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

PHYSICAL SETTING
PHYSICS

Thursday, June 13, 2013 — 1:15 to 4:15 p.m., only

The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

Answer all questions in all parts of this examination according to the directions provided in the examination booklet.

A separate answer sheet for Part A and Part B–1 has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet. Record your answers to the Part A and Part B–1 multiple-choice questions on this separate answer sheet. Record your answers for the questions in Part B–2 and Part C in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

All answers in your answer booklet 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 your separate answer sheet or in your answer booklet as directed.

When you have completed the examination, you must sign the statement printed on 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 *2006 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, choose the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *2006 Edition Reference Tables for Physical Setting/Physics.* Record your answers on your separate answer sheet.

1 Which term identifies a scalar quantity?

(1) displacement
(2) momentum
(3) velocity
(4) time

2 Two 20.-newton forces act concurrently on an object. What angle between these forces will produce a resultant force with the greatest magnitude?

(1) 0°
(2) 45°
(3) 90.°
(4) 180.°

3 A car traveling west in a straight line on a highway decreases its speed from 30.0 meters per second to 23.0 meters per second in 2.00 seconds. The car's average acceleration during this time interval is

(1) 3.5 m/s^2 east
(2) 3.5 m/s^2 west
(3) 13 m/s^2 east
(4) 13 m/s^2 west

4 In a race, a runner traveled 12 meters in 4.0 seconds as she accelerated uniformly from rest. The magnitude of the acceleration of the runner was

(1) 0.25 m/s^2
(2) 1.5 m/s^2
(3) 3.0 m/s^2
(4) 48 m/s^2

5 A projectile is launched at an angle above the ground. The horizontal component of the projectile's velocity, v_x, is initially 40. meters per second. The vertical component of the projectile's velocity, v_y, is initially 30. meters per second. What are the components of the projectile's velocity after 2.0 seconds of flight? [Neglect friction.]

(1) v_x = 40. m/s and v_y = 10. m/s
(2) v_x = 40. m/s and v_y = 30. m/s
(3) v_x = 20. m/s and v_y = 10. m/s
(4) v_x = 20. m/s and v_y = 30. m/s

6 A ball is thrown with an initial speed of 10. meters per second. At what angle above the horizontal should the ball be thrown to reach the greatest height?

(1) 0°
(2) 30.°
(3) 45°
(4) 90.°

7 Which object has the greatest inertia?

(1) a 0.010-kg bullet traveling at 90. m/s
(2) a 30.-kg child traveling at 10. m/s on her bike
(3) a 490-kg elephant walking with a speed of 1.0 m/s
(4) a 1500-kg car at rest in a parking lot

8 An 8.0-newton wooden block slides across a horizontal wooden floor at constant velocity. What is the magnitude of the force of kinetic friction between the block and the floor?

(1) 2.4 N
(2) 3.4 N
(3) 8.0 N
(4) 27 N

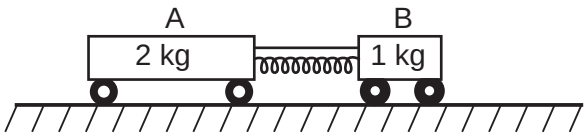
9 Which situation represents a person in equilibrium?

(1) a child gaining speed while sliding down a slide
(2) a woman accelerating upward in an elevator
(3) a man standing still on a bathroom scale
(4) a teenager driving around a corner in his car

10 A rock is thrown straight up into the air. At the highest point of the rock's path, the magnitude of the net force acting on the rock is

(1) less than the magnitude of the rock's weight, but greater than zero
(2) greater than the magnitude of the rock's weight
(3) the same as the magnitude of the rock's weight
(4) zero

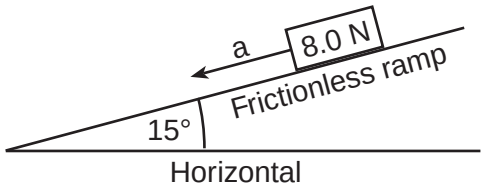
11 The diagram below shows a compressed spring between two carts initially at rest on a horizontal, frictionless surface. Cart *A* has a mass of 2 kilograms and cart *B* has a mass of 1 kilogram. A string holds the carts together.



The string is cut and the carts move apart. Compared to the magnitude of the force the spring exerts on cart *A*, the magnitude of the force the spring exerts on cart *B* is

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

12 An 8.0-newton block is accelerating down a frictionless ramp inclined at 15° to the horizontal, as shown in the diagram below.



What is the magnitude of the net force causing the block's acceleration?

(1) 0 N
(2) 2.1 N
(3) 7.7 N
(4) 8.0 N

13 At a certain location, a gravitational force with a magnitude of 350 newtons acts on a 70.-kilogram astronaut. What is the magnitude of the gravitational field strength at this location?

(1) 0.20 kg/N
(2) 5.0 N/kg
(3) 9.8 m/s^2
(4) 25 000 N•kg

14 A spring gains 2.34 joules of elastic potential energy as it is compressed 0.250 meter from its equilibrium position. What is the spring constant of this spring?

(1) 9.36 N/m
(2) 18.7 N/m
(3) 37.4 N/m
(4) 74.9 N/m

15 When a teacher shines light on a photocell attached to a fan, the blades of the fan turn. The brighter the light shone on the photocell, the faster the blades turn. Which energy conversion is illustrated by this demonstration?

(1) light → thermal → mechanical
(2) light → nuclear → thermal
(3) light → electrical → mechanical
(4) light → mechanical → chemical

16 Which statement describes a characteristic common to all electromagnetic waves and mechanical waves?

(1) Both types of waves travel at the same speed.
(2) Both types of waves require a material medium for propagation.
(3) Both types of waves propagate in a vacuum.
(4) Both types of waves transfer energy.

17 An electromagnetic wave is produced by charged particles vibrating at a rate of 3.9×10^8 vibrations per second. The electromagnetic wave is classified as

(1) a radio wave
(2) an infrared wave
(3) an x ray
(4) visible light

18 The energy of a sound wave is most closely related to the wave's

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

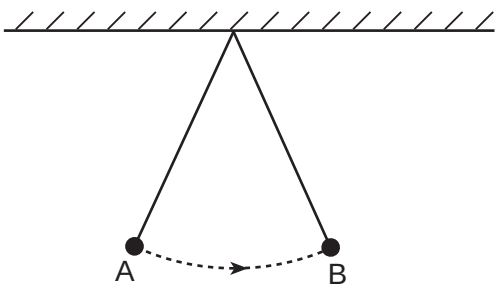
19 A sound wave traveling eastward through air causes the air molecules to

(1) vibrate east and west
(2) vibrate north and south
(3) move eastward, only
(4) move northward, only

20 What is the speed of light ($f = 5.09 \times 10^{14}$ Hz) in ethyl alcohol?

(1) 4.53×10^{-9} m/s
(2) 2.43×10^2 m/s
(3) 1.24×10^8 m/s
(4) 2.21×10^8 m/s

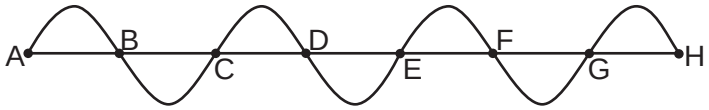
21 In the diagram below, an ideal pendulum released from position *A* swings freely to position *B*.



As the pendulum swings from *A* to *B*, its total mechanical energy

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

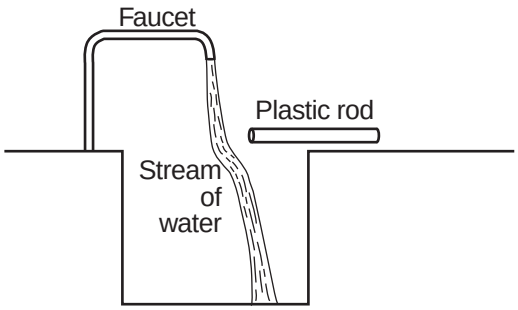
22 The diagram below represents a periodic wave.



Which two points on the wave are out of phase?

(1) *A* and *C*
(2) *B* and *F*
(3) *C* and *E*
(4) *D* and *G*

23 A dry plastic rod is rubbed with wool cloth and then held near a thin stream of water from a faucet. The path of the stream of water is changed, as represented in the diagram below.



Which force causes the path of the stream of water to change due to the plastic rod?

(1) nuclear
(2) magnetic
(3) electrostatic
(4) gravitational

24 A distance of 1.0×10^{-2} meter separates successive crests of a periodic wave produced in a shallow tank of water. If a crest passes a point in the tank every 4.0×10^{-1} second, what is the speed of this wave?

(1) 2.5×10^{-4} m/s
(2) 4.0×10^{-3} m/s
(3) 2.5×10^{-2} m/s
(4) 4.0×10^{-1} m/s

25 One vibrating 256-hertz tuning fork transfers energy to another 256-hertz tuning fork, causing the second tuning fork to vibrate. This phenomenon is an example of

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

26 Sound waves are produced by the horn of a truck that is approaching a stationary observer. Compared to the sound waves detected by the driver of the truck, the sound waves detected by the observer have a greater

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

27 The electronvolt is a unit of

(1) energy
(2) charge
(3) electric field strength
(4) electric potential difference

28 Which particle would produce a magnetic field?

(1) a neutral particle moving in a straight line
(2) a neutral particle moving in a circle
(3) a stationary charged particle
(4) a moving charged particle

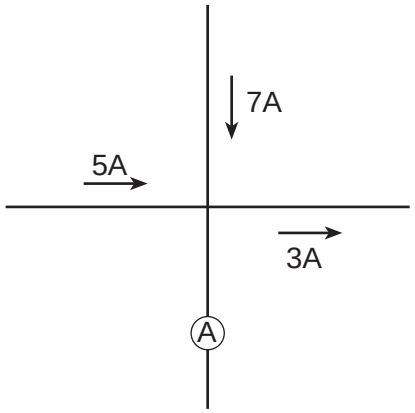
29 A physics student takes her pulse and determines that her heart beats periodically 60 times in 60 seconds. The period of her heartbeat is

(1) 1 Hz
(2) 60 Hz
(3) 1 s
(4) 60 s

30 Moving 4.0 coulombs of charge through a circuit requires 48 joules of electric energy. What is the potential difference across this circuit?

(1) 190 V
(2) 48 V
(3) 12 V
(4) 4.0 V

31 The diagram below shows currents in a segment of an electric circuit.



What is the reading of ammeter *A*?

(1) 1 A
(2) 5 A
(3) 9 A
(4) 15 A

32 An electric dryer consumes 6.0×10^6 joules of electrical energy when operating at 220 volts for 1.8×10^3 seconds. During operation, the dryer draws a current of

(1) 10. A
(2) 15 A
(3) 9.0×10^2 A
(4) 3.3×10^3 A

33 Which net charge could be found on an object?

(1) $+4.80 \times 10^{-19}$ C
(2) $+2.40 \times 10^{-19}$ C
(3) -2.40×10^{-19} C
(4) -5.60×10^{-19} C

34 A photon is emitted as the electron in a hydrogen atom drops from the $n = 5$ energy level directly to the $n = 3$ energy level. What is the energy of the emitted photon?

(1) 0.85 eV
(2) 0.97 eV
(3) 1.51 eV
(4) 2.05 eV

35 In a process called pair production, an energetic gamma ray is converted into an electron and a positron. It is *not* possible for a gamma ray to be converted into two electrons because

(1) charge must be conserved
(2) momentum must be conserved
(3) mass-energy must be conserved
(4) baryon number must be conserved

Part B–1

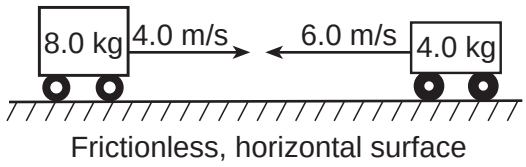
Answer all questions in this part.

Directions (36–50): For *each* statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *2006 Edition Reference Tables for Physical Setting/Physics.* Record your answers on your separate answer sheet.

36 The approximate length of an unsharpened No. 2 pencil is

(1) 2.0×10^{-2} m
(2) 2.0×10^{-1} m
(3) 2.0×10^{0} m
(4) 2.0×10^{1} m

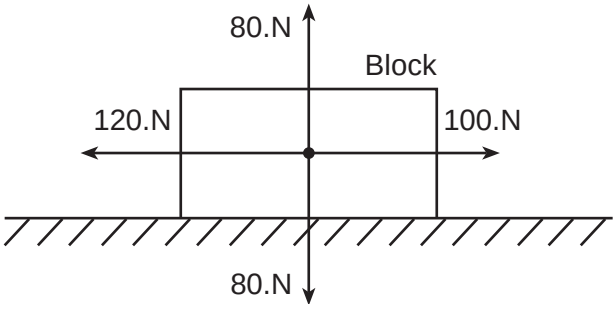
37 The diagram below shows an 8.0-kilogram cart moving to the right at 4.0 meters per second about to make a head-on collision with a 4.0-kilogram cart moving to the left at 6.0 meters per second.



After the collision, the 4.0-kilogram cart moves to the right at 3.0 meters per second. What is the velocity of the 8.0-kilogram cart after the collision?

(1) 0.50 m/s left
(2) 0.50 m/s right
(3) 5.5 m/s left
(4) 5.5 m/s right

38 Four forces act concurrently on a block on a horizontal surface as shown in the diagram below.



As a result of these forces, the block

(1) moves at constant speed to the right
(2) moves at constant speed to the left
(3) accelerates to the right
(4) accelerates to the left

39 If a motor lifts a 400.-kilogram mass a vertical distance of 10. meters in 8.0 seconds, the *minimum* power generated by the motor is

(1) 3.2×10^{2} W
(2) 5.0×10^{2} W
(3) 4.9×10^{3} W
(4) 3.2×10^{4} W

40 A 4.0-kilogram object is accelerated at 3.0 meters per second^2 north by an unbalanced force. The same unbalanced force acting on a 2.0-kilogram object will accelerate this object toward the north at

(1) 12 m/s^2
(2) 6.0 m/s^2
(3) 3.0 m/s^2
(4) 1.5 m/s^2

41 An electron is located in an electric field of magnitude 600. newtons per coulomb. What is the magnitude of the electrostatic force acting on the electron?

(1) 3.75×10^{21} N
(2) 6.00×10^{2} N
(3) 9.60×10^{-17} N
(4) 2.67×10^{-22} N

42 The current in a wire is 4.0 amperes. The time required for 2.5×10^{19} electrons to pass a certain point in the wire is

(1) 1.0 s
(2) 0.25 s
(3) 0.50 s
(4) 4.0 s

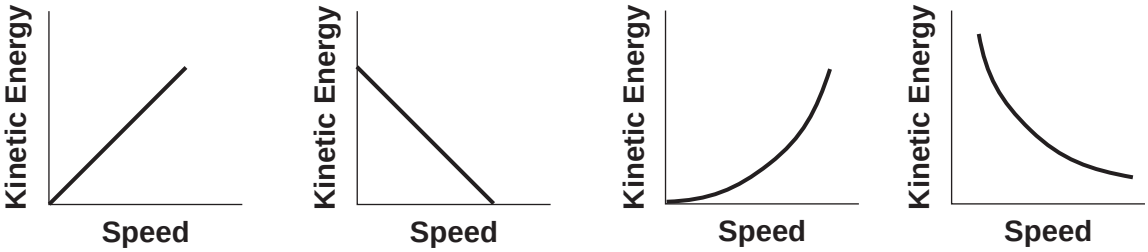
43 When two point charges of magnitude q_1 and q_2 are separated by a distance, r, the magnitude of the electrostatic force between them is F. What would be the magnitude of the electrostatic force between point charges $2q_1$ and $4q_2$ when separated by a distance of $2r$?

(1) F
(2) $2F$
(3) $16F$
(4) $4F$

44 The composition of a meson with a charge of –1 elementary charge could be

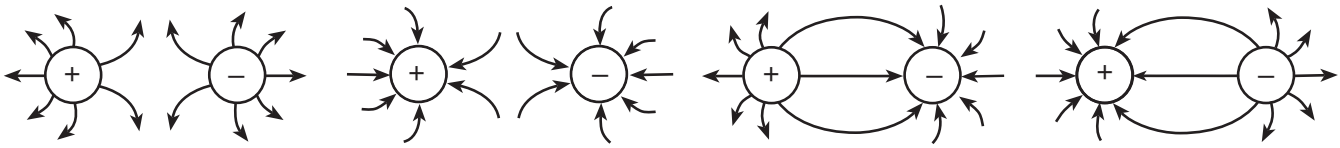
(1) $s\bar{c}$
(2) $d\,s\,s$
(3) $u\bar{b}$
(4) $\bar{u}\,\bar{c}\,\bar{d}$

45 Which graph represents the relationship between the kinetic energy and the speed of a freely falling object?



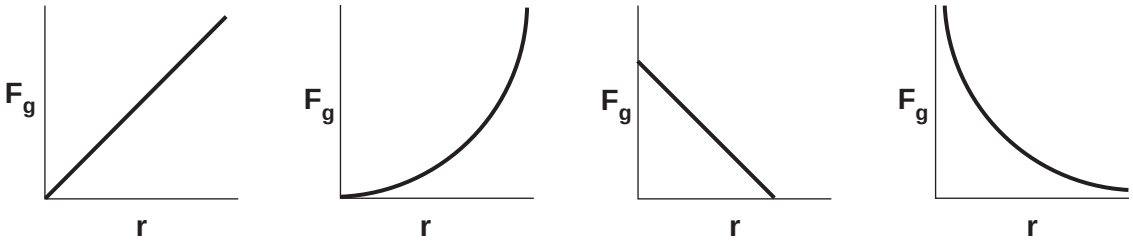
(1) (2) (3) (4)

46 Which diagram represents the electric field between two oppositely charged conducting spheres?



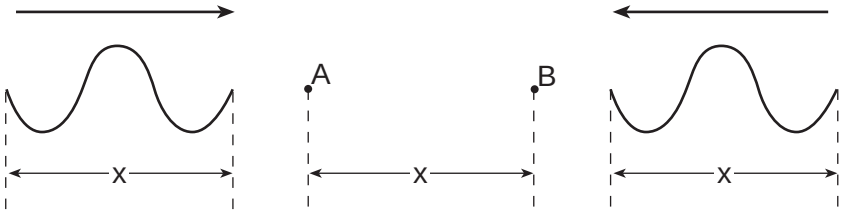
(1) (2) (3) (4)

47 Which graph represents the relationship between the magnitude of the gravitational force, F_g, between two masses and the distance, r, between the centers of the masses?



(1) (2) (3) (4)

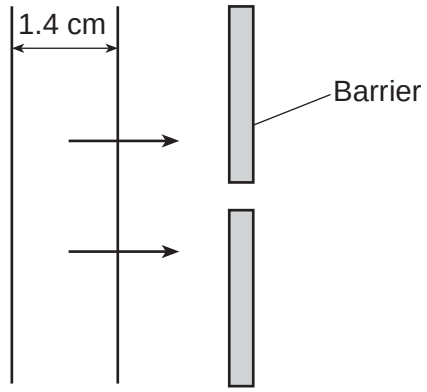
48 The diagram below shows two waves traveling toward each other at equal speed in a uniform medium.



When both waves are in the region between points A and B, they will undergo

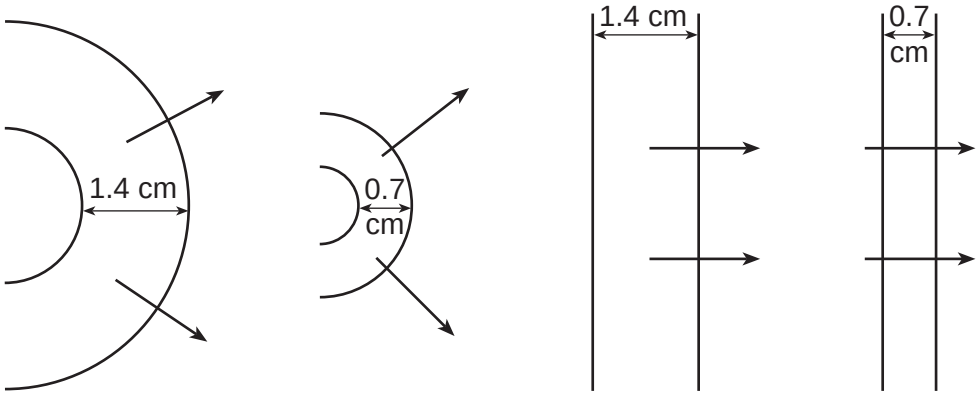
(1) diffraction
(2) the Doppler effect
(3) destructive interference
(4) constructive interference

49 The diagram below shows a series of straight wave fronts produced in a shallow tank of water approaching a small opening in a barrier.



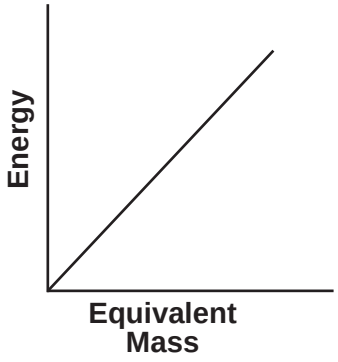
Wave fronts

Which diagram represents the appearance of the wave fronts after passing through the opening in the barrier?



(1) (2) (3) (4)

50 The graph below represents the relationship between energy and the equivalent mass from which it can be converted.



The slope of this graph represents

(1) c
(2) c^2
(3) g
(4) g^2

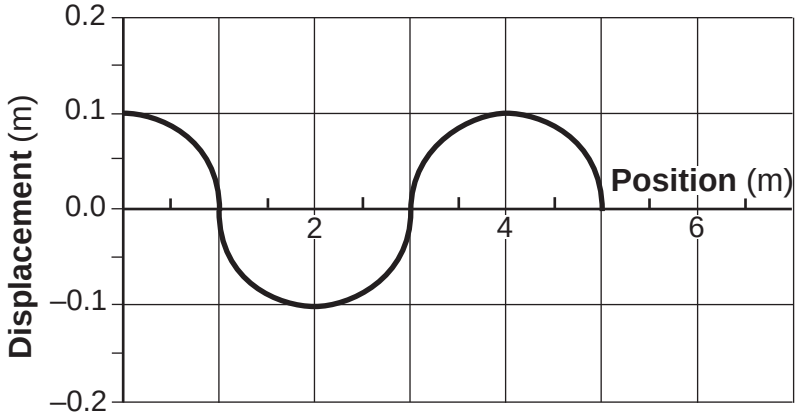
Part B–2

Answer all questions in this part.

Directions (51–65): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *2006 Edition Reference Tables for Physical Setting/Physics.*

51–52 A 25.0-meter length of platinum wire with a cross-sectional area of 3.50×10^{-6} meter^2 has a resistance of 0.757 ohm at 20°C. Calculate the resistivity of the wire. [Show all work, including the equation and substitution with units.] [2]

53 The diagram below represents a periodic wave moving along a rope.



On the grid *in your answer booklet*, draw *at least one* full wave with the same amplitude and half the wavelength of the given wave. [1]

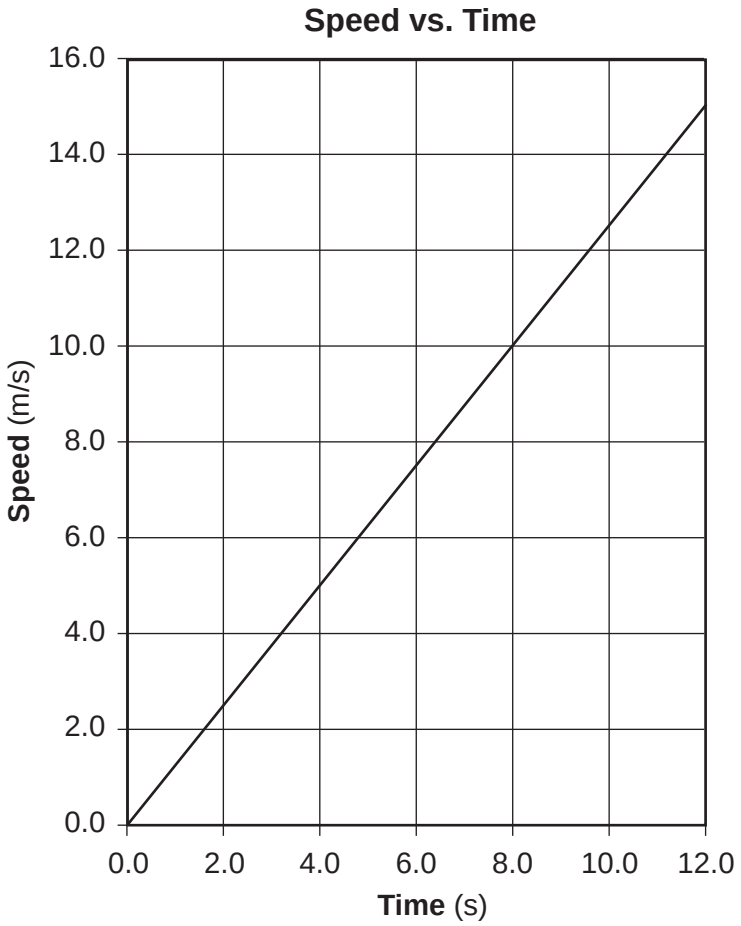
54–55 A baseball bat exerts an average force of 600. newtons east on a ball, imparting an impulse of 3.6 newton•seconds east to the ball. Calculate the amount of time the baseball bat is in contact with the ball. [Show all work, including the equation and substitution with units.] [2]

56 The diagram below shows the north pole of one bar magnet located near the south pole of another bar magnet.

On the diagram *in your answer booklet*, draw *three* magnetic field lines in the region between the magnets. [1]

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

The graph below shows the relationship between speed and elapsed time for a car moving in a straight line.

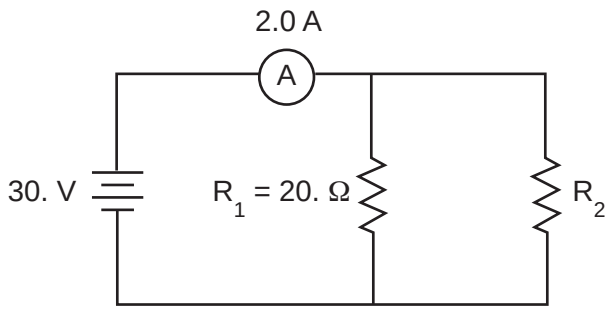


57 Determine the magnitude of the acceleration of the car. [1]

58–59 Calculate the total distance the car traveled during the time interval 4.0 seconds to 8.0 seconds. [Show all work, including the equation and substitution with units.] [2]

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

A 20.-ohm resistor, R_1, and a resistor of unknown resistance, R_2, are connected in parallel to a 30.-volt source, as shown in the circuit diagram below. An ammeter in the circuit reads 2.0 amperes.



60 Determine the equivalent resistance of the circuit. [1]

61–62 Calculate the resistance of resistor R_2. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 63 through 65 on the information below.

A 28-gram rubber stopper is attached to a string and whirled clockwise in a horizontal circle with a radius of 0.80 meter. The diagram in your answer booklet represents the motion of the rubber stopper. The stopper maintains a constant speed of 2.5 meters per second.

63–64 Calculate the magnitude of the centripetal acceleration of the stopper. [Show all work, including the equation and substitution with units.] [2]

65 On the diagram *in your answer booklet*, draw an arrow showing the direction of the centripetal force acting on the stopper when it is at the position shown. [1]

Part C

Answer all questions in this part.

Directions (66–85): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *2006 Edition Reference Tables for Physical Setting/Physics.*

Base your answers to questions 66 through 69 on the information below.

Auroras over the polar regions of Earth are caused by collisions between charged particles from the Sun and atoms in Earth's atmosphere. The charged particles give energy to the atoms, exciting them from their lowest available energy level, the ground state, to higher energy levels, excited states. Most atoms return to their ground state within 10. nanoseconds.

In the higher regions of Earth's atmosphere, where there are fewer interatom collisions, a few of the atoms remain in excited states for longer times. For example, oxygen atoms remain in an excited state for up to 1.0 second. These atoms account for the greenish and red glows of the auroras. As these oxygen atoms return to their ground state, they emit green photons ($f = 5.38 \times 10^{14}$ Hz) and red photons ($f = 4.76 \times 10^{14}$ Hz). These emissions last long enough to produce the changing aurora phenomenon.

66 What is the order of magnitude of the time, in seconds, that most atoms spend in an excited state? [1]

67–68 Calculate the energy of a photon, in joules, that accounts for the red glow of the aurora. [Show all work, including the equation and substitution with units.] [2]

69 Explain what is meant by an atom being in its ground state. [1]

Base your answers to questions 70 through 75 on the information below.

A girl rides her bicycle 1.40 kilometers west, 0.70 kilometer south, and 0.30 kilometer east in 12 minutes. The vector diagram in your answer booklet represents the girl's first two displacements in sequence from point *P*. The scale used in the diagram is 1.0 centimeter = 0.20 kilometer.

70–71 On the vector diagram *in your answer booklet*, using a ruler and a protractor, construct the following vectors:

- Starting at the arrowhead of the second displacement vector, draw a vector to represent the 0.30 kilometer east displacement. Label the vector with its magnitude. [1]
- Draw the vector representing the resultant displacement of the girl for the entire bicycle trip *and* label the vector *R*. [1]

72–73 Calculate the girl's average speed for the entire bicycle trip. [Show all work, including the equation and substitution with units.] [2]

74 Determine the magnitude of the girl's resultant displacement for the entire bicycle trip, in kilometers. [1]

75 Determine the measure of the angle, in degrees, between the resultant and the 1.40-kilometer displacement vector. [1]

Base your answers to questions 76 through 80 on the information below.

A light ray with a frequency of 5.09×10^{14} hertz traveling in water has an angle of incidence of 35° on a water-air interface. At the interface, part of the ray is reflected from the interface and part of the ray is refracted as it enters the air.

76 What is the angle of reflection of the light ray at the interface? [1]

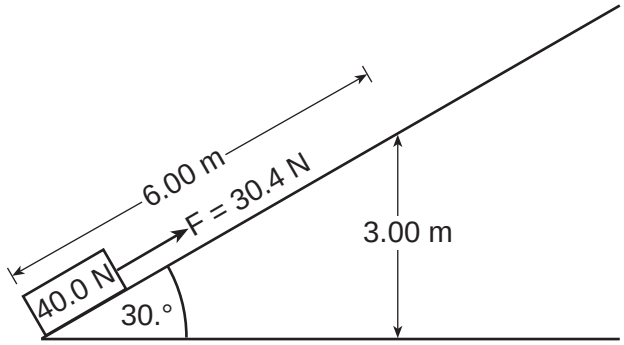
77 On the diagram *in your answer booklet*, using a protractor and a straightedge, draw the reflected ray. [1]

78–79 Calculate the angle of refraction of the light ray as it enters the air. [Show all work, including the equation and substitution with units.] [2]

80 Identify *one* characteristic of this light ray that is the same in *both* the water and the air. [1]

Base your answers to questions 81 through 85 on the information and diagram below.

A 30.4-newton force is used to slide a 40.0-newton crate a distance of 6.00 meters at constant speed along an incline to a vertical height of 3.00 meters.



81 Determine the total work done by the 30.4-newton force in sliding the crate along the incline. [1]

82–83 Calculate the total increase in the gravitational potential energy of the crate after it has slid 6.00 meters along the incline. [Show all work, including the equation and substitution with units.] [2]

84 State what happens to the kinetic energy of the crate as it slides along the incline. [1]

85 State what happens to the internal energy of the crate as it slides along the incline. [1]

P.S./PHYSICS

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
PHYSICS

Thursday, June 13, 2013 — 1:15 to 4:15 p.m., only

ANSWER BOOKLET

☐ Male

Student . . . . . Sex: ☐ Female

Teacher . . . . . .

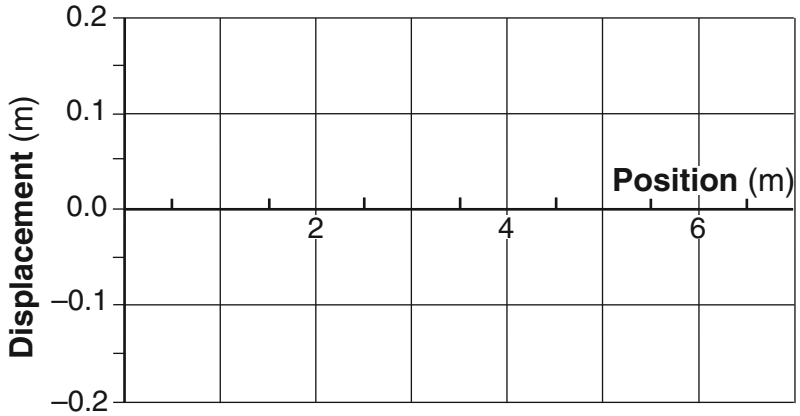
School . . . . . Grade . . . . . .

Record your answers for Part B–2 and Part C in this booklet.

Part B–2

51–52

53



54–55

56

57 _____ **m/s^2**

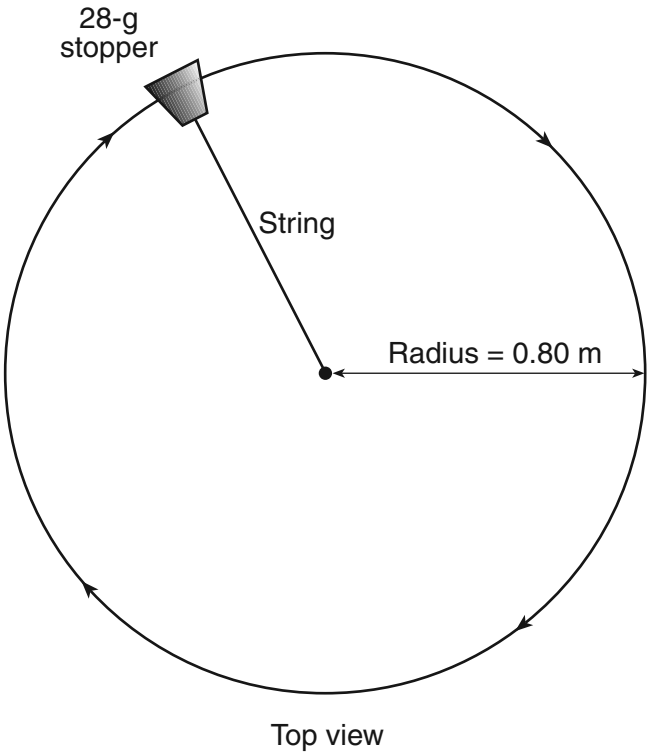
58–59

60 _____ Ω

61–62

63–64

65



Part C

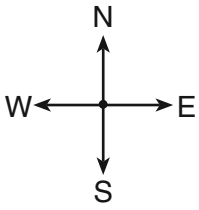
66 _____

67–68

69 _____

_____

70–71



Scale
1.0 cm = 0.20 km

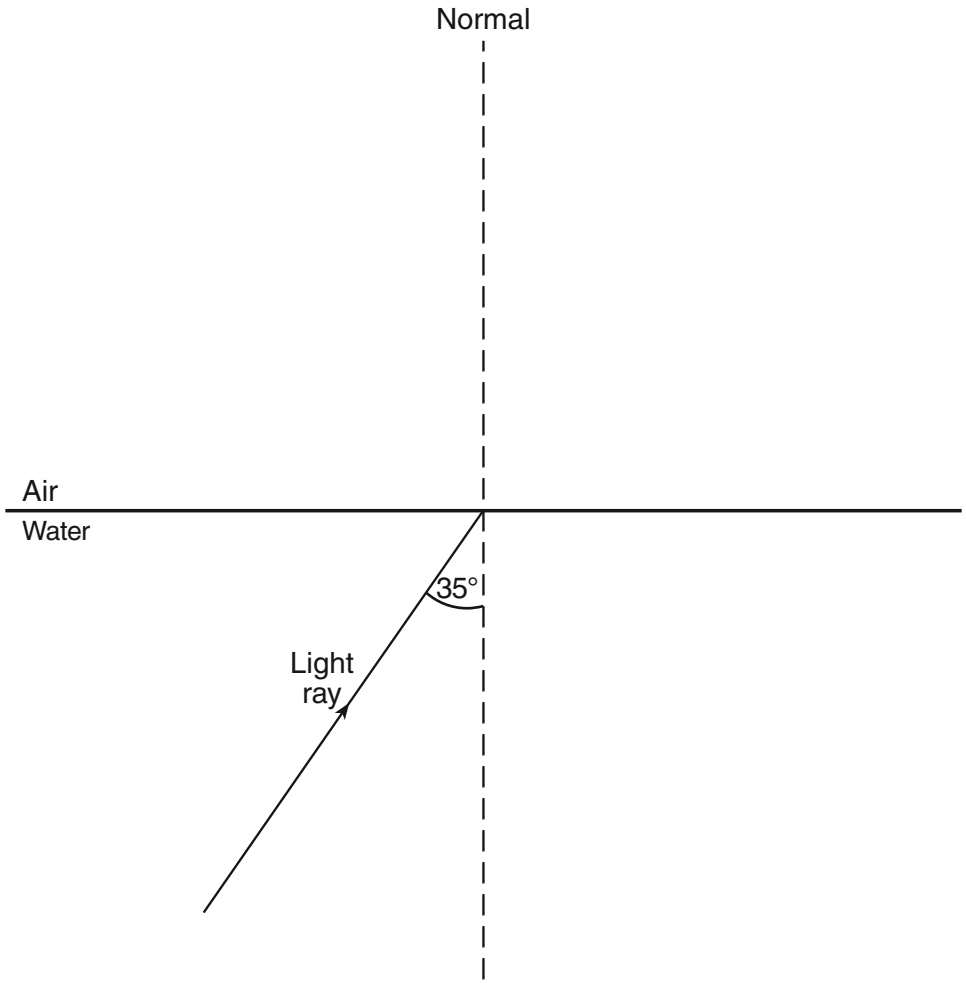
72–73

74 _____ **km**

75 _____ **°**

76 _____ °

77



78–79

80 _____

81 _____ **J**

82–83

84 _____

85 _____

P.S./PHYSICS

FOR TEACHERS ONLY

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

PS–P

PHYSICAL SETTING/PHYSICS

Thursday, June 13, 2013 — 1:15 to 4:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:
Refer to the directions on page 2 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. Check this web site at: http://www.p12.nysed.gov/assessment/ and select the link "Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents Examination period.

Part A and Part B–1

Allow 1 credit for each correct response.

Part A

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

Part B–1

36 . . . . . **2**	40 . . . . . **2**	44 . . . . . **1**	48 . . . . . **4** . . . . .
37 . . . . . **1**	41 . . . . . **3**	45 . . . . . **3**	49 . . . . . **1** . . . . .
38 . . . . . **4**	42 . . . . . **1**	46 . . . . . **3**	50 . . . . . **2** . . . . .
39 . . . . . **3**	43 . . . . . **2**	47 . . . . . **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 Scoring Regents Examinations in the Sciences,* which may be found on the Department web site at http://www.p12.nysed.gov/assessment/science/science-hs.html.

Do not attempt to correct the student's work by making insertions or changes of any kind. If the student's responses for the multiple-choice questions are being hand scored prior to being scanned, the scorer must be careful not to make any marks on the answer sheet except to record the scores in the designated score boxes. Marks elsewhere on the answer sheet will interfere with the accuracy of the scanning.

For Part A and Part B–1, indicate by means of a check mark 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 more than approximately one-half of the open-ended questions on a student's answer paper. Teachers may not score their own students' answer papers.

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 scale score by using the conversion chart that will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ on Thursday, June 13, 2013. The student's scale score should be entered in the labeled box on the student's answer booklet. The scale score is the student's final examination score. On the front of the student's answer booklet, raters must enter their initials on the lines next to "Rater 1" or "Rater 2."

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart may change from one administration 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.

Teachers should become familiar with 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.p12.nysed.gov/assessment/science/phyratg02.pdf. This guide provides a set of directions, along with some examples, to assist teachers in rating parts B–2 and C of the Regents Examination in Physical Setting/Physics.

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 credit if the student has listed the values with units and written a correct equation.
- Allow 1 credit for the correct answer (number and unit). If the number is given without the unit, allow credit if the credit for units was previously deducted for this calculation problem.
- Penalize a student only once per calculation problem for incorrect or omitted units.
- Allow credit if the answer is not expressed with the correct number of significant figures.

Part B–2

51 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

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

$$\rho = \frac{RA}{L}$$

$$\rho = \frac{(0.757\ \Omega)(3.50 \times 10^{-6}\ \text{m}^2)}{25.0\ \text{m}}$$

52 [1] Allow 1 credit for the correct answer with units.

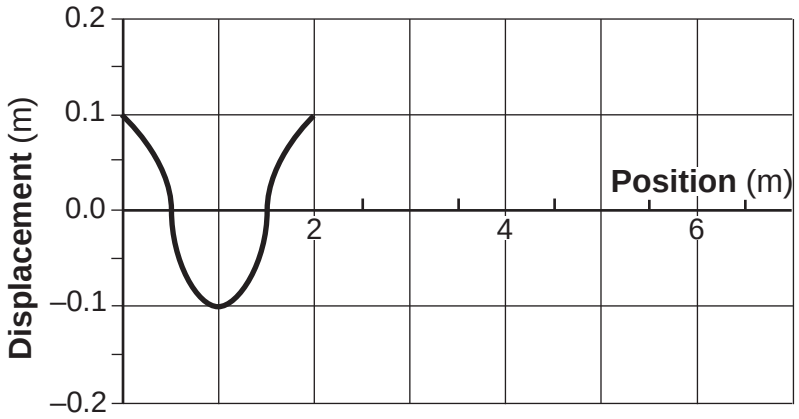
Examples of 1-credit responses:

$\rho = 1.06 \times 10^{-7}\ \Omega\cdot\text{m}$ *or* $\rho = 10.6 \times 10^{-8}\ \Omega\cdot\text{m}$

Note: Allow credit for an answer that is consistent with the student's response to question 51. Do *not* penalize the student more than 1 credit for errors in units in questions 51 and 52.

53 [1] Allow 1 credit for *at least one* complete wave with an amplitude of 0.1 m and a wavelength of 2 m, regardless of phase or shape.

Example of a 1-credit response:



Note: If more than one cycle is drawn, grade only the first cycle.

54 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

$J = F_{net}t$

$t = \dfrac{J}{F_{net}}$

$t = \dfrac{3.6\ \text{N} \bullet \text{s}}{600.\ \text{N}}$

55 [1] Allow 1 credit for a correct answer with units.

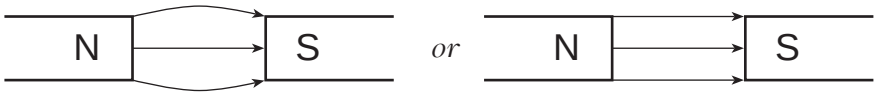
Examples of 1-credit responses:

$t = 0.0060$ s *or* $t = 6.0 \times 10^{-3}$ s

Note: Allow credit for an answer that is consistent with the student's response to question 54. Do *not* penalize the student more than 1 credit for errors in units in questions 54 and 55.

56 [1] Allow 1 credit for *three* field lines drawn showing the correct shape and direction of the field.

Examples of 1-credit responses:



57 [1] Allow 1 credit for 1.25 m/s^2 ± 0.05 m/s^2.

58 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

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

$$d = (5.0 \text{ m/s})(4.0 \text{ s}) + \frac{1}{2}(1.25 \text{ m/s}^2)(4.0 \text{ s})^2$$

or

$$\bar{v} = \frac{d}{t}$$

$$d = \bar{v} t$$

$$d = (7.5 \text{ m/s})(4.0 \text{ s})$$

or

d = area under graph

$$d = \left(\frac{b_1 + b_2}{2}\right) h$$

$$d = \left(\frac{5.0 \text{ m/s} + 10.0 \text{ m/s}}{2}\right) 4.0 \text{ s}$$

Note: Allow credit for an answer that is consistent with the student's response to question 57.

59 [1] Allow 1 credit for the correct answer with units.

Example of a 1-credit response:

d = 30. m

Note: Allow credit for an answer that is consistent with the student's response to question 58. Do *not* penalize the student more than 1 credit for errors in units in questions 58 and 59.

60 [1] Allow 1 credit for 15 Ω.

61 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$ $\qquad R = \frac{V}{I}$

$\frac{1}{R_2} = \frac{1}{R_{eq}} - \frac{1}{R_1}$ $\qquad$ *or* $\qquad R = \frac{30.\ V}{0.50\ A}$

$\frac{1}{R_2} = \frac{1}{15\ \Omega} - \frac{1}{20.\ \Omega}$

Note: Allow credit for substitution consistent with the student's response to question 60.

62 [1] Allow 1 credit for the correct answer with units.

Example of a 1-credit response:

$R_2 = 60.\ \Omega$

Note: Allow credit for an answer that is consistent with the student's response to question 61. Do *not* penalize the student more than 1 credit for errors in units in questions 61 and 62.

63 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

$$a_c = \frac{v^2}{r}$$

$$a_c = \frac{(2.5 \text{ m/s})^2}{0.80 \text{ m}}$$

64 [1] Allow 1 credit for the correct answer with units.

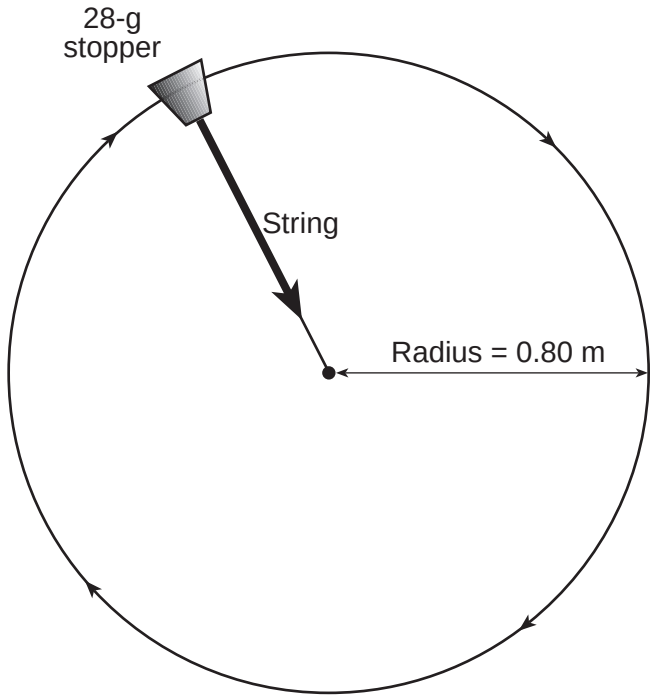
Example of a 1-credit response:

$a_c = 7.8 \text{ m/s}^2$

Note: Allow credit for an answer that is consistent with the student's response to question 63. Do *not* penalize the student more than 1 credit for errors in units in questions 63 and 64.

65 [1] Allow 1 credit for an arrow drawn on the string and directed toward the center of curvature *or* drawn alongside and parallel to the string.

Example of a 1-credit response:



Top view

Note: Do *not* allow credit if more than one arrow is drawn, unless the correct arrow is labeled appropriately.

Part C

66 [1] Allow 1 credit for -8 *or* 10^{-8}.

Note: Allow credit for a correct answer that also includes the unit "s".
Do *not* allow credit for 10 nanoseconds or a decimal form, such as 0.000000010 s.

67 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

$E = hf$

$E = (6.63 \times 10^{-34}\ \text{J•s})(4.76 \times 10^{14}\ \text{Hz})$

68 [1] Allow 1 credit for the correct answer with units.

Example of a 1-credit response:

$E = 3.16 \times 10^{-19}\ \text{J}$

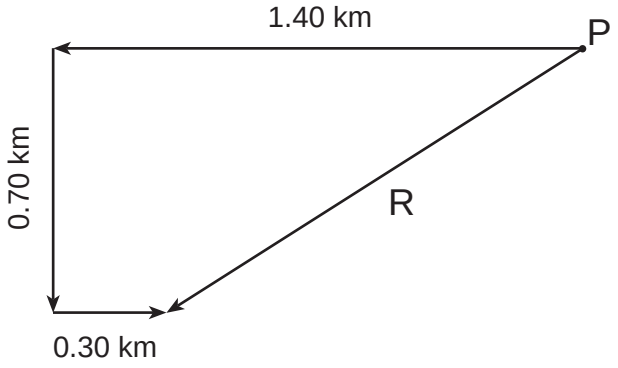
Note: Allow credit for an answer that is consistent with the student's response to question 67. Do *not* penalize the student more than 1 credit for errors in units in questions 67 and 68.

69 [1] Allow 1 credit for stating that the ground state is the lowest available energy level that an atom can have *or* that the ground state is the most stable energy state.

70 [1] Allow 1 credit for a 1.5-cm-long vector ± 0.2 cm, directed east from the arrowhead of the second displacement vector, and labeled 0.30 km.

71 [1] Allow 1 credit for a vector drawn from *P* to the tip of the arrowhead of the student's drawn vector in the previous response, and labeled *R*.

Example of a 1-credit response for question 70 and a 1-credit response for question 71:



Note: Deduct only 1 credit for missing labels and/or arrowheads for questions 70 and 71.

72 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

$\overline{v} = \dfrac{d}{t}$ $\qquad$ $\overline{v} = \dfrac{d}{t}$

or

$\overline{v} = \dfrac{1.40\ \text{km} + 0.70\ \text{km} + 0.30\ \text{km}}{12\ \text{min}}$ $\qquad$ $\overline{v} = \dfrac{2400\ \text{m}}{720\ \text{s}}$

73 [1] Allow 1 credit for a correct answer with units.

Examples of 1-credit responses:

$\overline{v} = 0.20$ km/min $\qquad$ *or* $\qquad$ $\overline{v} = 3.3$ m/s

Note: Allow credit for an answer that is consistent with the student's response to question 72. Do *not* penalize the student more than one credit for errors in units in questions 72 and 73.

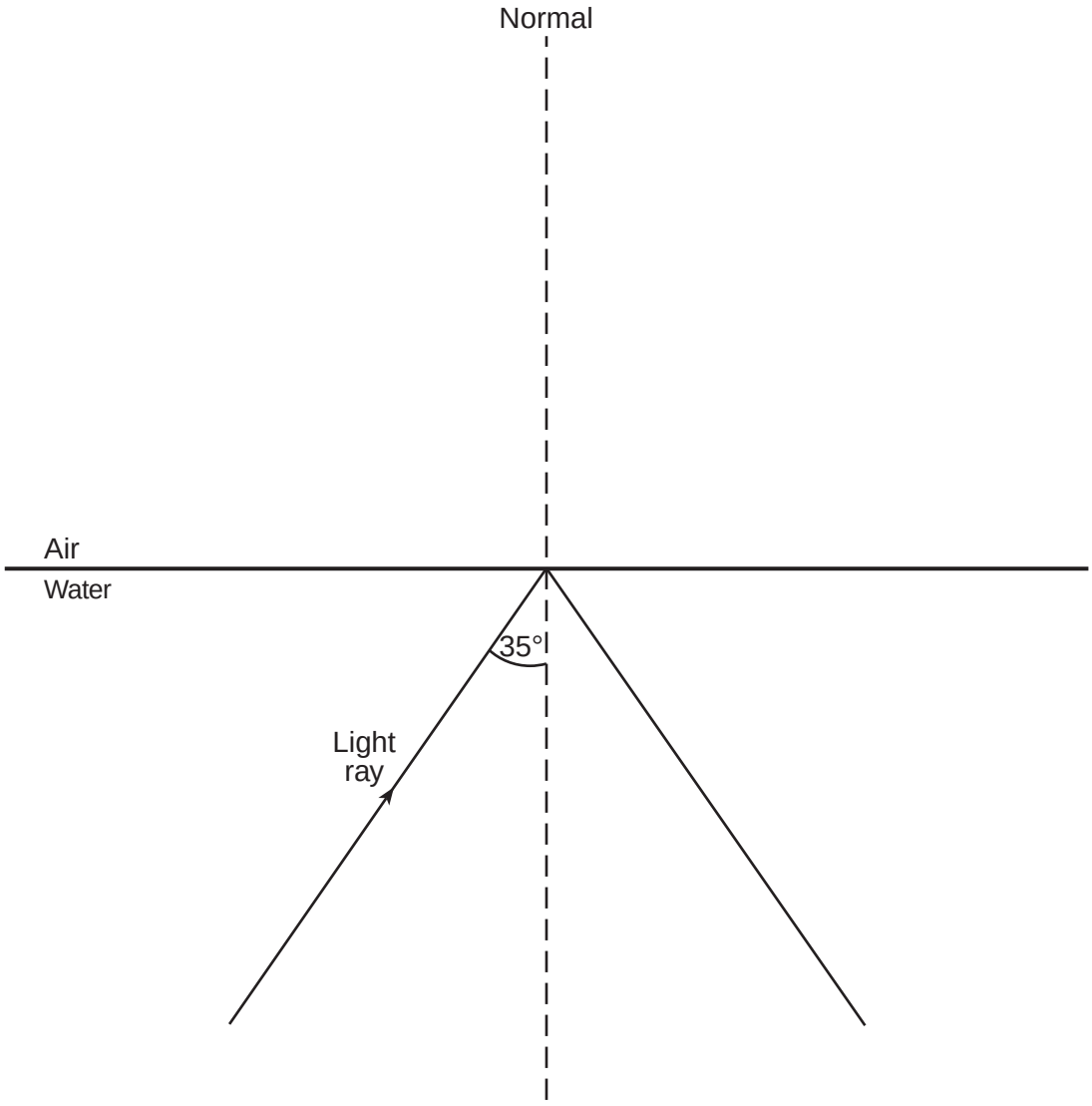
74 [1] Allow 1 credit for 1.3 km ± 0.2 km *or* an answer that is consistent with the student's response to question 71.

75 [1] Allow 1 credit for 32° ± 2° *or* an answer that is consistent with the student's response to question 71 (the angle at *P*).

76 [1] Allow 1 credit for 35°.

77 [1] Allow 1 credit for drawing the reflected ray at an angle of 35° ± 2° to the normal.

Example of a 1-credit response:



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

78 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

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

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

$$\sin \theta_2 = \frac{(1.33) \sin 35°}{1.00}$$

79 [1] Allow 1 credit for the correct answer with units.

Example of a 1-credit response:

$\theta_2 = 50°$ *or* $49°$

Note: Allow credit for an answer that is consistent with the student's response to question 78. Do *not* penalize the student more than 1 credit for errors in units in questions 78 and 79.

80 [1] Allow 1 credit for frequency, period, phase, color, *or* transverse.

81 [1] Allow 1 credit for 182 J.

82 [1] Allow 1 credit for the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

$\Delta PE = mg\Delta h$

$\Delta PE = (40.0\text{ N})(3.00\text{ m})$

83 [1] Allow 1 credit for the correct answer with units.

Example of a 1-credit response:

$\Delta PE = 120.\text{ J}$

Note: Allow credit for an answer that is consistent with the student's response to question 82. Do *not* penalize the student more than 1 credit for errors in units in questions 82 and 83.

84 [1] Allow 1 credit for indicating that the kinetic energy of the crate is constant.

85 [1] Allow 1 credit for indicating that the internal energy of the crate increases.

Note: Allow credit for an answer that is consistent with the student's responses to questions 81 and 83.

Regents Examination in Physical Setting/Physics

June 2013

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

The *Chart for Determining the Final Examination Score for the June 2013 Regents Examination in Physical Setting/Physics* will be posted on the Department's web site at: http://www.p12.nysed.gov/assessment/ on Thursday, June 13, 2013. 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.

Online Submission of Teacher Evaluations of the Test to the Department

Suggestions and feedback from teachers provide an important contribution to the test development process. The Department provides an online evaluation form for State assessments. It contains spaces for teachers to respond to several specific questions and to make suggestions. Instructions for completing the evaluation form are as follows:

1. Go to http://www.forms2.nysed.gov/emsc/osa/exameval/reexameval.htm.
2. Select the test title.
3. Complete the required demographic fields.
4. Complete each evaluation question and provide comments in the space provided.
5. Click the SUBMIT button at the bottom of the page to submit the completed form.

Map to Core Curriculum

June 2013 Physical Setting/Physics			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	2, 3, 4, 5, 6, 8, 11, 12, 13, 14, 20, 24, 29, 30, 31, 32, 33, 34	37, 38, 39, 40, 41, 42, 51, 52, 54, 55, 57, 58, 59, 60, 61, 62, 63	69, 72, 73, 74, 78, 79, 81, 82, 83
Math Key Idea 2	10	45, 47	
Math Key Idea 3		50, 57, 58, 59, 64, 65	
Sci. Inq. Key Idea 1			
Sci. Inq. Key Idea 2			
Sci. Inq. Key Idea 3		38, 44, 46	
Eng. Des. Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2		43	
Key Idea 3		36, 39	66
Key Idea 4	23		
Key Idea 5			
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
4.1		53, 56	84
4.3		48, 49	77, 80
5.1	14	38, 57, 58, 59	70, 71, 74, 75
5.3	34		67, 68
Standard 4			
4.1	14, 15, 21, 27, 28, 30, 31, 32	39, 41, 42, 45, 51, 52, 56, 60, 61, 62	81, 82, 83, 84, 85
4.3	16, 17, 18, 19, 20, 22, 24, 25, 26, 29	48, 49, 53	76, 77, 78, 79, 80
5.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 23	37, 38, 40, 43, 46, 47, 54, 55, 57, 58, 59, 63, 64, 65	70, 71, 72, 73, 74, 75
5.3	33, 34, 35	44, 50	66, 67, 68, 69

Regents Examination in Physical Setting/Physics – June 2013

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

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

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 scale score that corresponds to that raw score. The scale score is the student's final examination score. Enter this score in the space labeled "Scale Score" on the student's answer sheet.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart change from one administration 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 Regents Examination in Physical Setting/Physics.