PHYSICAL SETTING
PHYSICS

Tuesday, June 19, 2018 — 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 combination correctly pairs a vector quantity with its corresponding unit?

   (1) weight and kg
   (2) velocity and m/s
   (3) speed and m/s
   (4) acceleration and m²/s

2 A 12.0-kilogram cart is moving at a speed of 0.25 meter per second. After the speed of the cart is tripled, the inertia of the cart will be

   (1) unchanged
   (2) one-third as great
   (3) three times greater
   (4) nine times greater

3 While taking off from an aircraft carrier, a jet starting from rest accelerates uniformly to a final speed of 40. meters per second on a runway that is 70. meters long. What is the magnitude of the acceleration of the jet?

   (1) 0.29 m/s²   (3) 1.8 m/s²
   (2) 0.57 m/s²   (4) 11 m/s²

4 A 6.0-kilogram cart initially traveling at 4.0 meters per second east accelerates uniformly at 0.50 meter per second squared east for 3.0 seconds. What is the speed of the cart at the end of this 3.0 second interval?

   (1) 1.5 m/s   (3) 3.0 m/s
   (2) 5.5 m/s   (4) 7.0 m/s

5 A soccer ball is kicked into the air from level ground with an initial speed of 20. meters per second and returns to ground level. At which angle above the horizontal should the ball be kicked in order for the ball to travel the greatest total horizontal distance? [Neglect friction.]

   (1) 15°   (3) 45°
   (2) 30.°   (4) 75°

6 Starting from rest, a car travels 18 meters as it accelerates uniformly for 3.0 seconds. What is the magnitude of the car's acceleration?

   (1) 6.0 m/s²   (3) 3.0 m/s²
   (2) 2.0 m/s²   (4) 4.0 m/s²

7 A ball is rolling horizontally at 3.00 meters per second as it leaves the edge of a tabletop 0.750 meter above the floor. The ball lands on the floor 0.391 second after leaving the tabletop. What is the magnitude of the ball's acceleration 0.200 second after it leaves the tabletop? [Neglect friction.]

   (1) 1.96 m/s²   (3) 9.81 m/s²
   (2) 7.65 m/s²   (4) 15.3 m/s²

8 A projectile with mass m is fired with initial horizontal velocity v_x from height h above level ground. Which change would have resulted in a greater time of flight for the projectile? [Neglect friction.]

   (1) decreasing the mass to $m/2$
   (2) decreasing the height to $h/2$
   (3) increasing the initial horizontal velocity to $2v_x$
   (4) increasing the height to $2h$

9 A golf club hits a stationary 0.050-kilogram golf ball with an average force of 5.0×10^3 newtons, accelerating the ball to a speed of 44 meters per second. What is the magnitude of the impulse imparted to the ball by the golf club?

   (1) 2.2 N•s   (3) 1.1×10^4 N•s
   (2) 880 N•s   (4) 2.2×10^5 N•s

10 A tennis player's racket applies an average force of 200. newtons to a tennis ball for 0.025 second. The average force exerted on the racket by the tennis ball is

   (1) 0.025 N   (3) 200. N
   (2) 5.0 N   (4) 80.0 N

11 The diagram below represents a box sliding down an incline at constant velocity.
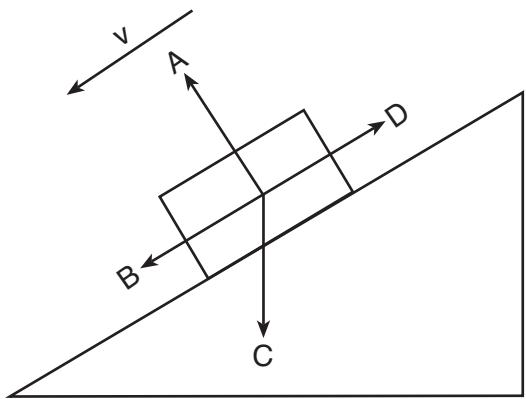
Which arrow represents the direction of the frictional force acting on the box?

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

12 Which diagram represents the directions of the velocity, v, and acceleration, a, of a toy car as it moves in a clockwise, horizontal, circular path at a constant speed?

(1)   (3)

(2)   (4)
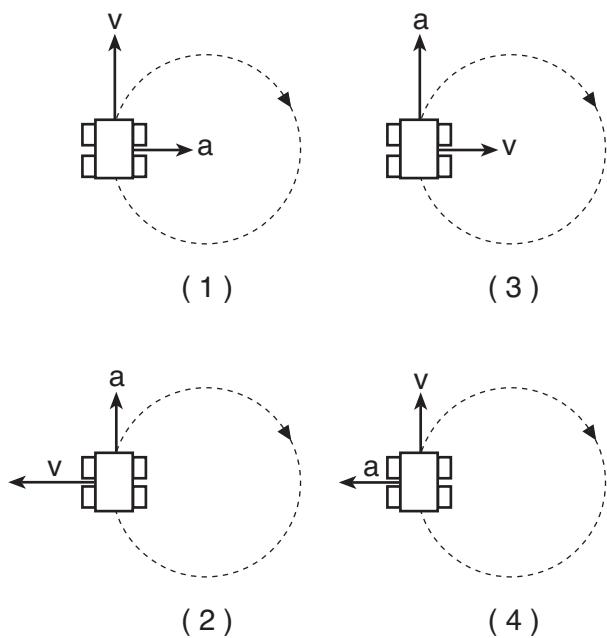
13 A charged particle is located in an electric field where the magnitude of the electric field strength is 2.0×10^3 newtons per coulomb. If the magnitude of the electrostatic force exerted on the particle is 3.0×10^{-3} newton, what is the charge of the particle?

(1) 1.6×10^{-19} C   (3) 6.0 C
(2) 1.5×10^{-6} C   (4) 6.7×10^5 C

14 The magnitude of the gravitational field strength near Earth's surface is represented by

(1) $\dfrac{F_g}{m}$ (3) mg

(2) G (4) $\dfrac{Gm_1m_2}{r^2}$

15 A car engine supplies 2.0×10^3 joules of energy during the 10. seconds it takes to accelerate the car along a horizontal surface. What is the average power developed by the car engine while it is accelerating?

(1) 2.0×10^1 W   (3) 2.0×10^3 W
(2) 2.0×10^2 W   (4) 2.0×10^4 W

16 Which forces can be either attractive or repulsive?

(1) gravitational and magnetic
(2) electrostatic and gravitational
(3) magnetic and electrostatic
(4) gravitational, magnetic, and electrostatic

17 Compared to the resistivity of a 0.4-meter length of 1-millimeter-diameter copper wire at 0°C, the resistivity of a 0.8-meter length of 1-millimeter-diameter copper wire at 0°C is

(1) one-fourth as great   (3) the same
(2) one-half as great   (4) four times greater

18 The work per unit charge required to move a charge between two points in an electric circuit defines electric

(1) force
(2) power
(3) field strength
(4) potential difference

19 A 2.0-meter length of copper wire is connected across a potential difference of 24 millivolts. The current through the wire is 0.40 ampere. The same copper wire at the same temperature is then connected across a potential difference of 48 millivolts. The current through the wire is

(1) 0.20 A   (3) 0.80 A
(2) 0.40 A   (4) 1.6 A

20 What is the magnitude of the gravitational force of attraction between two 0.425-kilogram soccer balls when the distance between their centers is 0.500 meter?

(1) 2.41×10^{-11} N   (3) 5.67×10^{-11} N
(2) 4.82×10^{-11} N   (4) 1.13×10^{-10} N

21 A sound wave produced by a loudspeaker can travel through water, but not through a vacuum. In comparison, a red light wave produced by a laser can travel through

(1) water, but not through a vacuum
(2) a vacuum, but not through water
(3) both water and a vacuum
(4) neither water nor a vacuum

22 As a group of soldiers marches along a road, each soldier steps simultaneously. However, when crossing a bridge, the group does not step simultaneously in order to prevent the bridge from vibrating intensely. The phenomenon responsible for the intense vibrations is

(1) action and reaction
(2) conservation of momentum
(3) inertia
(4) resonance

23 Which characteristics of a light wave remain constant when the light wave travels from air into corn oil?

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

24 The speed of a light ray $\left(f = 5.09 \times 10^{14}\text{ Hz}\right)$ in corn oil is

(1) 1.47×10^8 m/s   (3) 3.00×10^8 m/s
(2) 2.04×10^8 m/s   (4) 4.41×10^8 m/s

25 The spreading out of a wave after passing through an opening in a barrier is an example of

(1) diffraction   (3) reflection
(2) Doppler effect   (4) refraction

26 A microwave with a frequency of 5.0×10^{10} hertz has a period of

(1) 2.0×10^{-11} s   (3) 1.7×10^2 s
(2) 6.0×10^{-3} s   (4) 1.5×10^{19} s

27 After two light waves have interfered in a vacuum, the two waves will be

(1) changed in frequency
(2) changed in velocity
(3) changed in amplitude
(4) unchanged

28 A glass rod is rubbed with silk. During this process, a positive charge is given to the glass rod by

(1) adding electrons to the rod
(2) adding protons to the rod
(3) removing electrons from the rod
(4) removing protons from the rod

29 A photon with an energy of 1.33×10^{-21} joule has a frequency of

(1) 5.02×10^{13} Hz   (3) 8.82×10^{14} Hz
(2) 2.01×10^{12} Hz   (4) 5.30×10^{34} Hz

30 The speed of a car is increased uniformly from 11 meters per second to 19 meters per second. The average speed of the car during this interval is

(1) 0.0 m/s   (3) 30. m/s
(2) 15 m/s   (4) 4.0 m/s

31 The energy equivalent of the rest mass of an electron is

(1) 2.73×10^{-22} J   (3) 1.50×10^{-10} J
(2) 8.20×10^{-14} J   (4) 1.44×10^{-2} J

32 A spring has an unstretched length of 0.40 meter. The spring is stretched to a length of 0.60 meter when a 10.-newton weight is hung motionless from one end. The spring constant of this spring is

(1) 10. N/m

(3) 25 N/m

(2) 17 N/m

(4) 50. N/m

33 An electric circuit contains a battery, three lamps, and an open switch, as represented in the diagram below.

When the switch is open, there is an electric current in

(1) lamp I, only

(3) lamps I, II, and III

(2) lamps II and III, only

(4) none of the lamps

34 Which diagram correctly represents an electric field?

35 Which points on the wave diagram below are 90º out of phase with each other?

(1) *A* and *E*

(3) *C* and *D*

(2) *B* and *C*

(4) *D* and *E*

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 height of an individual step on a staircase is closest to
(1) 2.0×10^{-2} m   (3) 2.0×10^{0} m
(2) 2.0×10^{-1} m   (4) 2.0×10^{1} m

37 What is the magnitude of the electrostatic force exerted on an electron by another electron when they are 0.10 meter apart?
(1) 2.6×10^{-36} N   (3) 2.3×10^{-26} N
(2) 2.3×10^{-27} N   (4) 1.4×10^{-8} N

38 After a 65-newton weight has fallen freely from rest a vertical distance of 5.3 meters, the kinetic energy of the weight is
(1) 12 J   (3) 910 J
(2) 340 J   (4) 1800 J

39 A 0.500-kilogram cart traveling to the right on a horizontal, frictionless surface at 2.20 meters per second collides head on with a 0.800-kilogram cart moving to the left at 1.10 meters per second. What is the magnitude of the total momentum of the two-cart system after the collision?
(1) 0.22 kg•m/s   (3) 1.98 kg•m/s
(2) 0.39 kg•m/s   (4) 4.29 kg•m/s

40 An object weighing 2.0 newtons is pushed across a horizontal, frictionless surface by a horizontal force of 4.0 newtons. The magnitude of the net force acting on the object is
(1) 0.0 N   (3) 8.0 N
(2) 2.0 N   (4) 4.0 N

41 The ratio of the wavelength of AM radio waves traveling in a vacuum to the wavelength of FM radio waves traveling in a vacuum is approximately
(1) 1 to 1   (3) 10^{2} to 1
(2) 2 to 1   (4) 10^{8} to 1

42 A charm quark has a charge of approximately
(1) 5.33×10^{-20} C   (3) 1.60×10^{-19} C
(2) 1.07×10^{-19} C   (4) 2.40×10^{-19} C

43 The diagram below represents a 3.0-ohm resistor connected to a 12-volt battery. Meters X and Y are correctly connected in the circuit.
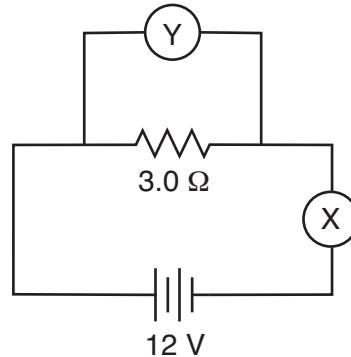

What are the readings on the meters?
(1) X = 12 V and Y = 0.25 A
(2) X = 12 V and Y = 4.0 A
(3) X = 0.25 A and Y = 12 V
(4) X = 4.0 A and Y = 12 V

44 A toy airplane, flying in a horizontal, circular path, completes 10. complete circles in 30. seconds. If the radius of the plane's circular path is 4.0 meters, the average speed of the airplane is
(1) 0.13 m/s   (3) 1.3 m/s
(2) 0.84 m/s   (4) 8.4 m/s

45 Which pair of graphs represents the vertical motion of an object falling freely from rest?

Displacement vs **Time**, **Velocity** vs **Time**

(1)

Displacement vs **Time**, **Velocity** vs **Time**

(3)

Displacement vs **Time**, **Velocity** vs **Time**

(2)

Displacement vs **Time**, **Velocity** vs **Time**
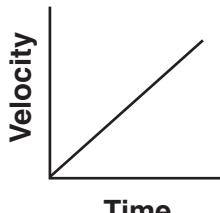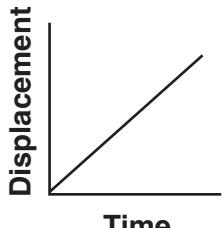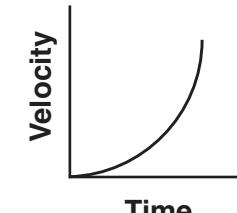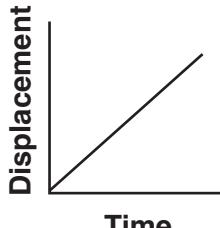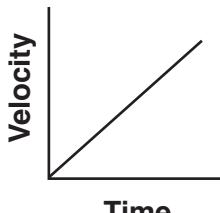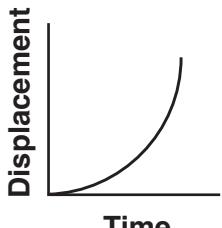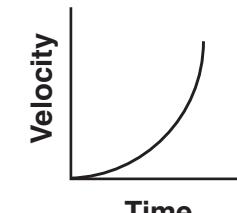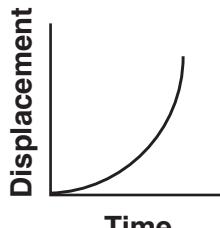
(4)

46 An object is thrown straight upward. Which graph best represents the relationship between the object's kinetic energy and the height of the object above its release point? [Neglect friction.]

Kinetic Energy vs **Height**

(1)

Kinetic Energy vs **Height**

(2)

Kinetic Energy vs **Height**

(3)

Kinetic Energy vs **Height**
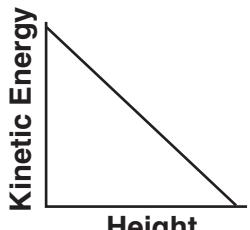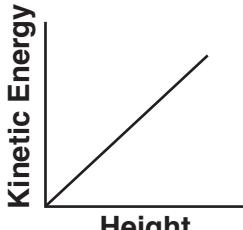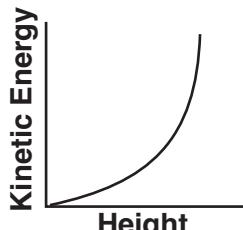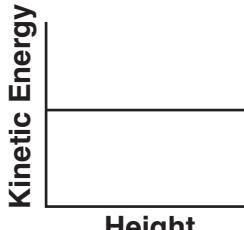
(4)

47 In the diagram below, X represents a particle in a spring.

X
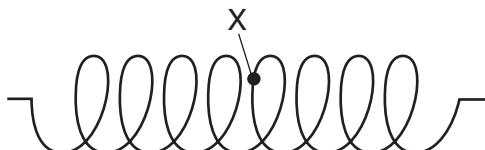
Which diagram represents the motion of particle X as a longitudinal wave passes through the spring toward the right?
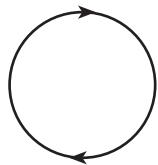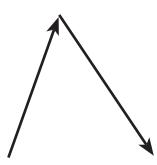
(1)   (2)   (3)   (4)

48 As represented in the diagram below, two wave pulses, X and Y, are traveling toward each other in a rope. Both wave pulses have an amplitude of 0.30 m.

0.30 m ↕ ⌒ X ⌒ Y ⌒ ↕ 0.30 m

Which diagram shows the pulse produced due to the superposition of pulse X and pulse Y?

↕ 0.30 m

(1)

↕ 0.60 m

(3)

↕ 0.30 m

(2)

↕ 0.60 m

(4)

49 The horn of a car produces a sound wave of constant frequency. The car, traveling at constant speed, approaches, passes, and then moves away from a stationary observer. Which graph best represents the frequency of this sound wave detected by the observer during the time interval in which the car approaches, passes, and moves away?

Observed frequency	Observed frequency	Observed frequency	Observed frequency
Time	Time	Time	Time
(1)	(2)	(3)	(4)
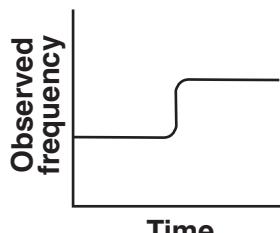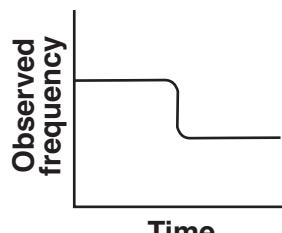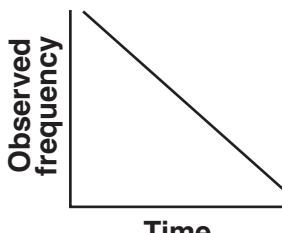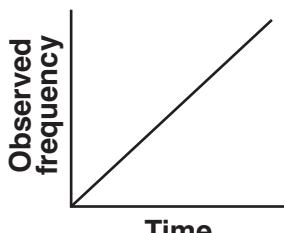
50 A combination of two identical resistors connected in series has an equivalent resistance of 10. ohms. What is the equivalent resistance of the combination of these same two resistors when connected in parallel?

(1) 2.5 Ω (3) 10. Ω
(2) 5.0 Ω (4) 20. Ω

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 below and on your knowledge of physics.

The scaled diagram below represents two forces acting concurrently at point *P*. The magnitude of force *A* is 32 newtons and the magnitude of force *B* is 20. newtons. The angle between the directions of force *A* and force *B* is 120º.
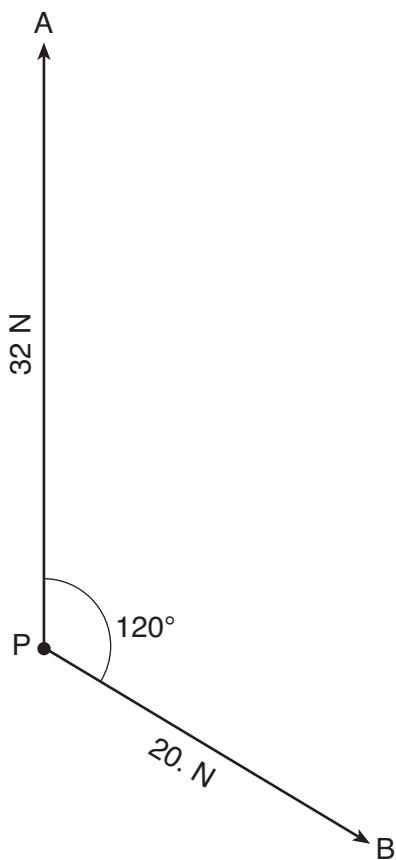
51 Determine the linear scale used in the diagram. [1]

52 On the diagram *in your answer booklet*, use a protractor and a ruler to construct a scaled vector to represent the resultant of forces *A* and *B*. Label the vector *R*. [1]

53 Determine the magnitude of the resultant force. [1]

Base your answers to questions 54 through 56 on the information and diagram below and on your knowledge of physics.

A student pushes a box, weighing 50. newtons, 6.0 meters up an incline at a constant speed by applying a force of 25 newtons parallel to the incline. The top of the incline is 2.0 meters higher than the bottom.
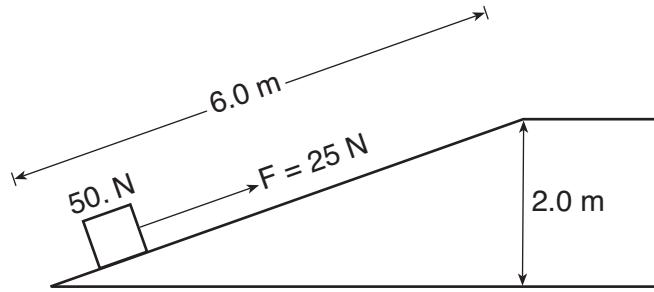
54–55 Calculate the total work done on the box by the student while pushing the box from the bottom to the top of the incline. [Show all work, including the equation and substitution with units.]   [2]

56 Describe what would happen to the total work done on the box by the student to push the box 6.0 meters up the incline at constant speed if the coefficient of kinetic friction between the box and the incline were increased.   [1]

57 In the diagram below, a light ray is incident on an interface between glass and air. When the light strikes the glass-air interface, some of the light is reflected. On the diagram *in your answer booklet*, use a protractor and straightedge to construct the reflected light ray.   [1]

|Normal

Air

Glass
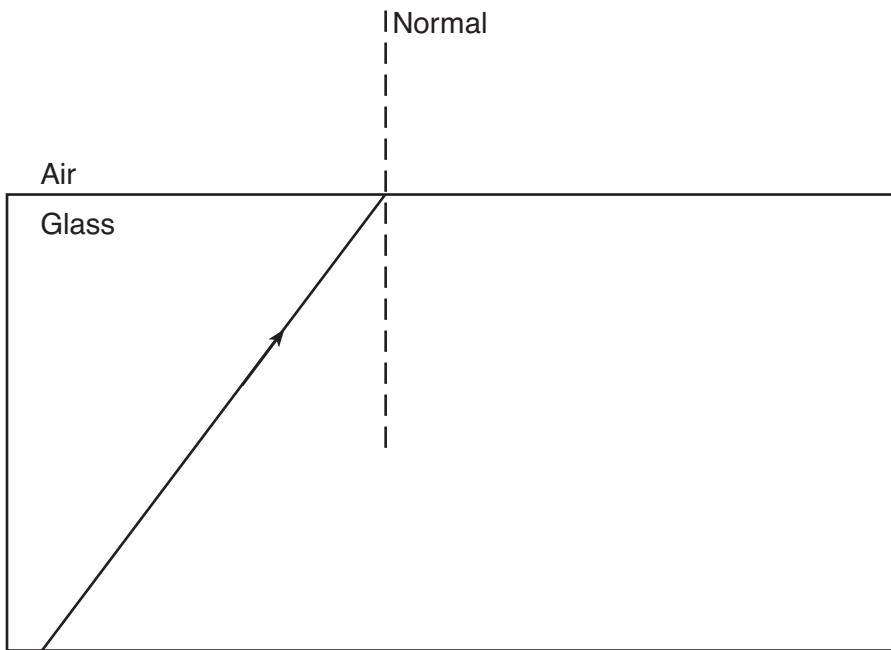
58–59 The current in a wire is 5.0 amperes. Calculate the total amount of charge, in coulombs, that travels through the wire in 36 seconds. [Show all work, including the equation and substitution with units.]   [2]

60–61 A spring, with a spring constant of 100. newtons per meter, possesses 2.0 joules of elastic potential energy when compressed. Calculate the spring's change in length from its uncompressed length. [Show all work, including the equation and substitution with units.]   [2]

62–63 A monochromatic ray of light ($f = 5.09 \times 10^{14}$ Hz) travels from air into medium X. The angle of incidence of the ray in air is 45.0° and the ray's angle of refraction in medium X is 29.0°. Calculate the absolute index of refraction of medium X. [Show all work, including the equation and substitution with units.]   [2]

64–65 An argon-ion laser emits blue-green light having a wavelength of 488 nanometers in a vacuum. Calculate the energy of a photon of this light. [Show all work, including the equation and substitution with units.]   [2]

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 70 on the information and diagram below and on your knowledge of physics.

An incandescent lightbulb uses a length of thin tungsten wire as the filament (the part of the operating bulb that produces light).

Incandescent Lightbulb
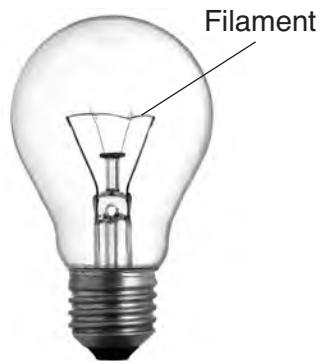
Filament

One particular lightbulb has a 0.22-meter length of the tungsten wire used as its filament. This tungsten wire filament has a resistance of 19 ohms at a temperature of 20°C. The tungsten wire filament has a resistance of 240 ohms when this bulb is operated at a potential difference of 120 volts.

66–67 Calculate the cross-sectional area of this tungsten wire filament. [Show all work, including the equation and substitution with units.] [2]

68 Explain why the resistance of the tungsten wire filament increases when the bulb is being operated compared to the resistance of the filament at 20°C. [1]

69–70 Calculate the power of this lightbulb when it is being operated at a potential difference of 120 volts. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 71 through 75 on the information and diagram below and on your knowledge of physics.

A 150-newton force, applied to a wooden crate at an angle of 30.° above the horizontal, causes the crate to travel at constant velocity across a horizontal wooden floor, as represented below.
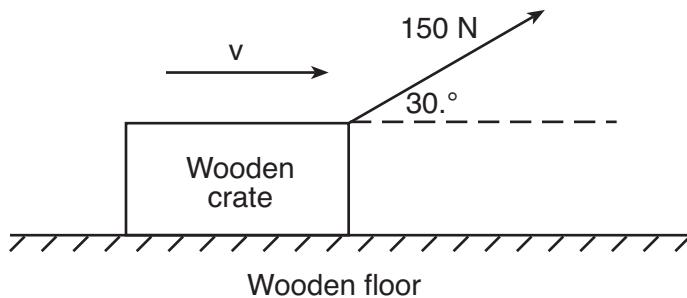
71–72 Calculate the magnitude of the horizontal component of the 150-newton force. [Show all work, including the equation and substitution with units.] [2]

73 Determine the magnitude of the frictional force acting on the crate. [1]

74–75 Calculate the magnitude of the normal force exerted by the floor on the crate. [Show all work, including the equation and substitution with units.] [2]

Base your answers to question 76 through 80 on the information below and on your knowledge of physics.

On a flat, level road, a 1500-kilogram car travels around a curve having a constant radius of 45 meters. The centripetal acceleration of the car has a constant magnitude of 3.2 meters per second squared.

76–77 Calculate the car's speed as it travels around the curve. [Show all work, including the equation and substitution with units.] [2]

78 Determine the magnitude of the centripetal force acting on the car as it travels around the curve. [1]

79 What force provides the centripetal force needed for the car to travel around the curve? [1]

80 Describe what happens to the magnitude of the centripetal force on the car as it travels around the curve if the speed of the car *decreases*. [1]

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

A musician plucks a 0.620-meter-long string on an acoustic guitar, as represented in the diagram below.

Fingerboard

Acoustic guitar

├──────────── 0.620 m ────────────┤

Single vibrating string
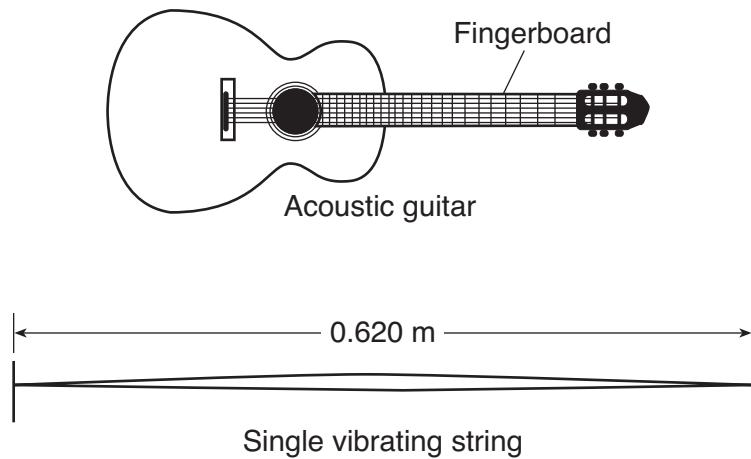
The plucked string vibrates, producing a musical note called "G." The waves traveling along the vibrating string produce a standing wave with a frequency of 196 hertz.

81 On the diagram of the standing wave *in your answer booklet*, label *one* node with the letter **N** and *one* antinode with the letter **A**.   [1]

82 Determine the wavelength of the standing wave on the 0.620-meter-long vibrating string.   [1]

83–84 Calculate the speed of the wave traveling on the vibrating string. [Show all work, including the equation and substitution with units.]   [2]

85 Describe what happens to the frequency when the musician shortens the vibrating portion of the string by pinching the string against the fingerboard while the string continues to vibrate.   [1]

PHYSICAL SETTING
PHYSICS

Tuesday, June 19, 2018 — 1:15 to 4:15 p.m., only

ANSWER BOOKLET

Student . . . .

Teacher . . . .

School . . . . Grade . . . .

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

Part B–2

51 1.0 cm = _____ **N**

52

53 _____ **N**

54–55

56 _____

57

Normal

Air
Glass
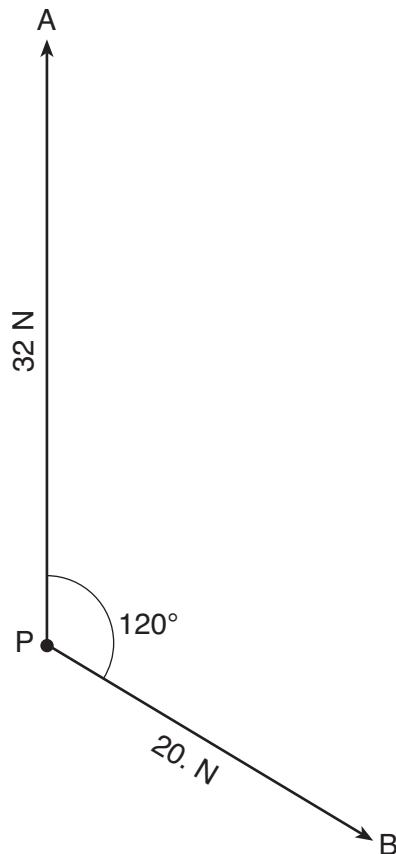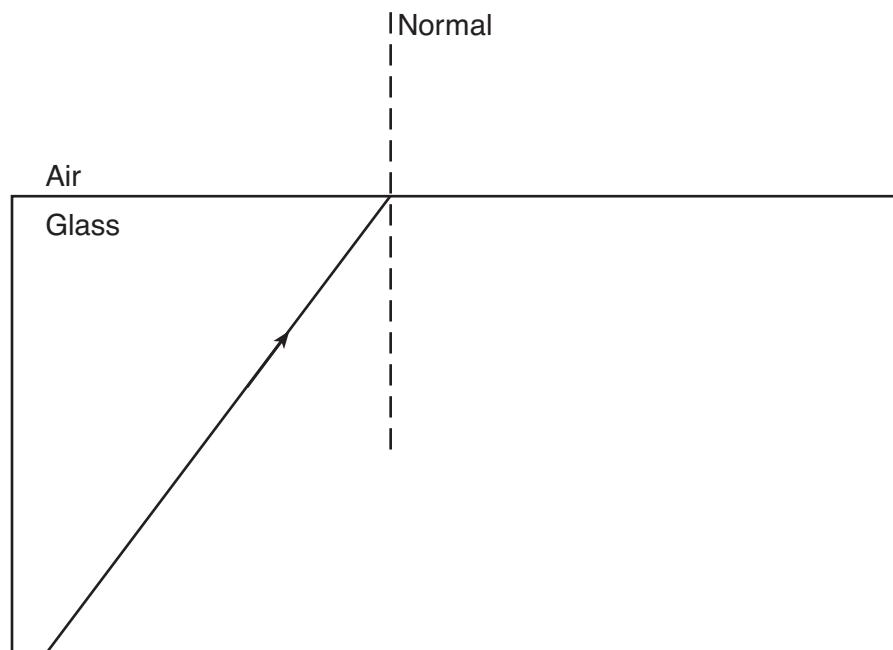
58–59

60–61

62–63

64–65

Part C

66–67

68 _____

69–70

71–72

73 _____ **N**

74–75

76–77

78 _____ **N**

79 _____

80 _____

81

0.620 m

82 _____ **m**

83–84

85 _____

Printed on Recycled Paper
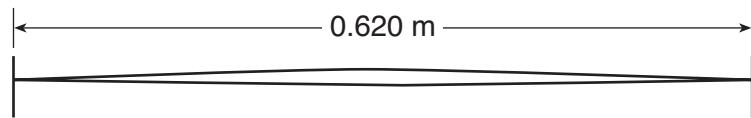
FOR TEACHERS ONLY

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

PS–P   PHYSICAL SETTING/PHYSICS

Tuesday, June 19, 2018 — 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 ...... **2**	10 ...... **3**	19 ...... **3**	28 ...... **3** ......
2 ...... **1**	11 ...... **4**	20 ...... **2**	29 ...... **2** ......
3 ...... **4**	12 ...... **1**	21 ...... **3**	30 ...... **2** ......
4 ...... **2**	13 ...... **2**	22 ...... **4**	31 ...... **2** ......
5 ...... **3**	14 ...... **1**	23 ...... **3**	32 ...... **4** ......
6 ...... **4**	15 ...... **2**	24 ...... **2**	33 ...... **1** ......
7 ...... **3**	16 ...... **3**	25 ...... **1**	34 ...... **1** ......
8 ...... **4**	17 ...... **3**	26 ...... **1**	35 ...... **4** ......
9 ...... **1**	18 ...... **4**	27 ...... **4**	

Part B–1

36 ...... **2**	40 ...... **4**	44 ...... **4**	48 ...... **3** ......
37 ...... **3**	41 ...... **3**	45 ...... **2**	49 ...... **3** ......
38 ...... **2**	42 ...... **2**	46 ...... **1**	50 ...... **1** ......
39 ...... **1**	43 ...... **4**	47 ...... **2**	

Directions to the Teacher

Follow the procedures below for scoring student answer papers for the Regents Examination in PhysicalSetting/Physics. Additional information about scoring is provided in the publication *Information Booklet 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.

Allow 1 credit for a correct response to each item.

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 on a student's paper. 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. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

Fractional credit is *not* allowed. Only whole-number credit may be given for a response. If the student gives more than one answer to a question, only the first answer should be rated. Units need not to be given when the wording of the question allows such omissions.

For hand scoring, raters should enter the scores earned in the appropriate boxes printed on the separate answer sheet. Next, the rater should add these scores and enter the total in the box labeled "Total Raw 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 19, 2018. The student's scale score should be entered in the box labeled "Scale Score"on the student's answer booklet. The scale score is the student's final examination score.

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 4.0 N ± 0.2 N.

52 [1] Allow 1 credit for constructing the resultant 7.0 cm ± 0.2 cm long at an angle of 38° ± 2° clockwise from force *A*.

Examples of 1-credit responses:

or
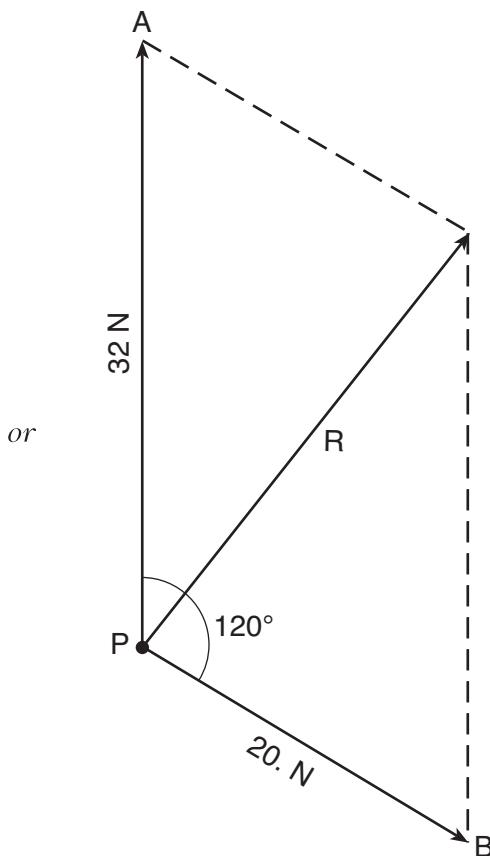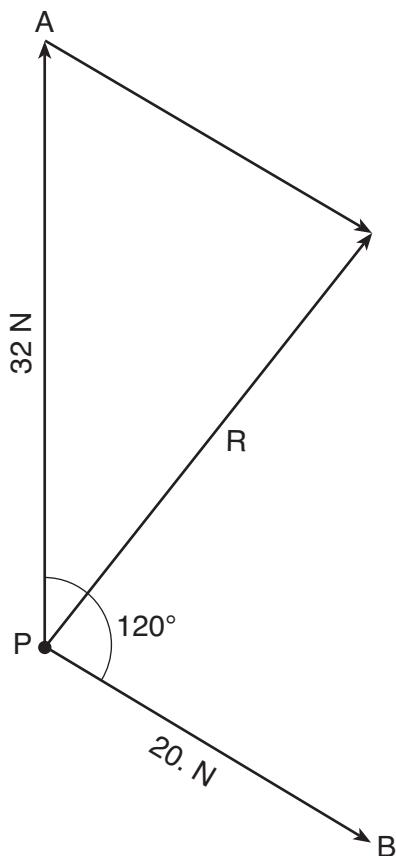
Note: The resultant vector need *not* be labeled to receive this credit

53 [1] Allow 1 credit for 28 N ± 2 N *or* for an answer that is consistent with the student's responses to questions 51 and 52.

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:

$W = Fd$

$W = (25\ \text{N})(6.0\ \text{m})$

55 [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 54.

Examples of 1-credit responses:

$W = 150 \text{ J}$ *or* $150 \text{ N} \cdot \text{m}$

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

56 [1] Allow 1 credit for stating that the total work would increase.

57 [1] Allow 1 credit for a light ray drawn at an angle of $37° \pm 2°$.

Example of a 1-credit response:
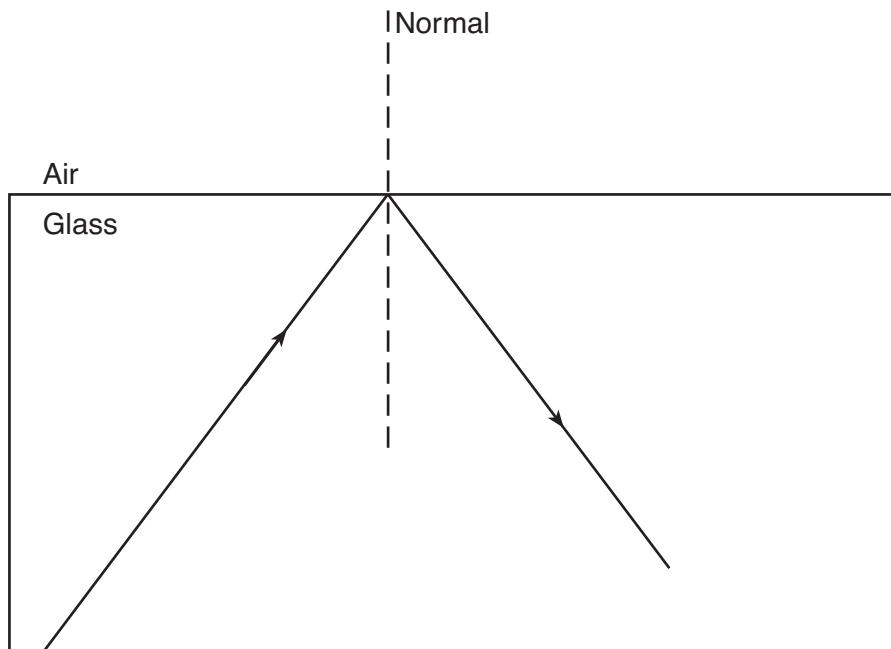
Note: No arrowhead is required on the reflected ray. The direction of the ray is implied by the arrowhead on the incident ray. (Rays are not vectors.)

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

Example of a 1-credit response:

$$I = \frac{\Delta q}{t}$$

$$\Delta q = It$$

$$\Delta q = (5.0 \text{ A})(36 \text{ s})$$

59 [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 58.

Examples of a 1-credit responses:

$\Delta q = 180$ C   *or*   180 A•s

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 58 and 59.

60 [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:

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

$$x = \sqrt{\frac{2\,PE_s}{k}}$$

$$x = \sqrt{\frac{2(2.0\text{ J})}{100.\text{ N/m}}}$$

61 [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 60.

Example of a 1-credit response:

$x = 0.20$ m

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 60 and 61.

62 [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:

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

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

$$n_2 = \frac{(1.00)\sin 45.0°}{\sin 29.0°}$$

63 [1] Allow 1 credit for the correct answer *or* for an answer, without units, that is consistent with the student's response to question 62.

Example of a 1-credit response:

$n_2 = 1.46$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 62 and 63.

64 [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:

$$E_{photon} = \frac{hc}{\lambda}$$

$$E_{photon} = \frac{(6.63 \times 10^{-34} \text{ J} \bullet \text{s})(3.00 \times 10^8 \text{ m/s})}{4.88 \times 10^{-7} \text{ m}}$$

65 [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 64.

Example of a 1-credit response:

$$E_{photon} = 4.08 \times 10^{-19} \text{ J}$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 64 and 65.

Part C

66 [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:

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

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

$$A = \frac{(5.60 \times 10^{-8} \; \Omega \cdot \text{m})(0.22 \; \text{m})}{19 \; \Omega}$$

67 [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 66.

Example of a 1-credit response:

$$A = 6.5 \times 10^{-10} \; \text{m}^2$$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 66 and 67.

68 [1] Allow 1 credit for an explanation that the filament of the operating bulb is at a higher temperature. Acceptable responses include, but are not limited to:

— The operating bulb is hotter.

— The filament gets hot when the bulb is operating.

— The resistivity of the tungsten increases.

— The temperature of the filament increases.

69 [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:

$$P = \frac{V^2}{R}$$

$$P = \frac{(120 \; \text{V})^2}{240 \; \Omega}$$

or

$$P = VI$$

$$P = (120 \; \text{V})(0.50 \; \text{A})$$

70 [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 69.

Example of a 1-credit response:

$P = 60.$ W

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 69 and 70.

71 [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:

$A_x = A \cos\theta$
$F_x = (150 \text{ N})(\cos 30.°)$

or

$\cos\theta = \dfrac{b}{c}$
$b = c \cos\theta$
$F_x = (150 \text{ N})(\cos 30.°)$

72 [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 71.

Example of a 1-credit response:

$F_x = 130 \text{ N}$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 71 and 72.

73 [1] Allow 1 credit for 130 N *or* for an answer that is equal to the student's response to question 72.

74 [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 73. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

$F_f = \mu F_N$

$F_N = \dfrac{F_f}{\mu}$

$F_N = \dfrac{130 \text{ N}}{0.30}$

75 [1] Allow one credit for the correct answer with units *or* for an answer, with units, that is consistent with the student's response to question 74.

Example of a 1-credit response:

$F_N = 430$ N

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 74 and 75.

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:

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

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

$$v = \sqrt{(3.2 \text{ m/s}^2)(45 \text{ m})}$$

77 [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 76.

Example of a 1-credit response:

$v = 12$ m/s

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 4800 N.

79 [1] Allow 1 credit for friction, static friction, or electromagnetic. Do *not* allow credit for centripetal force, net force, gravitational force, weight, or normal force.

80 [1] Allow 1 credit. Acceptable responses include, but are not limited to:
  — The magnitude of the centripetal force decreases.
  — It becomes less.
  — decreases

81 [1] Allow 1 credit for labeling *one* node and *one* antinode correctly.

Example of a 1-credit response:
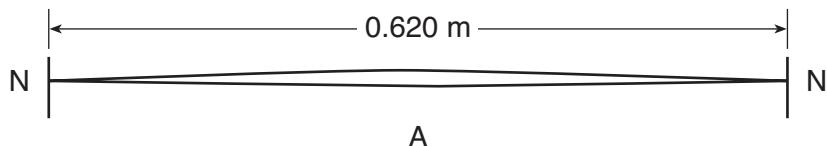
82 [1] Allow 1 credit for 1.24 m *or* 1.240 m.

83 [1] Allow 1 credit for the equation and substitutions 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:

$v = f\lambda$

$v = (196 \text{ Hz})(1.240 \text{ m})$

84 [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 83.

Example of a 1-credit response:

$v = 243 \text{ m/s}$

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 a statement indicating that the frequency will increase. Acceptable responses include, but are not limited to:

— It increases.

— The frequency gets higher.

Regents Examination in Physical Setting/Physics

June 2018

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

The *Chart for Determining the Final Examination Score for the June 2018 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 19, 2018. 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.cfm.

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 2018 Physical Setting/Physics		
Question Numbers		
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	3, 4, 5, 7, 9, 13, 15, 20, 24, 25, 29, 30, 31, 32	37, 38, 39, 40, 42, 43, 44, 48, 50, 51, 52, 53, 54, 55, 58, 59, 60, 61, 62, 63, 64, 65	66, 67, 69, 70, 71, 72, 74, 75, 76, 77, 78, 82, 83, 84
Math Key Idea 2	19	41, 45, 46, 49, 56	80, 85
Math Key Idea 3			
Science Inquiry Key Idea 1			
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3	34	36	
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			66, 67, 68, 69, 70
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2			80, 81, 82, 85
Key Idea 3		36, 37, 42	
Key Idea 4			
Key Idea 5		45, 46, 49	
Key Idea 6			
Standard 7			
Key Idea 1			76, 77, 85
Key Idea 2			
Standard 4 Process Skills			
4.1	33	38, 43, 45, 60, 61	66, 67
4.3	17, 25, 27, 35	41, 47, 48, 57, 62, 63	81, 82, 83, 84, 85
5.1	6, 7, 8, 32	39, 51, 52, 53	71, 72, 78
5.3			
Standard 4			
4.1	15, 18, 19, 33	38, 43, 46, 50, 54, 55, 56, 58, 59, 60, 61	66, 67, 68, 69, 70
4.3	21, 22, 23, 24, 25, 26, 27, 35	41, 47, 48, 49, 57, 62, 63	81, 82, 83, 84, 85
5.1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 20, 30, 32, 34	36, 37, 39, 40, 44, 45, 51, 52, 53	71, 72, 73, 74, 75, 76, 77, 78, 79, 80
5.3	28, 29, 31	42, 64, 65	

Regents Examination in Physical Setting/Physics – June 2018

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