

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

PHYSICAL SETTING
PHYSICS

Tuesday, June 21, 2016 — 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 quantity is a vector?

- (1) power (3) speed
(2) kinetic energy (4) weight

2 A 65.0-kilogram astronaut weighs 638 newtons at the surface of Earth. What is the mass of the astronaut at the surface of the Moon, where the acceleration due to gravity is 1.62 meters per second squared?

- (1) 10.7 kg (3) 105 N
(2) 65.0 kg (4) 638 N

3 When the sum of all the forces acting on a block on an inclined plane is zero, the block

- (1) must be at rest
(2) must be accelerating
(3) may be slowing down
(4) may be moving at constant speed

4 The greatest increase in the inertia of an object would be produced by increasing the

- (1) mass of the object from 1.0 kg to 2.0 kg
(2) net force applied to the object from 1.0 N to 2.0 N
(3) time that a net force is applied to the object from 1.0 s to 2.0 s
(4) speed of the object from 1.0 m/s to 2.0 m/s

5 A 100.-kilogram cart accelerates at 0.50 meter per second squared west as a horse exerts a force of 60. newtons west on the cart. What is the magnitude of the force that the cart exerts on the horse?

- (1) 10. N (3) 60. N
(2) 50. N (4) 110 N

6 Sound waves are described as

- (1) mechanical and transverse
(2) mechanical and longitudinal
(3) electromagnetic and transverse
(4) electromagnetic and longitudinal

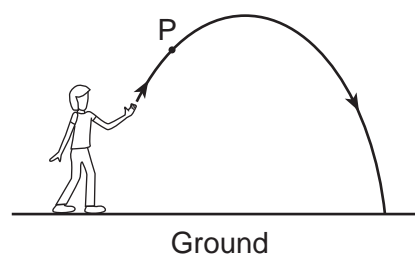
7 An electrical force of 8.0×10^{-5} newton exists between two point charges, q_1 and q_2 . If the distance between the charges is doubled, the new electrical force between the charges will be

- (1) 1.6×10^{-4} N (3) 3.2×10^{-4} N
(2) 2.0×10^{-5} N (4) 4.0×10^{-5} N

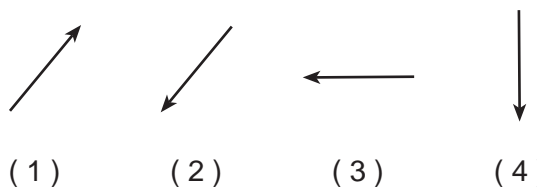
8 A blue lab cart is traveling west on a track when it collides with and sticks to a red lab cart traveling east. The magnitude of the momentum of the blue cart before the collision is 2.0 kilogram • meters per second, and the magnitude of the momentum of the red cart before the collision is 3.0 kilogram • meters per second. The magnitude of the total momentum of the two carts after the collision is

- (1) 1.0 kg • m/s (3) 3.0 kg • m/s
(2) 2.0 kg • m/s (4) 5.0 kg • m/s

9 The diagram below represents the path of a thrown ball through the air.



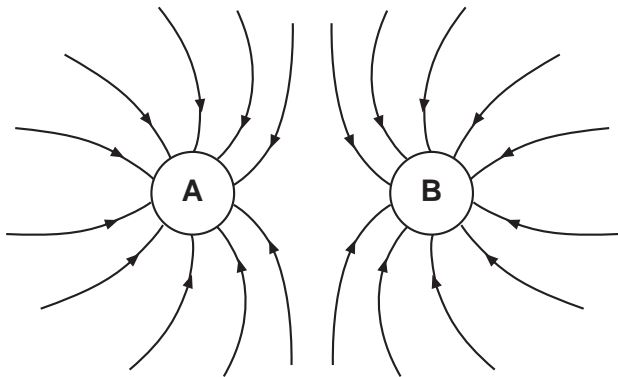
Which arrow best represents the direction in which friction acts on the ball at point P?



10 A magnetic field would be produced by a beam of

- (1) x rays (3) protons
(2) gamma rays (4) neutrons

- 11 The diagram below represents the electric field in the region of two small charged spheres, *A* and *B*.



What is the sign of the net charge on *A* and *B*?

- (1) *A* is positive and *B* is positive.
 (2) *A* is positive and *B* is negative.
 (3) *A* is negative and *B* is negative.
 (4) *A* is negative and *B* is positive.
- 12 A horizontal force of 20 newtons eastward causes a 10-kilogram box to have a displacement of 5 meters eastward. The total work done on the box by the 20-newton force is
- (1) 40 J (3) 200 J
 (2) 100 J (4) 1000 J
- 13 A block initially at rest on a horizontal, frictionless surface is accelerated by a constant horizontal force of 5.0 newtons. If 15 joules of work is done on the block by this force while accelerating it, the kinetic energy of the block increases by
- (1) 3.0 J (3) 20. J
 (2) 15 J (4) 75 J
- 14 Two objects, *A* and *B*, are held one meter above the horizontal ground. The mass of *B* is twice as great as the mass of *A*. If *PE* is the gravitational potential energy of *A* relative to the ground, then the gravitational potential energy of *B* relative to the ground is
- (1) *PE* (3) $\frac{PE}{2}$
 (2) $2PE$ (4) $4PE$

- 15 What is the kinetic energy of a 55-kilogram skier traveling at 9.0 meters per second?
- (1) 2.5×10^2 J (3) 2.2×10^3 J
 (2) 5.0×10^2 J (4) 4.9×10^3 J
- 16 A 5.09×10^{14} -hertz electromagnetic wave is traveling through a transparent medium. The main factor that determines the speed of this wave is the
- (1) nature of the medium
 (2) amplitude of the wave
 (3) phase of the wave
 (4) distance traveled through the medium
- 17 A motor does a total of 480 joules of work in 5.0 seconds to lift a 12-kilogram block to the top of a ramp. The average power developed by the motor is
- (1) 8.0 W (3) 96 W
 (2) 40. W (4) 2400 W
- 18 A 5.8×10^4 -watt elevator motor can lift a total weight of 2.1×10^4 newtons with a maximum constant speed of
- (1) 0.28 m/s (3) 2.8 m/s
 (2) 0.36 m/s (4) 3.6 m/s
- 19 A stationary police officer directs radio waves emitted by a radar gun at a vehicle moving toward the officer. Compared to the emitted radio waves, the radio waves reflected from the vehicle and received by the radar gun have a
- (1) longer wavelength (3) longer period
 (2) higher speed (4) higher frequency
- 20 A light wave strikes the Moon and reflects toward Earth. As the light wave travels from the Moon toward Earth, the wave carries
- (1) energy, only
 (2) matter, only
 (3) both energy and matter
 (4) neither energy nor matter
- 21 The time required to produce one cycle of a wave is known as the wave's
- (1) amplitude (3) period
 (2) frequency (4) wavelength

22 A magnetic compass is placed near an insulated copper wire. When the wire is connected to a battery and a current is created, the compass needle moves and changes its position. Which is the best explanation for the production of a force that causes the needle to move?

- (1) The copper wire magnetizes the compass needle and exerts the force on the compass needle.
- (2) The compass needle magnetizes the copper wire and exerts the force on the compass needle.
- (3) The insulation on the wire becomes charged, which exerts the force on the compass needle.
- (4) The current in the wire produces a magnetic field that exerts the force on the compass needle.

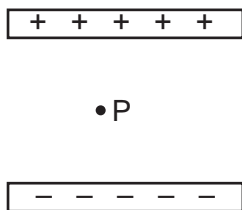
23 A beam of monochromatic light ($f = 5.09 \times 10^{14}$ Hz) has a wavelength of 589 nanometers in air. What is the wavelength of this light in Lucite?

- (1) 150 nm
- (2) 393 nm
- (3) 589 nm
- (4) 884 nm

24 If the amplitude of a sound wave is increased, there is an increase in the sound's

- (1) loudness
- (2) pitch
- (3) velocity
- (4) wavelength

25 In the diagram below, point P is located in the electric field between two oppositely charged parallel plates.



Compared to the magnitude and direction of the electrostatic force on an electron placed at point P , the electrostatic force on a proton placed at point P has

- (1) the same magnitude and the same direction
- (2) the same magnitude, but the opposite direction
- (3) a greater magnitude, but the same direction
- (4) a greater magnitude and the opposite direction

26 The effect produced when two or more sound waves pass through the same point simultaneously is called

- (1) interference
- (2) diffraction
- (3) refraction
- (4) resonance

27 A gamma ray photon and a microwave photon are traveling in a vacuum. Compared to the wavelength and energy of the gamma ray photon, the microwave photon has a

- (1) shorter wavelength and less energy
- (2) shorter wavelength and more energy
- (3) longer wavelength and less energy
- (4) longer wavelength and more energy

28 According to the Standard Model of Particle Physics, a neutrino is a type of

- (1) lepton
- (2) photon
- (3) meson
- (4) baryon

29 Which combination of quarks produces a neutral baryon?

- (1) cts
- (2) dsb
- (3) uds
- (4) uct

30 When 2.0×10^{-16} kilogram of matter is converted into energy, how much energy is released?

- (1) 1.8×10^{-1} J
- (2) 1.8×10^1 J
- (3) 6.0×10^{-32} J
- (4) 6.0×10^{-8} J

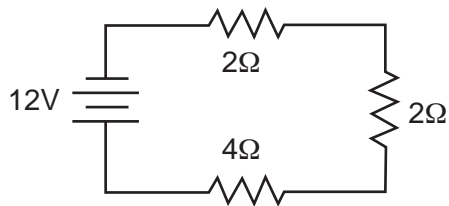
31 A ball is hit straight up with an initial speed of 28 meters per second. What is the speed of the ball 2.2 seconds after it is hit? [Neglect friction.]

- (1) 4.3 m/s
- (2) 6.4 m/s
- (3) 22 m/s
- (4) 28 m/s

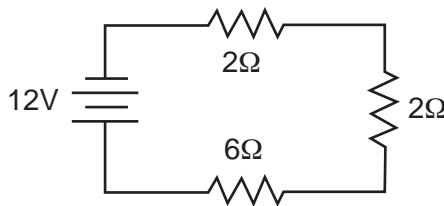
32 A particle with a charge of 3.00 elementary charges moves through a potential difference of 4.50 volts. What is the change in electrical potential energy of the particle?

- (1) 1.07×10^{-19} eV
- (2) 2.16×10^{-18} eV
- (3) 1.50 eV
- (4) 13.5 eV

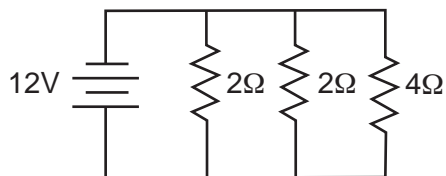
33 Which circuit has the largest equivalent resistance?



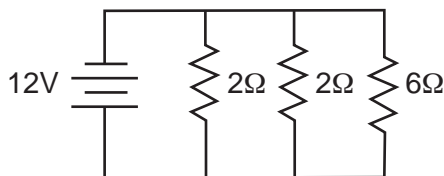
(1)



(3)

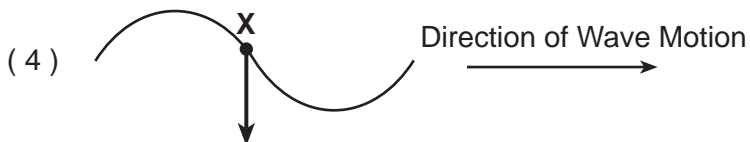


(2)

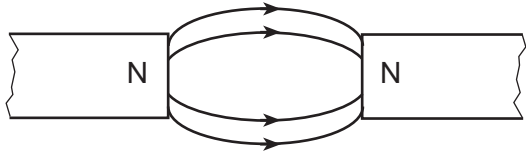


(4)

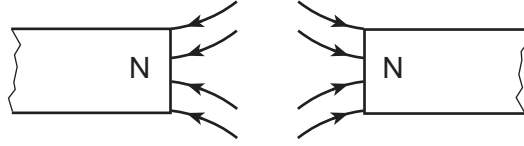
34 A transverse wave is moving toward the right in a uniform medium. Point X represents a particle of the uniform medium. Which diagram represents the direction of the motion of particle X at the instant shown?



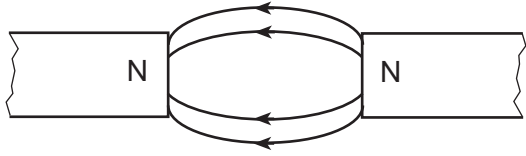
35 Which diagram represents magnetic field lines between two north magnetic poles?



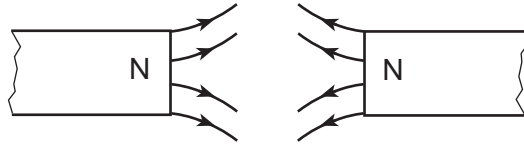
(1)



(3)



(2)



(4)



Part B-1

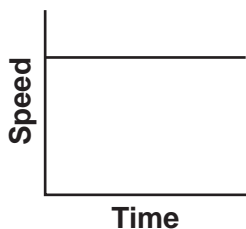
Answer all questions in this part.

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.

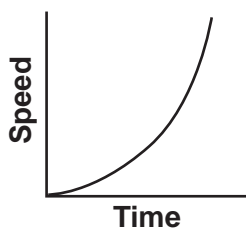
36 Which measurement is closest to 1×10^{-2} meter?

- (1) diameter of an atom
- (2) width of a student's finger
- (3) length of a football field
- (4) height of a schoolteacher

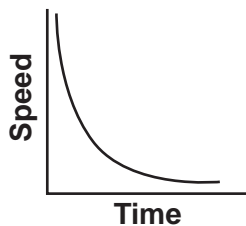
37 Which graph represents the relationship between the speed of a freely falling object and the time of fall of the object near Earth's surface?



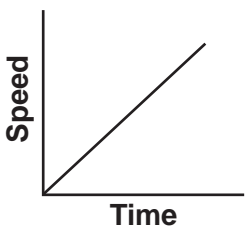
(1)



(3)



(2)



(4)

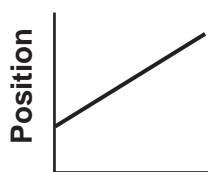
38 A hair dryer with a resistance of 9.6 ohms operates at 120 volts for 2.5 minutes. The total electrical energy used by the dryer during this time interval is

- (1) 2.9×10^3 J
- (2) 3.8×10^3 J
- (3) 1.7×10^5 J
- (4) 2.3×10^5 J

39 A box weighing 46 newtons rests on an incline that makes an angle of 25° with the horizontal. What is the magnitude of the component of the box's weight perpendicular to the incline?

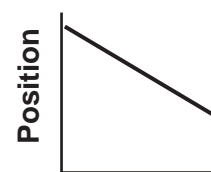
- (1) 19 N
- (2) 21 N
- (3) 42 N
- (4) 46 N

40 Which graph represents the motion of an object traveling with a positive velocity and a negative acceleration?



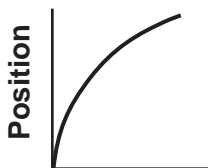
Time

(1)



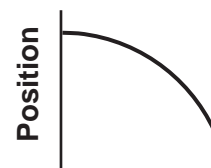
Time

(3)



Time

(2)



Time

(4)

41 Car A, moving in a straight line at a constant speed of 20. meters per second, is initially 200 meters behind car B, moving in the same straight line at a constant speed of 15 meters per second. How far must car A travel from this initial position before it catches up with car B?

- (1) 200 m
- (2) 400 m
- (3) 800 m
- (4) 1000 m

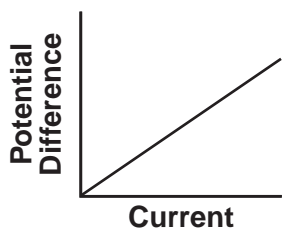
42 A 2700-ohm resistor in an electric circuit draws a current of 2.4 milliamperes. The total charge that passes through the resistor in 15 seconds is

- (1) 1.6×10^{-4} C
- (2) 3.6×10^{-2} C
- (3) 1.6×10^{-1} C
- (4) 3.6×10^1 C

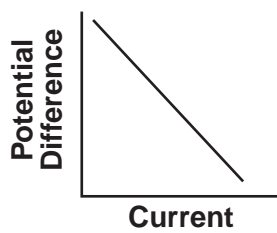
43 A 1000.-kilogram car traveling 20.0 meters per second east experiences an impulse of 2000. newton • seconds west. What is the final velocity of the car after the impulse has been applied?

- (1) 18.0 m/s east
- (2) 19.5 m/s east
- (3) 20.5 m/s west
- (4) 22.0 m/s west

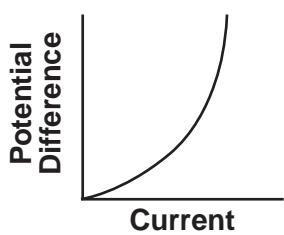
44 Which graph represents the relationship between the potential difference applied to a copper wire and the resulting current in the wire at constant temperature?



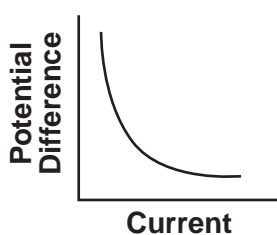
(1)



(3)



(2)



(4)

45 A tungsten wire has resistance R at 20°C . A second tungsten wire at 20°C has twice the length and half the cross-sectional area of the first wire. In terms of R , the resistance of the second wire is

(1) $\frac{R}{2}$

(3) $2R$

(2) R

(4) $4R$

46 After an incandescent lamp is turned on, the temperature of its filament rapidly increases from room temperature to its operating temperature. As the temperature of the filament increases, what happens to the resistance of the filament and the current through the filament?

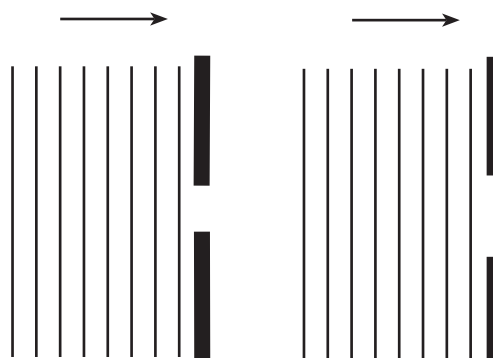
(1) The resistance increases and the current decreases.

(2) The resistance increases and the current increases.

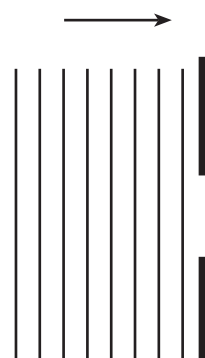
(3) The resistance decreases and the current decreases.

(4) The resistance decreases and the current increases.

47 Parallel wave fronts are incident on an opening in a barrier. Which diagram shows the configuration of wave fronts and barrier opening that will result in the greatest diffraction of the waves passing through the opening? [Assume all diagrams are drawn to the same scale.]



(1)



(3)



(2)



(4)

48 A singer demonstrated that she could shatter a crystal glass by singing a note with a wavelength of 0.320 meter in air at STP. What was the natural frequency of the glass?

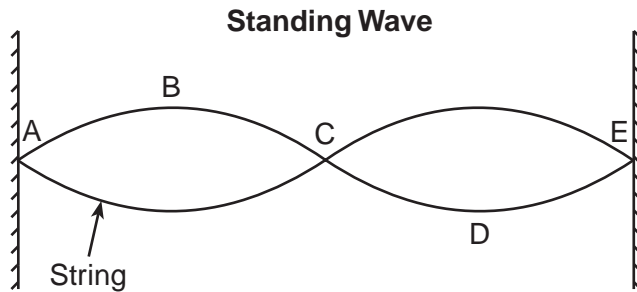
(1) $9.67 \times 10^{-4} \text{ Hz}$

(3) $1.03 \times 10^3 \text{ Hz}$

(2) $1.05 \times 10^2 \text{ Hz}$

(4) $9.38 \times 10^8 \text{ Hz}$

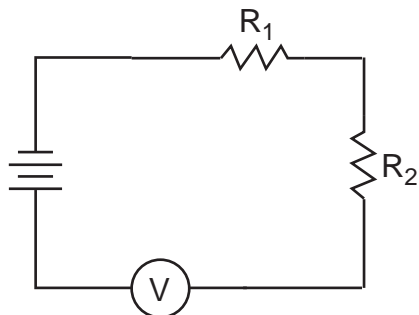
49 The diagram below represents a standing wave in a string.



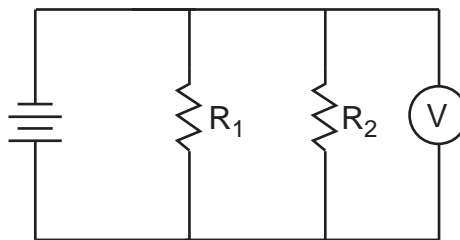
Maximum constructive interference occurs at the

- (1) antinodes A , C , and E
- (2) nodes A , C , and E
- (3) antinodes B and D
- (4) nodes B and D

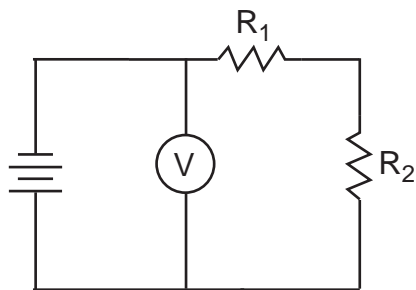
50 Which circuit diagram represents voltmeter V connected correctly to measure the potential difference across resistor R_2 ?



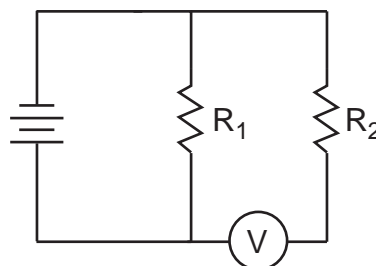
(1)



(3)



(2)



(4)

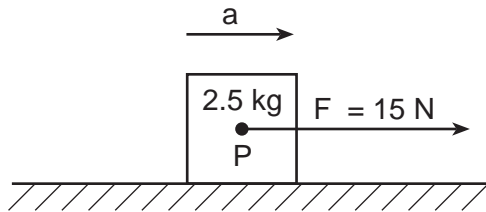
Part B-2

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*.

Base your answers to questions 51 through 53 on the information and diagram below and on your knowledge of physics.

As represented in the diagram below, a constant 15-newton force, F , is applied to a 2.5-kilogram box, accelerating the box to the right at 2.0 meters per second squared across a rough horizontal surface.

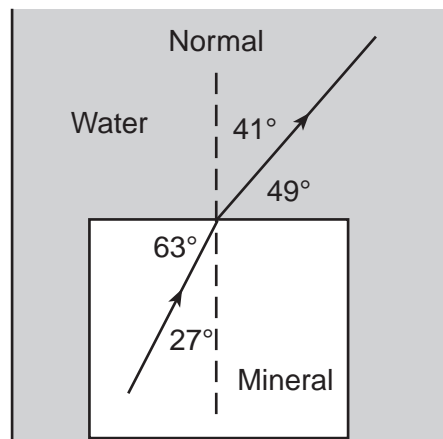


51–52 Calculate the magnitude of the net force acting on the box. [Show all work, including the equation and substitution with units.] [2]

53 Determine the magnitude of the force of friction on the box. [1]

Base your answers to questions 54 and 55 on the information and diagram below and on your knowledge of physics.

A ray of light ($f = 5.09 \times 10^{14}\text{ Hz}$) is traveling through a mineral sample that is submerged in water. The ray refracts as it enters the water, as shown in the diagram below.



54–55 Calculate the absolute index of refraction of the mineral. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 56 through 58 on the information below and on your knowledge of physics.

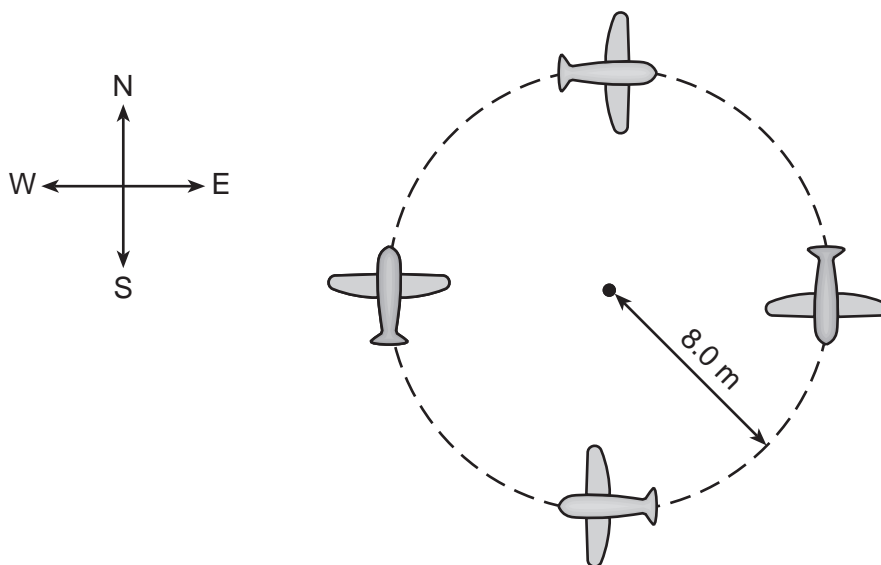
A ball is rolled twice across the same level laboratory table and allowed to roll off the table and strike the floor. In each trial, the time it takes the ball to travel from the edge of the table to the floor is accurately measured. [Neglect friction.]

56–57 In trial *A*, the ball is traveling at 2.50 meters per second when it reaches the edge of the table. The ball strikes the floor 0.391 second after rolling off the edge of the table. Calculate the height of the table. [Show all work, including the equation and substitution with units.] [2]

58 In trial *B*, the ball is traveling at 5.00 meters per second when it reaches the edge of the table. Compare the time it took the ball to reach the floor in trial *B* to the time it took the ball to reach the floor in trial *A*. [1]

Base your answers to questions 59 through 61 on the information and diagram below and on your knowledge of physics.

A toy airplane flies clockwise at a constant speed in a horizontal circle of radius 8.0 meters. The magnitude of the acceleration of the airplane is 25 meters per second squared. The diagram shows the path of the airplane as it travels around the circle.

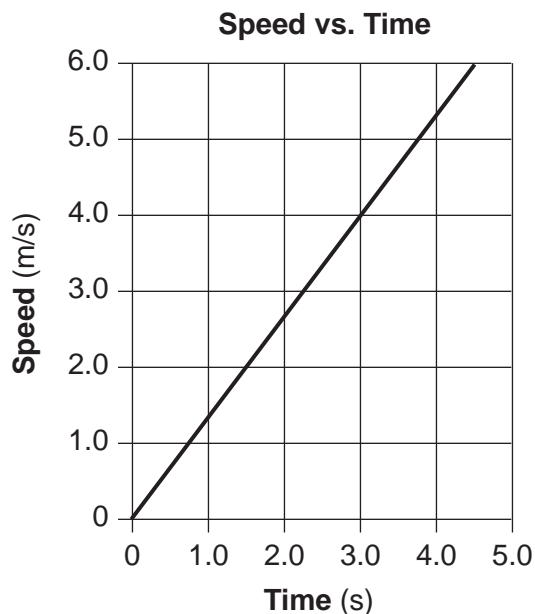


59–60 Calculate the speed of the airplane. [Show all work, including the equation and substitution with units.] [2]

61 State the direction of the velocity of the airplane at the instant the acceleration of the airplane is southward. [1]

Base your answers to questions 62 through 64 on the information and graph below and on your knowledge of physics.

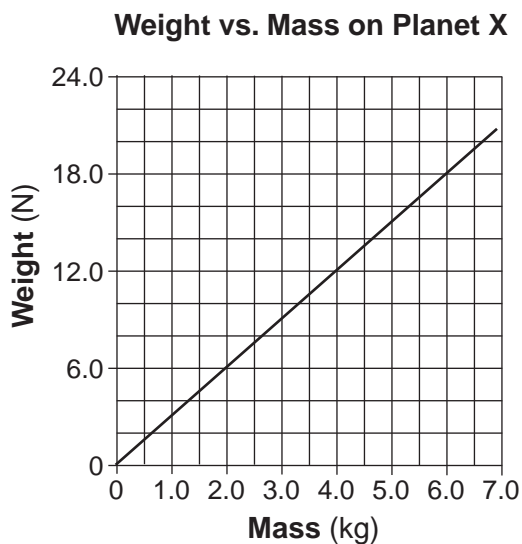
The graph below represents the speed of a marble rolling down a straight incline as a function of time.



62 What quantity is represented by the slope of the graph? [1]

63–64 Calculate the distance the marble travels during the first 3.0 seconds. [Show all work, including the equation and substitution with units.] [2]

65 The graph below represents the relationship between weight and mass for objects on the surface of planet X.



Determine the acceleration due to gravity on the surface of planet X. [1]

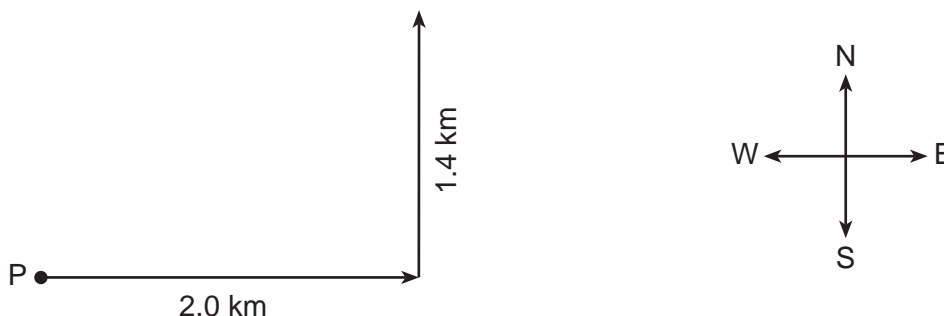
Part C

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 and vector diagram below and on your knowledge of physics.

A hiker starts at point P and walks 2.0 kilometers due east and then 1.4 kilometers due north. The vectors in the diagram below represent these two displacements.



- 66 Using a metric ruler, determine the scale used in the vector diagram. [1]
- 67 On the diagram *in your answer booklet*, use a ruler to construct the vector representing the hiker's resultant displacement. [1]
- 68 Determine the magnitude of the hiker's resultant displacement. [1]
- 69 Using a protractor, determine the angle between east and the hiker's resultant displacement. [1]
-

Base your answers to questions 70 through 74 on the information and diagram below and on your knowledge of physics.

A jack-in-the-box is a toy in which a figure in an open box is pushed down, compressing a spring. The lid of the box is then closed. When the box is opened, the figure is pushed up by the spring. The spring in the toy is compressed 0.070 meter by using a downward force of 12.0 newtons.



70–71 Calculate the spring constant of the spring. [Show all work, including the equation and substitution with units.] [2]

72–73 Calculate the total amount of elastic potential energy stored in the spring when it is compressed. [Show all work, including the equation and substitution with units.] [2]

74 Identify *one* form of energy to which the elastic potential energy of the spring is converted when the figure is pushed up by the spring. [1]

Base your answers to questions 75 through 80 on the information below and on your knowledge of physics.

A 12-volt battery causes 0.60 ampere to flow through a circuit that contains a lamp and a resistor connected in parallel. The lamp is operating at 6.0 watts.

75 Using the circuit symbols shown on the *Reference Tables for Physical Setting/Physics*, draw a diagram of the circuit in the space provided *in your answer booklet*. [1]

76–77 Calculate the current through the lamp. [Show all work, including the equation and substitution with units.] [2]

78 Determine the current in the resistor. [1]

79–80 Calculate the resistance of the resistor. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 81 through 85 on the information below and on your knowledge of physics.

The Great Nebula in the constellation Orion consists primarily of excited hydrogen gas. The electrons in the atoms of excited hydrogen have been raised to higher energy levels. When these atoms release energy, a frequent electron transition is from the excited $n = 3$ energy level to the $n = 2$ energy level, which gives the nebula one of its characteristic colors.

81 Determine the energy, in electronvolts, of an emitted photon when an electron transition from $n = 3$ to $n = 2$ occurs. [1]

82 Determine the energy of this emitted photon in joules. [1]

83–84 Calculate the frequency of the emitted photon. [Show all work, including the equation and substitution with units.] [2]

85 Identify the color of light associated with this photon. [1]

PHYSICAL SETTING PHYSICS

Tuesday, June 21, 2016 — 1:15 to 4:15 p.m., only

ANSWER BOOKLET

Student Sex: Male
 Female

Teacher

School Grade

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

Part B–2

51–52

53 _____ **N**

54–55

56–57

58 _____

59–60

61 _____

62 _____

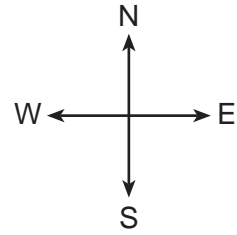
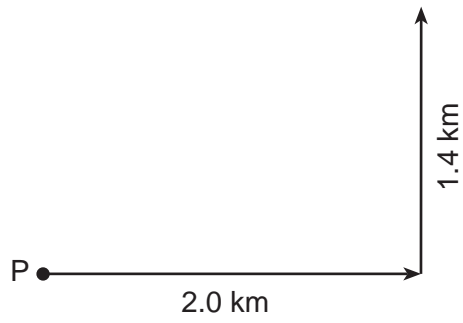
63–64

65 _____ m/s^2

Part C

66 1.0 cm = _____ km

67



68 _____ km

69 _____ °

70-71

72-73

74 _____

75

76-77

78 _____ **A**

79-80

81 _____ eV

82 _____ J

83–84

85 _____

FOR TEACHERS ONLY

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

PS–P

PHYSICAL SETTING/PHYSICS

Tuesday, June 21, 2016 — 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 4	28 1
2 2	11 3	20 1	29 3
3 4	12 2	21 3	30 2
4 1	13 2	22 4	31 2
5 3	14 2	23 2	32 4
6 2	15 3	24 1	33 3
7 2	16 1	25 2	34 3
8 1	17 3	26 1	35 4
9 2	18 3	27 3	
Part B–1			
36 2	40 2	44 1	48 3
37 4	41 3	45 4	49 3
38 4	42 2	46 1	50 3
39 3	43 1	47 2	

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's 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 Tuesday, June 21, 2016. 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’s 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:

$$a = \frac{F_{net}}{m}$$

$$F_{net} = ma$$

$$F_{net} = (2.5 \text{ kg})(2.0 \text{ m/s}^2)$$

- 52 [1] Allow 1 credit for a correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 51.

Example of a 1-credit response:

$$F_{net} = 5.0 \text{ N}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 51-52.

- 53 [1] Allow 1 credit for a correct answer or for an answer that is the difference between 15 N and the student's response to question 52.

Example of a 1-credit response:

$$F_{net} = 10. \text{ N}$$

- 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:

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

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

$$n_1 = \frac{(1.33)(\sin 41^\circ)}{\sin 27^\circ}$$

- 55 [1] Allow 1 credit for the correct answer without units *or* for an answer, without units, that is consistent with the student's response to question 54.

Examples of 1-credit responses:

$$n_1 = 1.9 \quad \text{or} \quad 2.0$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 54–55.

- 56 [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:

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

$$d = \frac{1}{2}(9.81 \text{ m/s}^2)(0.391 \text{ s})^2$$

- 57 [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 56.

Example of a 1-credit response:

$$d = 0.750 \text{ m}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 56–57.

- 58 [1] Allow 1 credit for stating that the measured times are the same.

- 59 [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:

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

$$v = \sqrt{a_c r}$$

$$v = \sqrt{(25 \text{ m/s}^2)(8.0 \text{ m})}$$

- 60 [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 59.

Example of a 1-credit response:

$$v = 14 \text{ m/s}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 59–60.

- 61 [1] Allow 1 credit for indicating the direction of the airplane's velocity is east *or* to the right.

- 62 [1] Allow 1 credit for acceleration *or* rate of change of velocity (speed).

- 63** [1] Allow 1 credit for the equation and substitution with units *or* for an answer, with units, that is consistent with the student's response to question 62. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

$$A = \frac{1}{2} bh \qquad \text{or} \qquad d = \frac{1}{2} at^2 \qquad \text{or} \qquad \bar{v} = \frac{d}{t}$$
$$A = d \qquad d = \frac{1}{2}(1.3 \text{ m/s}^2)(3.0 \text{ m/s})^2 \qquad d = \bar{v}t = (2.0 \text{ m/s})(3.0 \text{ s})$$
$$d = \frac{1}{2}(3.0 \text{ s})(4.0 \text{ m/s})$$

- 64** [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 63.

Examples of 1-credit responses:

$$d = 6.0 \text{ m} \qquad \text{or} \qquad d = 5.9 \text{ m}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 63 and 64.

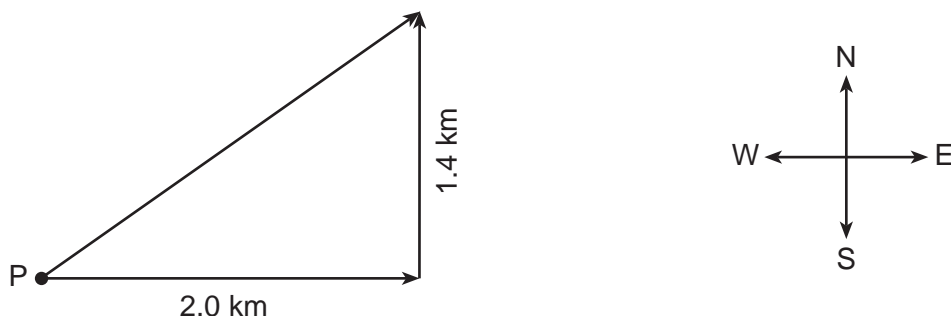
- 65** [1] Allow 1 credit for $3.0 \text{ m/s}^2 \pm 0.25 \text{ m/s}^2$.

Part C

66 [1] Allow 1 credit for $0.40 \text{ km} \pm 0.02 \text{ km}$.

67 [1] Allow 1 credit for constructing an arrow starting at point P and ending with an arrowhead at the top of the 1.4 km vector *or* for a vector $6.1 \text{ cm} \pm 0.2 \text{ cm}$ long at an angle of 35° north of the 2.0 km vector.

Example of a 1-credit response:



68 [1] Allow 1 credit for $2.4 \text{ km} \pm 0.2 \text{ km}$ *or* for an answer that is the product of the length of the resultant (in cm) drawn by the student for question 67 and the student's response to question 66.

69 [1] Allow 1 credit for $35^\circ \pm 2^\circ$ *or* for an answer that is the angle between the 2.0-km vector and the student's response to question 67.

70 [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:

$$F_s = kx$$

$$k = \frac{F_s}{x}$$

$$k = \frac{12.0 \text{ N}}{0.070 \text{ m}}$$

71 [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 70.

Example of a 1-credit response:

$$k = 170 \text{ N/m}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 70 and 71.

- 72 [1] Allow 1 credit for the equation and substitution with units *or* for an answer, with units, that is consistent with the student's response to questions 71. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

$$PE_s = \frac{1}{2} kx^2$$

or

$$W = \Delta E_T$$

$$\Delta PE_s = \bar{F}d$$

$$PE_s = \frac{1}{2}(170 \text{ N/m})(0.070 \text{ m})^2$$

$$PE_s = (6.0 \text{ N})(0.070 \text{ m})$$

- 73 [1] Allow 1 credit for correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 72.

Example of a 1-credit response:

$$PE_s = 0.42 \text{ J}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 72 and 73.

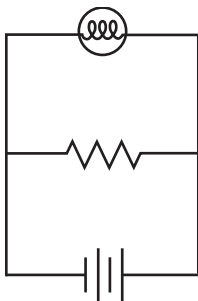
- 74 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

- kinetic energy
- sound
- internal energy (thermal energy)
- gravitational potential energy (potential energy)

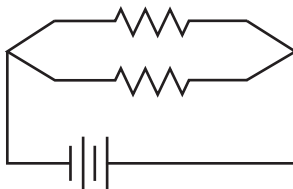
Note: Do *not* allow credit for elastic potential energy.

- 75 [1] Allow 1 credit for a correct circuit diagram.

Examples of 1-credit responses:



or



Note: Allow credit if student uses a cell symbol instead of a battery symbol.

- 76 [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:

$$P = VI$$

$$I = \frac{P}{V}$$

$$I = \frac{6.0 \text{ W}}{12 \text{ V}}$$

- 77 [1] Allow 1 credit for the correct response with units *or* for an answer, with units, that is consistent with the student's response to questions 75 and 76.

Example of a 1-credit response:

$$I = 0.50 \text{ A}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 76 and 77.

- 78 [1] Allow 1 credit for 0.10 A *or* for an answer that is the difference between the student's response to question 77 and 0.60 A *or* for an answer that is consistent with the student's response to question 75.

- 79 [1] Allow 1 credit for the equation and substitution with units *or* for an answer that is consistent with the student's response to question 78. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

$$R = \frac{V}{I} \quad \text{or} \quad P = \frac{V^2}{R} \quad \text{or} \quad \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R = \frac{12 \text{ V}}{0.10 \text{ A}} \quad R = \frac{V^2}{P} \quad \frac{1}{R_2} = \frac{1}{R_{eq}} - \frac{1}{R_1}$$

$$R = \frac{(12 \text{ V})^2}{1.2 \text{ W}} \quad \frac{1}{R_2} = \frac{1}{20. \Omega} - \frac{1}{24 \Omega}$$

- 80 [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 79.

Example of a 1-credit response:

$$R = 120 \Omega$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 79 and 80.

81 [1] Allow 1 credit for 1.89 eV.

82 [1] Allow 1 credit for 3.02×10^{-19} J *or* for an answer that is the product of the student's response to question 81 and 1.60×10^{-19} J/eV.

83 [1] Allow 1 credit for the equation and substitution with units *or* for an answer, with units, that is consistent with the student's response to question 82. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

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

$$f = \frac{E_{\text{photon}}}{h}$$

$$f = \frac{3.02 \times 10^{-19} \text{ J}}{6.63 \times 10^{-34} \text{ J}\cdot\text{s}}$$

84 [1] Allow 1 credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 83.

Example of a 1-credit response:

$$f = 4.56 \times 10^{14} \text{ Hz}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 83 and 84.

85 [1] Allow 1 credit for red *or* for an answer that is consistent with the student's response to question 84.

Regents Examination in Physical Setting/Physics

June 2016

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

The *Chart for Determining the Final Examination Score for the June 2016 Regents Examination in Physical Setting/Physics* will be posted on the Department's web site at: <http://www.p12.nysed.gov/assessment/> on Tuesday, June 21, 2016. 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 2016 Physical Setting/Physics			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	2, 5, 7, 8, 12, 13, 14, 15, 17, 18, 23, 30, 31, 32, 33	38, 39, 41, 42, 43, 45, 46, 48, 51, 52, 53, 54, 55, 56, 57, 59, 60, 63, 64, 65	66, 68, 70, 71, 72, 73, 76, 77, 78, 79, 80, 81, 82, 83, 84
Math Key Idea 2		37, 40, 44, 45	
Math Key Idea 3		46, 62, 65	
Science Inquiry Key Idea 1			
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3		37	
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2			
Key Idea 3		36	
Key Idea 4			
Key Idea 5			
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
4.1		45, 50	72, 73, 74, 75, 76, 77
4.3	34	47, 49, 54, 55	
5.1		39, 40, 51, 52, 62	66, 67, 68, 69, 70, 71
5.3			81, 85
Standard 4			
4.1	10, 12, 13, 14, 15, 17, 18, 22, 32, 33	38, 42, 44, 45, 46, 50	72, 73, 74, 75, 76, 77, 78, 79, 80
4.3	6, 16, 19, 20, 21, 23, 24, 26, 34	47, 48, 49, 54, 55	
5.1	1, 2, 3, 4, 5, 7, 8, 9, 11, 25, 31, 35	36, 37, 39, 40, 41, 43, 51, 52, 53, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65	66, 67, 68, 69, 70, 71
5.3	27, 28, 29, 30		81, 82, 83, 84, 85

Regents Examination in Physical Setting/Physics – June 2016

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