The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
PHYSICS

Thursday, January 27, 2005 — 9:15 a.m. to 12:15 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 A ball dropped from rest falls freely until it hits the ground with a speed of 20 meters per second. The time during which the ball is in free fall is approximately

(1) 1 s
(2) 2 s
(3) 0.5 s
(4) 10 s

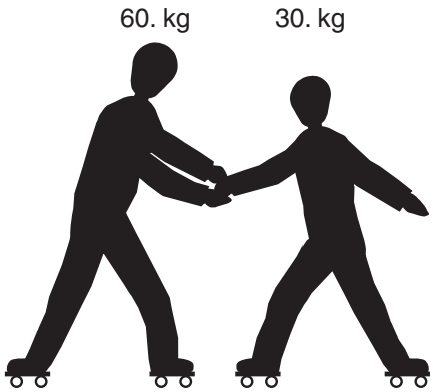
2 In a 4.0-kilometer race, a runner completes the first kilometer in 5.9 minutes, the second kilometer in 6.2 minutes, the third kilometer in 6.3 minutes, and the final kilometer in 6.0 minutes. The average speed of the runner for the race is approximately

(1) 0.16 km/min
(2) 0.33 km/min
(3) 12 km/min
(4) 24 km/min

3 A golf ball is hit with an initial velocity of 15 meters per second at an angle of 35 degrees above the horizontal. What is the vertical component of the golf ball's initial velocity?

(1) 8.6 m/s
(2) 9.8 m/s
(3) 12 m/s
(4) 15 m/s

4 In the diagram below, a 60.-kilogram rollerskater exerts a 10.-newton force on a 30.-kilogram rollerskater for 0.20 second.

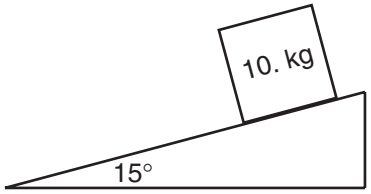


What is the magnitude of the impulse applied to the 30.-kilogram rollerskater?

(1) 50. N•s
(2) 2.0 N•s
(3) 6.0 N•s
(4) 12 N•s

Note that question 5 has only three choices.

5 In the diagram below, a 10.-kilogram block is at rest on a plane inclined at 15° to the horizontal.



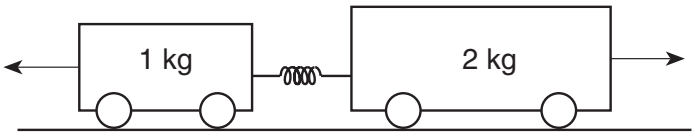
As the angle of the incline is increased to 30.°, the mass of the block will

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

6 If the direction of a moving car changes and its speed remains constant, which quantity must remain the same?

(1) velocity
(2) momentum
(3) displacement
(4) kinetic energy

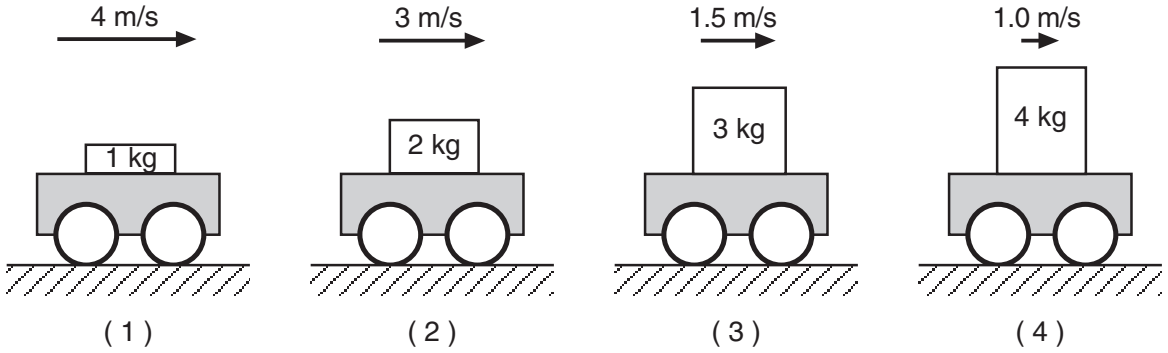
7 Two carts are pushed apart by an expanding spring, as shown in the diagram below.



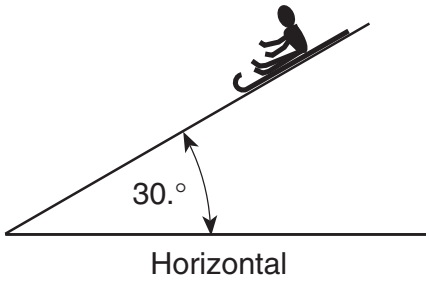
If the average force on the 1-kilogram cart is 1 newton, what is the average force on the 2-kilogram cart?

(1) 1 N
(2) 0.0 N
(3) 0.5 N
(4) 4 N

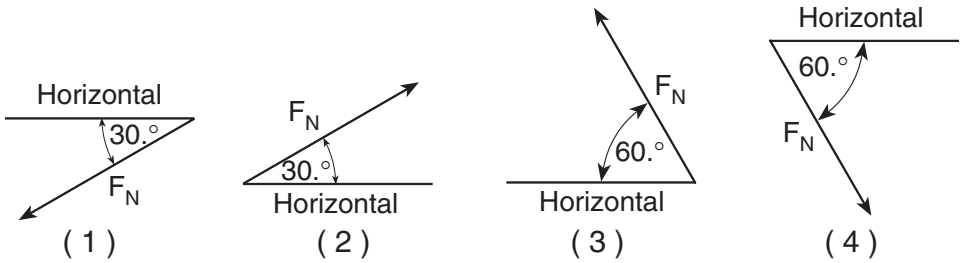
8 A lab cart is loaded with different masses and moved at various velocities. Which diagram shows the cart-mass system with the greatest inertia?



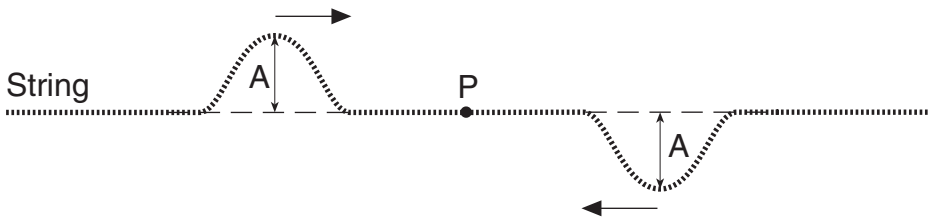
9 The diagram below shows a sled and rider sliding down a snow-covered hill that makes an angle of 30.° with the horizontal.



Which vector best represents the direction of the normal force, F_N, exerted by the hill on the sled?



10 The diagram below shows two pulses of equal amplitude, A, approaching point P along a uniform string.



When the two pulses meet at P, the vertical displacement of the string at P will be

(1) A
(2) $2A$
(3) 0
(4) $\frac{A}{2}$

11 The energy of a water wave is most closely related to its

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

12 Which form(s) of energy can be transmitted through a vacuum?

(1) light, only
(2) sound, only
(3) both light and sound
(4) neither light nor sound

13 A tuning fork vibrating in air produces sound waves. These waves are best classified as

(1) transverse, because the air molecules are vibrating parallel to the direction of wave motion
(2) transverse, because the air molecules are vibrating perpendicular to the direction of wave motion
(3) longitudinal, because the air molecules are vibrating parallel to the direction of wave motion
(4) longitudinal, because the air molecules are vibrating perpendicular to the direction of wave motion

14 A student in a band notices that a drum vibrates when another instrument emits a certain frequency note. This phenomenon illustrates

(1) reflection (3) refraction
(2) resonance (4) diffraction

15 Which quantity is equivalent to the product of the absolute index of refraction of water and the speed of light in water?

(1) wavelength of light in a vacuum
(2) frequency of light in water
(3) sine of the angle of incidence
(4) speed of light in a vacuum

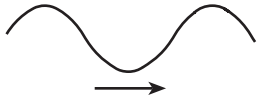
16 Radio waves and gamma rays traveling in space have the same

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

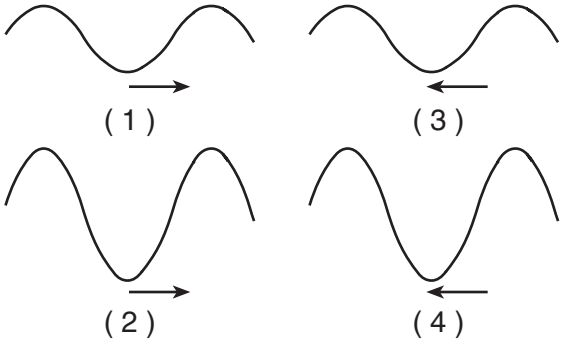
17 The spreading of a wave into the region behind an obstruction is called

(1) diffraction (3) reflection
(2) absorption (4) refraction

18 The diagram below represents a wave moving toward the right side of this page.



Which wave shown below could produce a standing wave with the original wave?



19 A train sounds a whistle of constant frequency as it leaves the train station. Compared to the sound emitted by the whistle, the sound that the passengers standing on the platform hear has a frequency that is

(1) lower, because the sound-wave fronts reach the platform at a frequency lower than the frequency at which they are produced
(2) lower, because the sound waves travel more slowly in the still air above the platform than in the rushing air near the train
(3) higher, because the sound-wave fronts reach the platform at a frequency higher than the frequency at which they are produced
(4) higher, because the sound waves travel faster in the still air above the platform than in the rushing air near the train

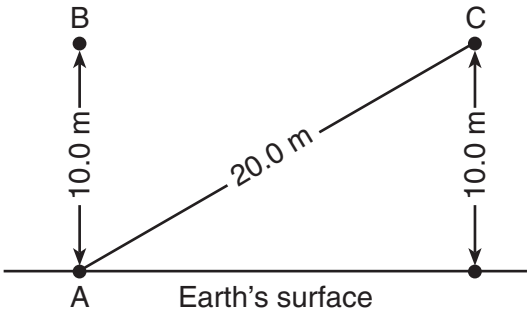
20 What is the gravitational potential energy with respect to the surface of the water of a 75.0-kilogram diver located 3.00 meters above the water?

(1) 2.17×10^4 J
(2) 2.21×10^3 J
(3) 2.25×10^2 J
(4) 2.29×10^1 J

21 A 60.0-kilogram runner has 1920 joules of kinetic energy. At what speed is she running?

(1) 5.66 m/s
(2) 8.00 m/s
(3) 32.0 m/s
(4) 64.0 m/s

22 The diagram below shows points *A*, *B*, and *C* at or near Earth's surface. As a mass is moved from *A* to *B*, 100. joules of work are done against gravity.



What is the amount of work done against gravity as an identical mass is moved from *A* to *C*?

(1) 100. J
(2) 173 J
(3) 200. J
(4) 273 J

23 When a force moves an object over a rough, horizontal surface at a constant velocity, the work done against friction produces an increase in the object's

(1) weight
(2) momentum
(3) potential energy
(4) internal energy

24 A motor used 120. watts of power to raise a 15-newton object in 5.0 seconds. Through what vertical distance was the object raised?

(1) 1.6 m
(2) 8.0 m
(3) 40. m
(4) 360 m

25 In an electric field, 0.90 joule of work is required to bring 0.45 coulomb of charge from point *A* to point *B*. What is the electric potential difference between points *A* and *B*?

(1) 5.0 V
(2) 2.0 V
(3) 0.50 V
(4) 0.41 V

26 In a flashlight, a battery provides a total of 3.0 volts to a bulb. If the flashlight bulb has an operating resistance of 5.0 ohms, the current through the bulb is

(1) 0.30 A
(2) 0.60 A
(3) 1.5 A
(4) 1.7 A

Note that question 27 has only three choices.

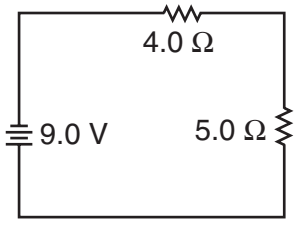
27 A complete circuit is left on for several minutes, causing the connecting copper wire to become hot. As the temperature of the wire increases, the electrical resistance of the wire

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

28 A 1.5-volt, AAA cell supplies 750 milliamperes of current through a flashlight bulb for 5.0 minutes, while a 1.5-volt, C cell supplies 750 milliamperes of current through the same flashlight bulb for 20. minutes. Compared to the total charge transferred by the AAA cell through the bulb, the total charge transferred by the C cell through the bulb is

(1) half as great
(2) twice as great
(3) the same
(4) four times as great

29 A 9.0-volt battery is connected to a 4.0-ohm resistor and a 5.0-ohm resistor as shown in the diagram below.



What is the current in the 5.0-ohm resistor?

(1) 1.0 A
(2) 1.8 A
(3) 2.3 A
(4) 4.0 A

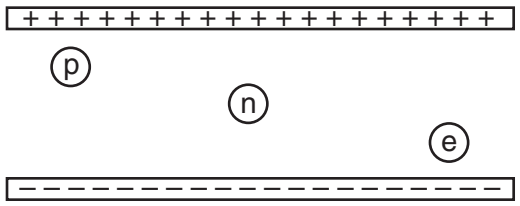
30 A 100.-ohm resistor and an unknown resistor are connected in series to a 10.0-volt battery. If the potential drop across the 100.-ohm resistor is 4.00 volts, the resistance of the unknown resistor is

(1) 50.0 Ω
(2) 100. Ω
(3) 150. Ω
(4) 200. Ω

31 If the potential difference applied to a fixed resistance is doubled, the power dissipated by that resistance

(1) remains the same
(2) doubles
(3) halves
(4) quadruples

32 In the diagram below, proton *p*, neutron *n*, and electron *e* are located as shown between two oppositely charged plates.



The magnitude of acceleration will be greatest for the

(1) neutron, because it has the greatest mass
(2) neutron, because it is neutral
(3) electron, because it has the smallest mass
(4) proton, because it is farthest from the negative plate

33 Two protons are located one meter apart. Compared to the gravitational force of attraction between the two protons, the electrostatic force between the protons is

(1) stronger and repulsive
(2) weaker and repulsive
(3) stronger and attractive
(4) weaker and attractive

34 A meson may *not* have a charge of

(1) +1e
(2) +2e
(3) 0e
(4) −1e

35 A balloon is rubbed against a student's hair and then touched to a wall. The balloon "sticks" to the wall due to

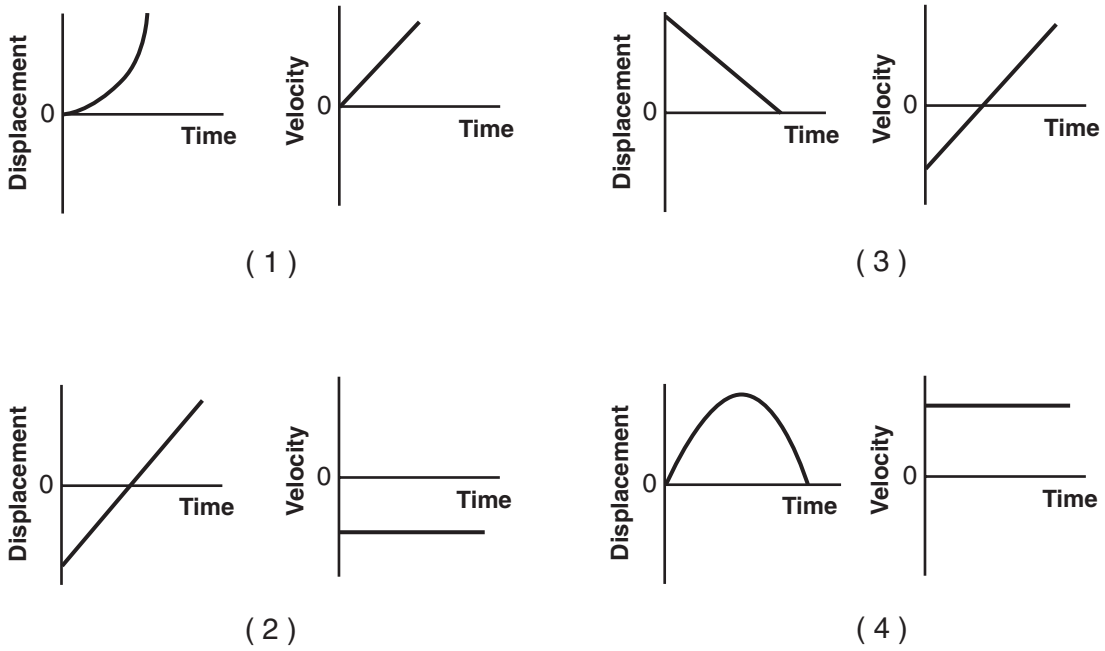
(1) electrostatic forces between the particles of the balloon
(2) magnetic forces between the particles of the wall
(3) electrostatic forces between the particles of the balloon and the particles of the wall
(4) magnetic forces between the particles of the balloon and the particles of the wall

Part B–1

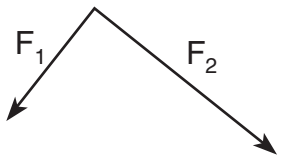
Answer all questions in this part.

Directions (36–48): 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.

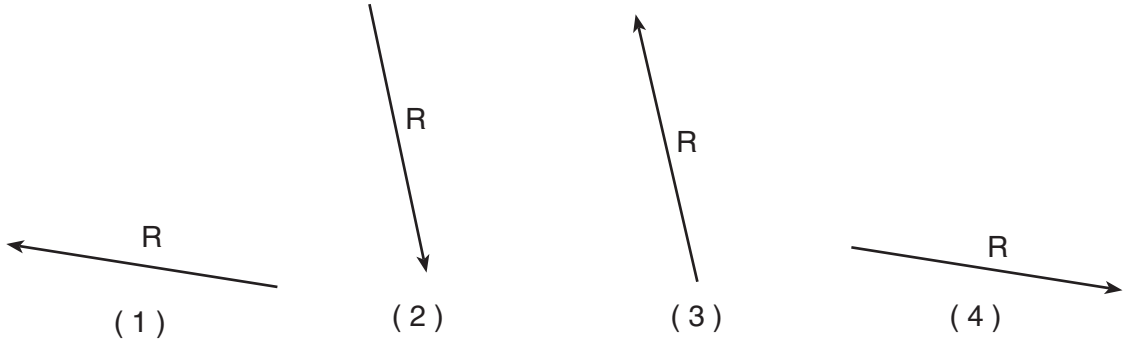
36 Which pair of graphs represents the same motion of an object?



37 The vector diagram below represents two forces, F_1 and F_2, simultaneously acting on an object.



Which vector best represents the resultant of the two forces?



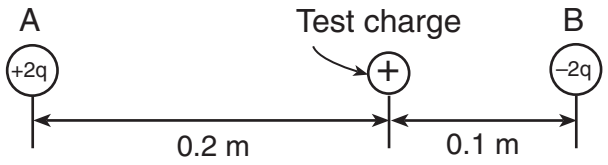
38 An egg is dropped from a third-story window. The distance the egg falls from the window to the ground is closest to

(1) 10^0 m
(2) 10^1 m
(3) 10^2 m
(4) 10^3 m

39 Which unit is equivalent to a newton per kilogram?

(1) $\frac{m}{s^2}$
(2) $\frac{W}{m}$
(3) J•s
(4) $\frac{kg \bullet m}{s}$

40 In the diagram below, a positive test charge is located between two charged spheres, *A* and *B*. Sphere *A* has a charge of $+2q$ and is located 0.2 meter from the test charge. Sphere *B* has a charge of $-2q$ and is located 0.1 meter from the test charge.



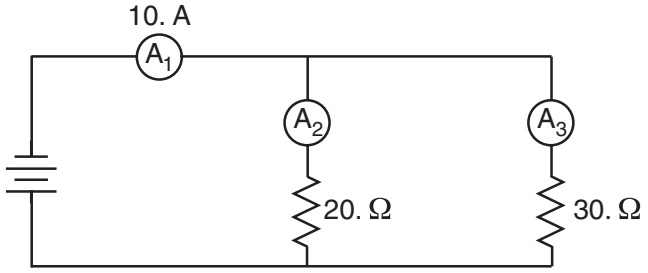
If the magnitude of the force on the test charge due to sphere *A* is *F*, what is the magnitude of the force on the test charge due to sphere *B*?

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

41 Electrons oscillating with a frequency of 2.0×10^{10} hertz produce electromagnetic waves. These waves would be classified as

(1) infrared
(2) visible
(3) microwave
(4) x ray

42 In the circuit diagram shown below, ammeter A_1 reads 10. amperes.



What is the reading of ammeter A_2?

(1) 6.0 A
(2) 10. A
(3) 20. A
(4) 4.0 A

43 According to the Standard Model, a proton is constructed of two up quarks and one down quark (*uud*) and a neutron is constructed of one up quark and two down quarks (*udd*). During beta decay, a neutron decays into a proton, an electron, and an electron antineutrino. During this process there is a conversion of a

(1) *u* quark to a *d* quark
(2) *d* quark to a meson
(3) baryon to another baryon
(4) lepton to another lepton

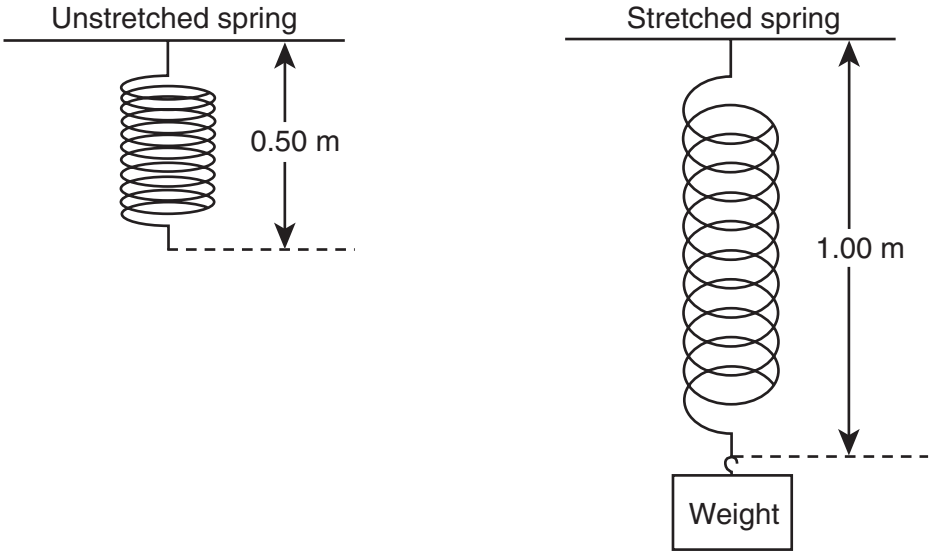
44 The bright-line emission spectrum of an element can best be explained by

(1) electrons transitioning between discrete energy levels in the atoms of that element
(2) protons acting as both particles and waves
(3) electrons being located in the nucleus
(4) protons being dispersed uniformly throughout the atoms of that element

45 How much energy is required to move an electron in a mercury atom from the ground state to energy level *h*?

(1) 1.57 eV
(2) 8.81 eV
(3) 10.38 eV
(4) 11.95 eV

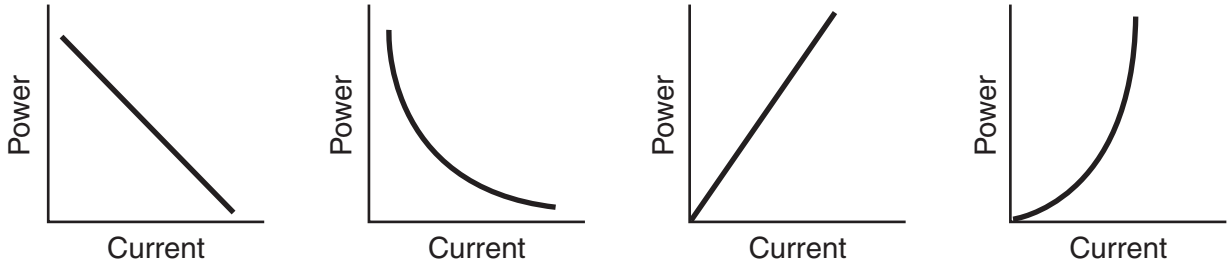
46 As shown in the diagram below, a 0.50-meter-long spring is stretched from its equilibrium position to a length of 1.00 meter by a weight.



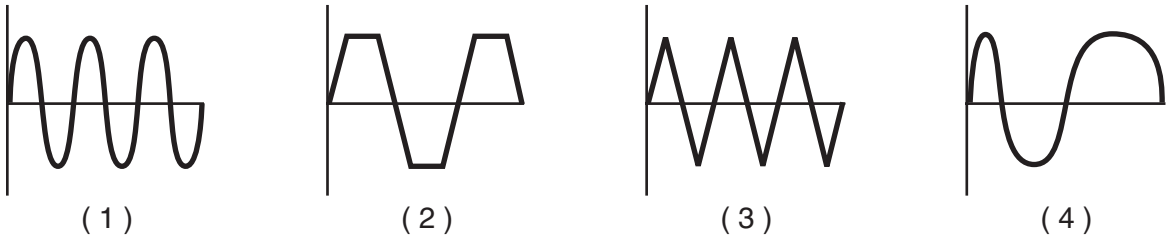
If 15 joules of energy are stored in the stretched spring, what is the value of the spring constant?

(1) 30. N/m
(2) 60. N/m
(3) 120 N/m
(4) 240 N/m

47 Which graph best represents the relationship between the electrical power and the current in a resistor that obeys Ohm's Law?



48 Which diagram below does *not* represent a periodic wave?



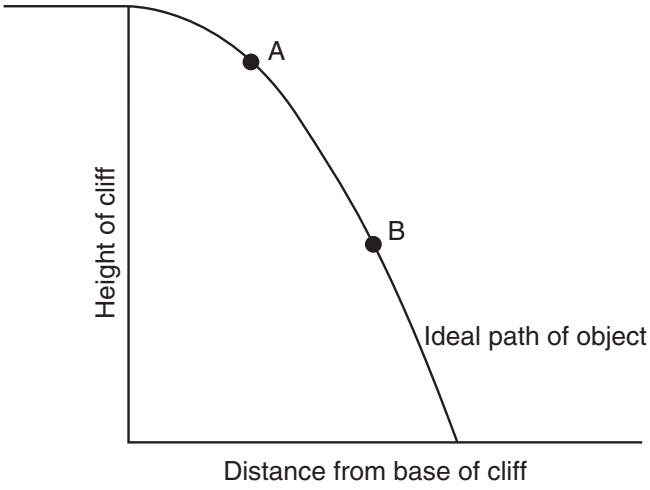
Part B–2

Answer all questions in this part.

Directions (49–61): Record your answers in the spaces provided in your answer booklet.

Base your answers to questions 49 through 51 on the information and diagram below.

An object was projected horizontally from a tall cliff. The diagram below represents the path of the object, neglecting friction.



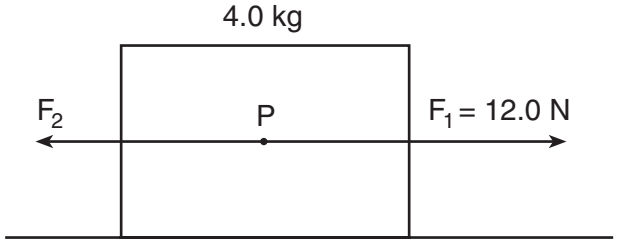
49 How does the magnitude of the horizontal component of the object's velocity at point *A* compare with the magnitude of the horizontal component of the object's velocity at point *B*? [1]

50 How does the magnitude of the vertical component of the object's velocity at point *A* compare with the magnitude of the vertical component of the object's velocity at point *B*? [1]

51 On the diagram *in your answer booklet,* sketch a likely path of the horizontally projected object, assuming that it was subject to air resistance. [1]

Base your answers to questions 52 through 54 on the information and diagram below.

In the scaled diagram, two forces, F_1 and F_2, act on a 4.0-kilogram block at point *P*. Force F_1 has a magnitude of 12.0 newtons, and is directed toward the right.



(Drawn to scale)

52 Using a ruler and the scaled diagram, determine the magnitude of F_2 in newtons. [1]

53 Determine the magnitude of the net force acting on the block. [1]

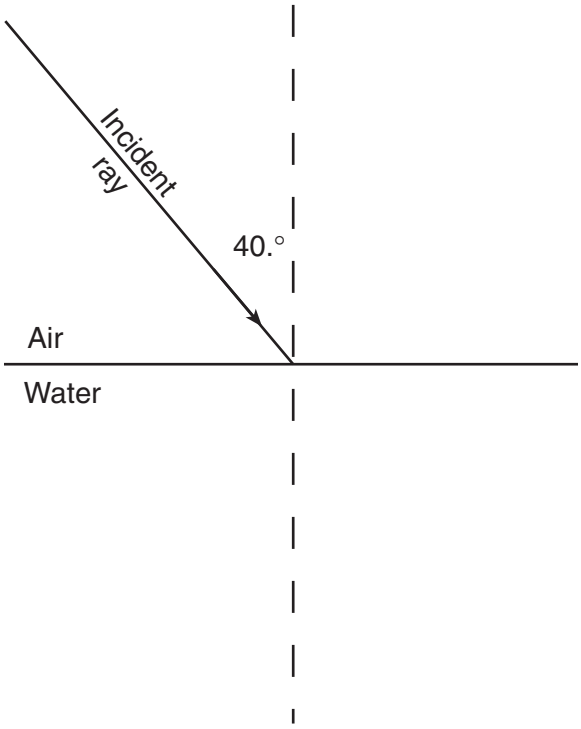
54 Calculate the magnitude of the acceleration of the block. [Show all work, including the equation and substitution with units.] [2]

55 The coefficient of kinetic friction between a 780.-newton crate and a level warehouse floor is 0.200. Calculate the magnitude of the horizontal force required to move the crate across the floor at constant speed. [Show all work, including the equation and substitution with units.] [2]

56 A photon has a wavelength of 9.00×10^{-10} meter. Calculate the energy of this photon in joules. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 57 through 59 on the information and diagram below.

A light ray with a frequency of 5.09×10^{14} hertz traveling in air is incident at an angle of 40.° on an air-water interface as shown. At the interface, part of the ray is refracted as it enters the water and part of the ray is reflected from the interface.



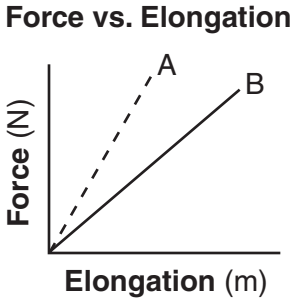
57 Calculate the angle of refraction of the light ray as it enters the water. [Show all work, including the equation and substitution with units.] [2]

58 On the diagram *in your answer booklet*, using a protractor and straightedge, draw the refracted ray. Label this ray "Refracted ray." [1]

59 On the diagram *in your answer booklet*, using a protractor and straightedge, draw the reflected ray. Label this ray "Reflected ray." [1]

Base your answers to questions 60 and 61 on the information and graph below.

The graph represents the relationship between the force applied to each of two springs, *A* and *B*, and their elongations.



60 What physical quantity is represented by the slope of each line? [1]

61 A 1.0-kilogram mass is suspended from each spring. If each mass is at rest, how does the potential energy stored in spring *A* compare to the potential energy stored in spring *B*? [1]

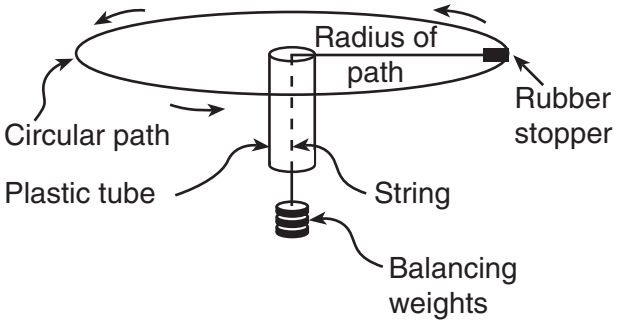
Part C

Answer all questions in this part.

Directions (62–74): Record your answers in the spaces provided in your answer booklet.

Base your answers to questions 62 through 65 on the information and diagram below.

In an experiment, a rubber stopper is attached to one end of a string that is passed through a plastic tube before weights are attached to the other end. The stopper is whirled in a horizontal circular path at constant speed.



62 On the diagram of the top view *in your answer booklet,* draw the path of the rubber stopper if the string breaks at the position shown. [1]

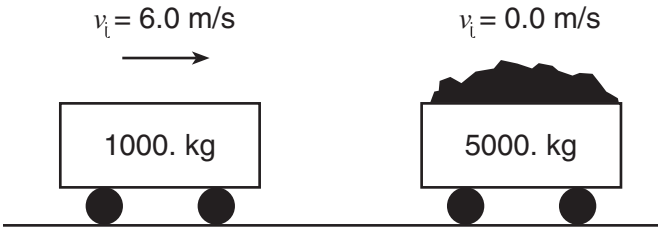
63 Describe what would happen to the radius of the circle if the student whirls the stopper at a greater speed without changing the balancing weights. [1]

64 List *three* measurements that must be taken to show that the magnitude of the centripetal force is equal to the balancing weights. [Neglect friction.] [3]

65 The rubber stopper is now whirled in a vertical circle at the same speed. On the diagram *in your answer booklet,* draw and label vectors to indicate the direction of the weight (F_g) and the direction of the centripetal force (F_c) at the position shown. [2]

Base your answers to questions 66 through 68 on the information and diagram below.

A 1000.-kilogram empty cart moving with a speed of 6.0 meters per second is about to collide with a stationary loaded cart having a total mass of 5000. kilograms, as shown. After the collision, the carts lock and move together. [Assume friction is negligible.]



66 Calculate the speed of the combined carts after the collision. [Show all work, including the equation and substitution with units.] [2]

67 Calculate the kinetic energy of the combined carts after the collision. [Show all work, including the equation and substitution with units.] [2]

68 How does the kinetic energy of the combined carts after the collision compare to the kinetic energy of the carts before the collision? [1]

Base your answers to questions 69 through 72 on the information and data table below.

An experiment was performed using various lengths of a conductor of uniform cross-sectional area. The resistance of each length was measured and the data recorded in the table below.

Length (meters)	**Resistance** (ohms)
5.1	1.6
11.0	3.8
16.0	4.6
18.0	5.9
23.0	7.5

Directions (69–71): Using the information in the data table, construct a graph on the grid provided *in your answer booklet*, following the directions below.

69 Mark an appropriate scale on the axis labeled "Length (m)." [1]

70 Plot the data points for resistance versus length. [1]

71 Draw the best-fit line. [1]

72 Calculate the slope of the best-fit line. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 73 and 74 on the information below.

A transverse wave with an amplitude of 0.20 meter and wavelength of 3.0 meters travels toward the right in a medium with a speed of 4.0 meters per second.

73 On the diagram *in your answer booklet*, place an **X** at each of *two* points that are in phase with each other. [1]

74 Calculate the period of the wave. [Show all work, including the equation and substitution with units.] [2]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
PHYSICS

Thursday, January 27, 2005 — 9:15 a.m. to 12:15 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	43 .....
37	44 .....
38	45 .....
39	46 .....
40	47 .....
41	48 .....
42	

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

Thursday, January 27, 2005 — 9:15 a.m. to 12:15 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	13	
B–2	17	
C	20	

Total Written Test Score (Maximum Raw Score: 85)

Final Score (From Conversion Chart)

Raters' Initials:

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

Part B–2

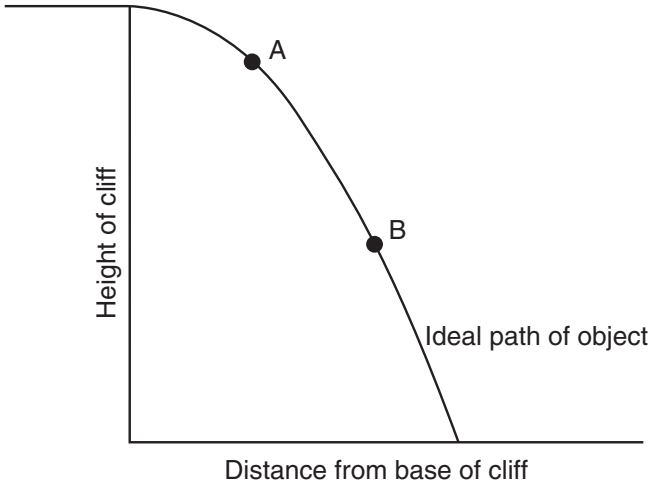
49 _____

_____

50 _____

_____

51



52 _____ N

53 _____ N

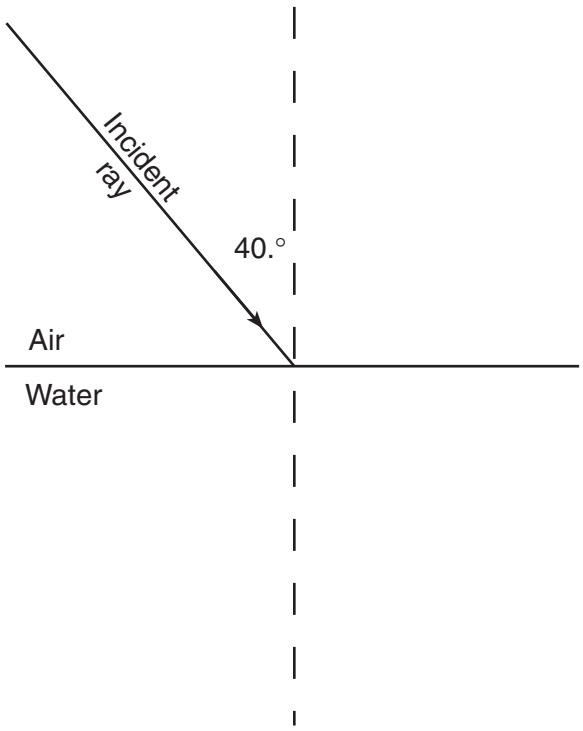
54

55

56

57

58–59



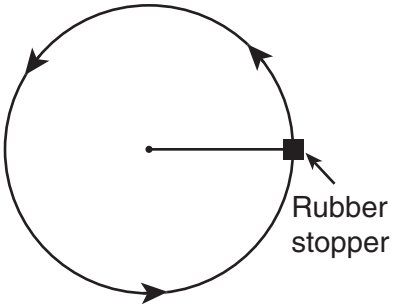
60 _____

61 _____

[b]

Part C

62



Top view

63 _____

_____

_____

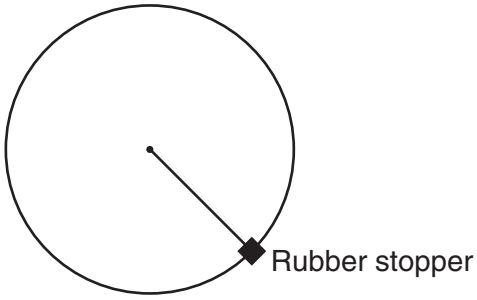
64 _____

_____

_____

65

Vertical Circle (side view)



66

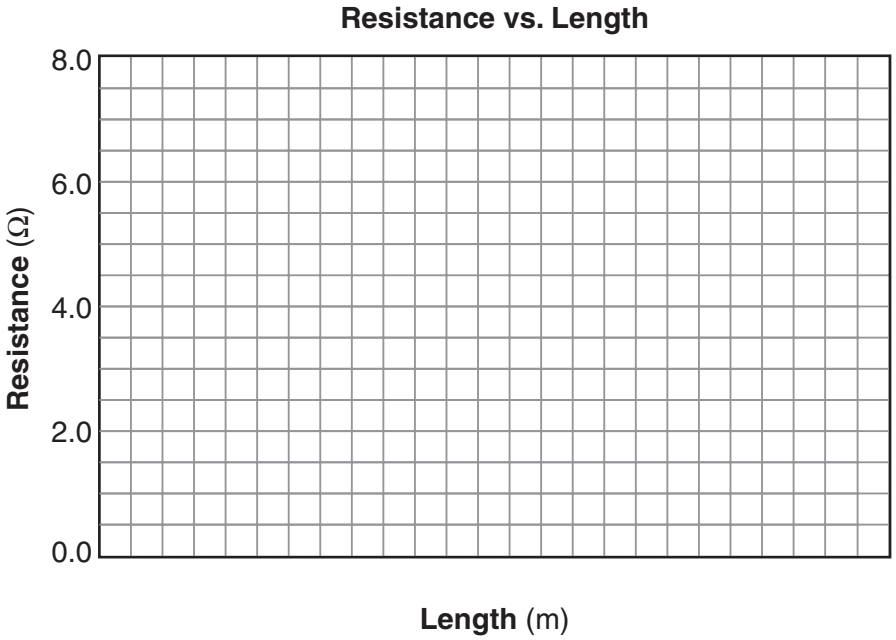
67

68 _____

_____

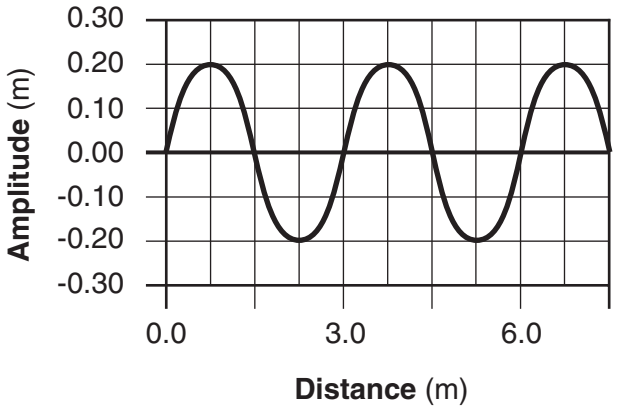
_____

69–71


Resistance vs. Length
8.0
6.0
4.0
2.0
0.0
Resistance (Ω)
Length (m)

72

73


0.30
0.20
0.10
0.00
-0.10
-0.20
-0.30
Amplitude (m)
0.0
3.0
6.0
Distance (m)

74

FOR TEACHERS ONLY

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

PS–P

PHYSICAL SETTING/PHYSICS

Thursday, January 27, 2005 — 9:15 a.m. to 12:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

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

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.

Part A and Part B–1

Allow 1 credit for each correct response.

Part A

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

Part B–1

(36)	**1**	(43)	**3**
(37)	**2**	(44)	**1**
(38)	**2**	(45)	**2**
(39)	**1**	(46)	**3**
(40)	**4**	(47)	**4**
(41)	**3**	(48)	**4**
(42)	**1**		

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 Thursday, January 27, 2005. 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 New York State Education Department web site http://www.emsc.nysed.gov/osa/scire/scirearch/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

49 Allow 1 credit for indicating that the components are equal. Acceptable responses include, but are not limited to:

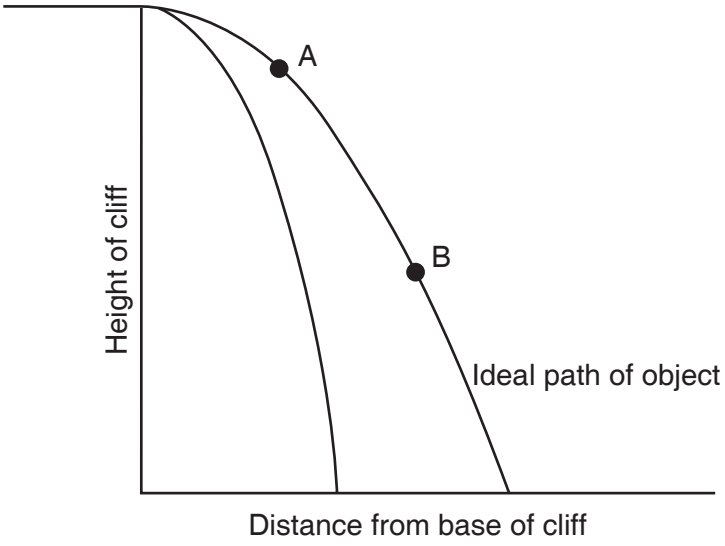
— The horizontal velocities at *A* and *B* are the same.
— The horizontal component is constant.
— the same

50 Allow 1 credit for indicating that the magnitude of the vertical component at *B* is greater. Acceptable responses include, but are not limited to:

— Velocity (or vertical velocity) at *A* is less than at *B*.
— Velocity (or vertical velocity) at *B* is greater than at *A*.
— less

51 Allow 1 credit for sketching a smooth curve that starts at the same point as the ideal path and lands at a distance less than that of the ideal path.

Example of an Acceptable Response



52 Allow 1 credit for 9.0 N ±0.6 N.

53 Allow 1 credit for 3.0 N or an answer that is consistent with the student's response to question 52.

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

Examples of Acceptable Responses

$$a = \frac{F_{net}}{m} \qquad a = \frac{3.0\text{ N}}{4.0\text{ kg}} \qquad a = 0.75\text{ m/s}^2$$

or

$$a = \frac{F_1 - F_2}{m} \qquad a = \frac{12.0\text{ N} - 9.0\text{ N}}{4.0\text{ kg}} \qquad a = 0.75\text{ m/s}^2$$

Allow credit for an answer that is consistent with the student's response to question 53.

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

Example of an Acceptable Response

$F_f = \mu F_N$
$F_f = (0.200)\ (780.\ \text{N})$
$F_f = 156\ \text{N}$

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

Example of an Acceptable Response

$$E = \frac{hc}{\lambda}$$
$$E = \frac{\left(6.63 \times 10^{-34}\ \text{J•s}\right)\left(3.00 \times 10^{8}\ \text{m/s}\right)}{9.00 \times 10^{-10}\ \text{m}}$$
$$E = 2.21 \times 10^{-16}\ \text{J}$$

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

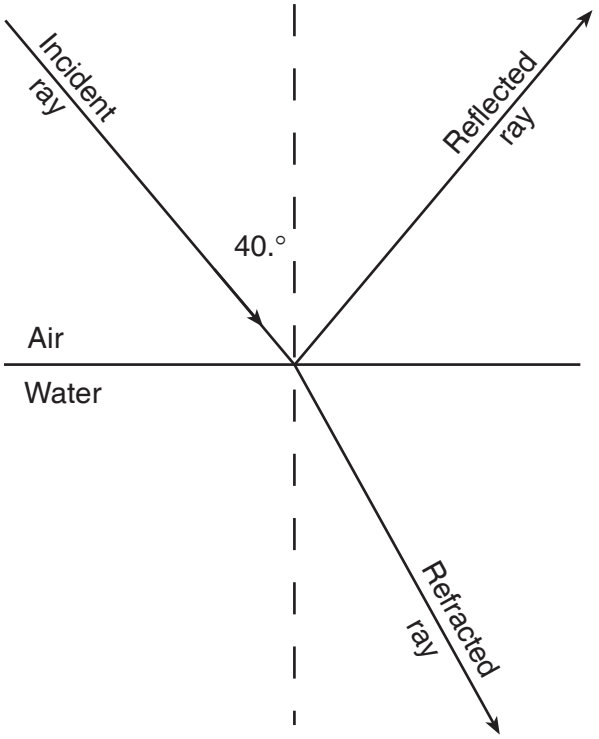
Example of an Acceptable Response

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$
$$\sin\theta_2 = \frac{n_1 \sin\theta_1}{n_2}$$
$$\sin\theta_2 = \frac{(1.00)(\sin 40.^\circ)}{1.33}$$
$$\sin\theta_2 = 0.483$$
$$\theta_2 = 29^\circ \quad \textit{or} \quad 28.9^\circ$$

58 Allow 1 credit for correctly drawing and labeling the refracted ray at an angle of 29° ±2°. Allow credit for an answer that is consistent with the student's response to question 57.

59 Allow 1 credit for correctly drawing and labeling the reflected ray at an angle of 40.° ±2°.

58–59 Example of an Acceptable Response



Note: Deduct no more than 1 credit for missing or incorrect labels.

60 Allow 1 credit for indicating that the quantity represented by the slope of each line is the spring constant.

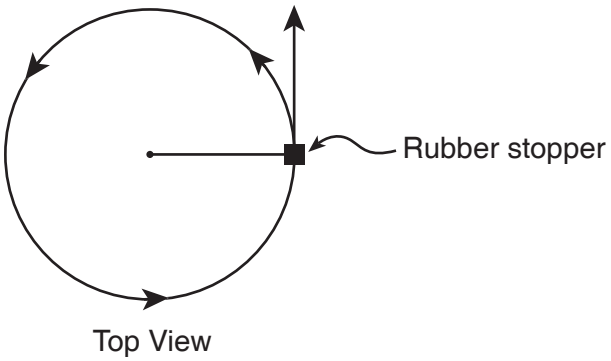
61 Allow 1 credit for indicating that the potential energy stored in spring *A* is less. Acceptable responses include, but are not limited to:

— The potential energy stored in spring *A* is less than the potential energy stored in spring *B*.
— Potential energy in *A* is less.
— Potential energy in *B* is more.
— less

Part C

62 Allow 1 credit for drawing the path of the rubber stopper if the string breaks at the position shown, showing a straight line tangent to the circle going up from the stopper, even if there is *no* arrowhead on the line.

Example of an Acceptable Response



63 Allow 1 credit for describing what would happen to the radius of the circle if the student whirls the stopper at a greater speed. Acceptable responses include, but are not limited to:

— As the speed of the stopper is increased, the radius of the orbit will increase.
— gets bigger *or* gets larger
— *R* gets bigger
— increases

Example of an *Unacceptable* Response

— It gets 4 times as big.

64 Allow a maximum of 3 credits, 1 credit for each of three measurements that must be taken to show that the magnitude of the centripetal force is equal to the balancing weights. Acceptable responses include, but are not limited to:

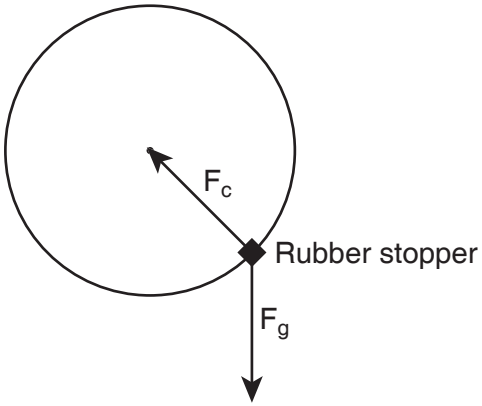
— mass of stopper
— radius of path
— velocity of stopper *or* frequency *or* period
— weight of the balancing weights

65 Allow a maximum of 2 credits, allocated as follows:
- Allow 1 credit for drawing and labeling the vector representing the weight.
- Allow 1 credit for drawing and labeling the vector representing the centripetal force.

Note: Deduct no more than 1 credit for missing arrowheads and/or labels.

Example of an Acceptable Response

Vertical Circle (side view)



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

Example of an Acceptable Response

$p_{\text{before}} = p_{\text{after}}$
$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$
$(1000.\ \text{kg})\ (6.0\ \text{m/s}) + (5000.\ \text{kg})\ (0.0\ \text{m/s}) = (1000.\ \text{kg} + 5000.\ \text{kg})\ v_f$
$6000\ \text{kg}\bullet\text{m/s} = (6000.\ \text{kg})\ v_f$
$v_f = 1.0\ \text{m/s}$

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

Example of an Acceptable Response

$KE = \frac{1}{2} mv^2$
$KE = \frac{1}{2} (6000.\ \text{kg})\ (1.0\ \text{m/s})^2$
$KE = 3000\ \text{J}$ *or* $3.0 \times 10^3\ \text{J}$

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

68 Allow 1 credit for stating how the kinetic energy of the combined carts after the collision compares to the kinetic energy of the carts before the collision. Acceptable responses include, but are not limited to:

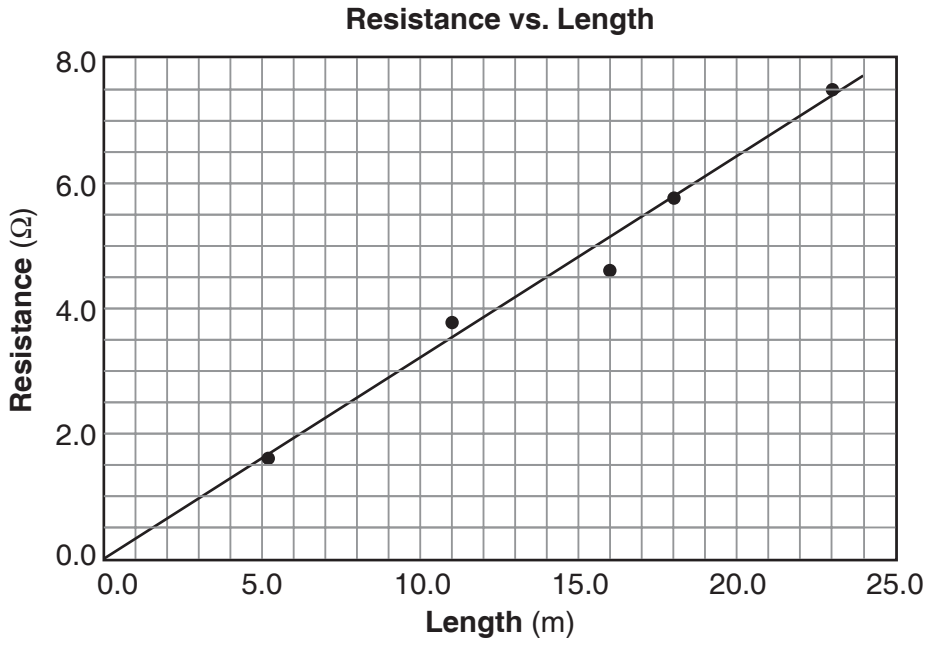
— The *KE* of the combined carts after the collision is less than the *KE* of the carts before the collision.
— less
— $KE_{before} > KE_{after}$

69 Allow 1 credit for marking a scale that is linear and has appropriate divisions.

70 Allow 1 credit for plotting all points accurately (±0.3 grid space). Allow credit if the student correctly uses his or her response to question 69.

71 Allow 1 credit for drawing the best-fit line. Allow credit if the student correctly uses his or her response to question 70.

69–71 Example of a 3-Credit Response



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

Example of a 2-Credit Response

$$\text{Slope} = \frac{\Delta y}{\Delta x} \qquad \textit{or} \qquad \text{slope} = \frac{\Delta \text{ resistance}}{\Delta \text{ length}}$$

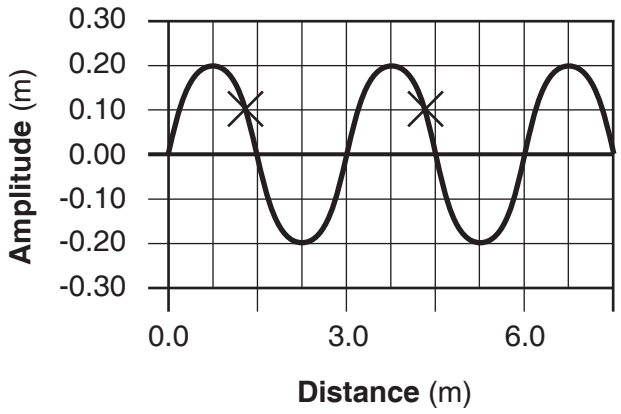
$$\text{Slope} = \frac{4.5\ \Omega - 0.0\ \Omega}{14.0\ \text{m} - 0.0\ \text{m}}$$

$$\text{Slope} = 0.32\ \Omega/\text{m}$$

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 line.

73 Allow 1 credit for marking any two points on the wave that are in phase with each other.

Example of an Acceptable Response



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

Examples of 2 Credit Responses

$$v = f\lambda$$
$$T = \frac{1}{f}$$
$$T = \frac{\lambda}{v}$$
$$T = \frac{3.0\ \text{m}}{4.0\ \text{m/s}}$$
$$T = 0.75\ \text{s}$$

or

$$v = f\lambda$$
$$4.0\ \text{m/s} = f(3.0\ \text{m})$$
$$f = 1.3\ \text{Hz}$$
$$T = \frac{1}{f}$$
$$T = \frac{1}{1.3\ \text{Hz}}$$
$$T = 0.77\ \text{s}$$

or

$$\bar{v} = \frac{d}{t}$$
$$t = \frac{d}{\bar{v}}$$
$$t = \frac{3.0\ \text{m}}{4.0\ \text{m/s}}$$
$$t = 0.75\ \text{s}$$

Regents Examination in Physical Setting/Physics

January 2005

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

The *Chart for Determining the Final Examination Score for the January 2005 Regents Examination in Physical Setting/Physics* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Thursday, January 27, 2005. 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

January 2005 Physical Setting/Physics			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	1,2,3,4,20,21,24,25,26	39,40,47,53,54,55,56, 57	66,67,69,70,71,74
Math Key Idea 2			
Math Key Idea 3		60,61	72
Sci. Inq. Key Idea 1			
Sci. Inq. Key Idea 2			
Sci. Inq. Key Idea 3		41,46	
Eng. Des. Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2			
Key Idea 3		38	
Key Idea 4			63
Key Idea 5			68
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
4.1		42	
4.3		48,58,59	73
5.1		36,37,49,50,51,52	62,64,65
5.3		43,44,45	
Standard 4			
4.1	20,21,22,23,24,25,26,27, 28,29,30,31	42,46,47	67,68,69,70,71,72
4.3	10,11,12,13,14,15,16,17, 18,19	41,48,57,58,59	73,74
5.1	1,2,3,4,5,6,7,8,9,32,33	36,37,40,49,50,51, 52,53,54,55,60,61	62,63,64,65,66
5.3	34,35	43,44,45,56	

University of the State of New York
State Education Department

Regents Examination in Physical Setting / Physics
January 2005

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

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.