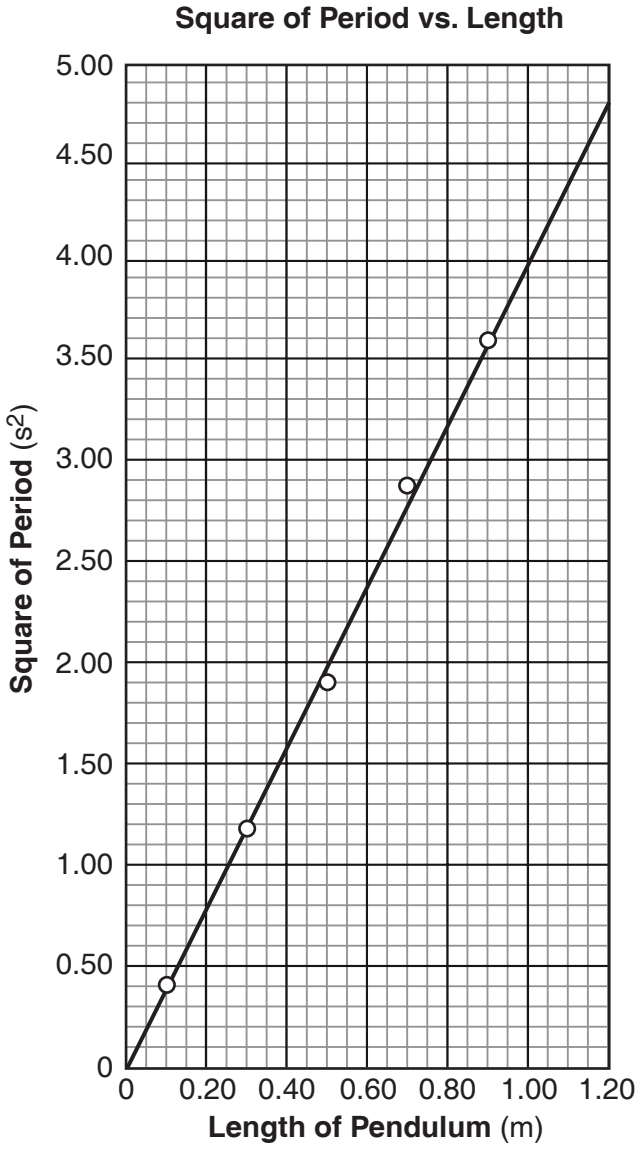
57 Allow 1 credit for stating a reason why exposure to visible light does not damage skin, while exposure to ultraviolet radiation can. Acceptable responses include, but are not limited to:

— 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.

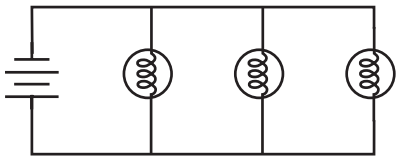
63 Allow 1 credit for **west**.

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.

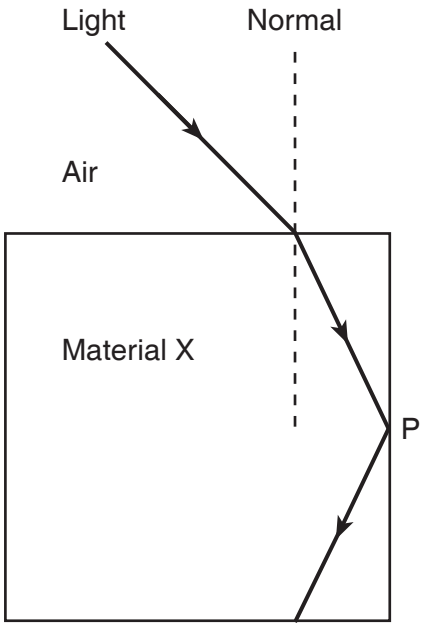
Example of Acceptable Response

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

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

Attachment D

University of the State of New York
State Education Department

New Scoring Chart for June 2003 Physics Regents Exam

Physics 2003		Physics 2003		Physics 2003	
Original Scaled Score	Revised Scaled Score	Original Scaled Score	Revised Scaled Score	Original Scaled Score	Revised Scaled Score
0	0	32	51	66	79
1	2	33	52	67	80
2	5	34	53	68	81
3	7	35	54	70	81
4	9	36	56	71	82
5	11	38	57	72	83
6	13	39	58	73	84
7	15	40	59	75	84
9	17	41	60	76	85
10	19	42	61	77	86
11	21	43	62	78	87
12	23	44	63	80	87
13	25	46	64	81	88
14	27	47	65	82	89
15	28	48	66	83	90
16	30	49	67	85	90
17	32	50	68	86	91
18	33	52	69	87	92

19	35		53	70		88	93
21	37		54	71		90	94
22	38		55	72		91	94
23	40		56	73		92	95
24	41		58	73		94	96
25	43		59	74		95	97
26	44		60	75		96	98
27	45		61	76		97	98
28	47		62	77		99	99
30	48		64	77		100	100
31	49		65	78			

Back to:
Field Memo
Attachment A: June 2002 Conversion Chart
Attachment B: August 2002 Conversion Chart
Attachment C: January 03 Conversion Chart