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

PHYSICAL SETTING
PHYSICS

Tuesday, June 25, 2019 — 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 pair of quantities represent scalar quantities?

(1) displacement and velocity
(2) displacement and time
(3) energy and velocity
(4) energy and time

2 A sailboat on a lake sails 40. meters north and then sails 40. meters due east. Compared to its starting position, the new position of the sailboat is

(1) 40. m due east
(2) 40. m due north
(3) 57 m northeast
(4) 80. m northeast

3 A ball is thrown straight upward from the surface of Earth. Which statement best describes the ball's velocity and acceleration at the top of its flight?

(1) Both velocity and acceleration are zero.
(2) Velocity is zero and acceleration is nonzero.
(3) Velocity is nonzero and acceleration is zero.
(4) Both velocity and acceleration are not zero.

4 As a student runs a plastic comb through her hair, the comb acquires a negative electric charge. This charge results from the transfer of

(1) protons from the comb to her hair
(2) protons from her hair to the comb
(3) electrons from the comb to her hair
(4) electrons from her hair to the comb

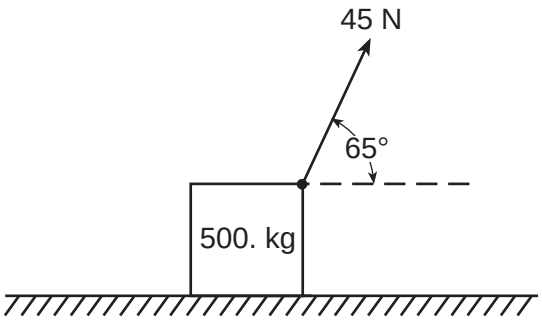
5 How would the mass and weight of an object on the Moon compare to the mass and weight of the same object on Earth?

(1) Mass and weight would both be less on the Moon.
(2) Mass would be the same but its weight would be less on the Moon.
(3) Mass would be less on the Moon and its weight would be the same.
(4) Mass and weight would both be the same on the Moon.

6 An object is moving with constant speed in a circular path. The object's centripetal acceleration remains constant in

(1) magnitude, only
(2) direction, only
(3) both magnitude and direction
(4) neither magnitude nor direction

7 As shown in the diagram below, a rope attached to a 500.-kilogram crate is used to exert a force of 45 newtons at an angle of 65 degrees above the horizontal.



The horizontal component of the force acting on the crate is

(1) 19 N
(2) 41 N
(3) 210 N
(4) 450 N

8 A spring with a spring constant of 68 newtons per meter hangs from a ceiling. When a 12-newton downward force is applied to the free end of the spring, the spring stretches a total distance of

(1) 0.18 m
(2) 0.59 m
(3) 5.7 m
(4) 820 m

9 As a student walks downhill at constant speed, his gravitational potential energy

(1) increases and his kinetic energy increases
(2) increases and his kinetic energy remains the same
(3) decreases and his kinetic energy increases
(4) decreases and his kinetic energy remains the same

10 When 150 joules of work is done on a system by an external force of 15 newtons in 20. seconds, the total energy of that system increases by

(1) 1.5×10^2 J
(2) 2.0×10^2 J
(3) 3.0×10^2 J
(4) 2.3×10^3 J

11 A person on a ledge throws a ball vertically downward, striking the ground below the ledge with 200 joules of kinetic energy. The person then throws an identical ball vertically upward at the same initial speed from the same point. What is the kinetic energy of the second ball when it hits the ground? [Neglect friction.]

(1) 200 J
(2) 400 J
(3) less than 200 J
(4) more than 400 J

12 Two construction cranes are used to lift identical 1200-kilogram loads of bricks the same vertical distance. The first crane lifts the bricks in 20. seconds and the second crane lifts the bricks in 40. seconds. Compared to the power developed by the first crane, the power developed by the second crane is

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

13 An ionized calcium atom has a charge of +2 elementary charges. If this ion is accelerated through a potential difference of 2.0×10^3 volts, the ion's change in kinetic energy will be

(1) 1.0×10^3 eV
(2) 2.0×10^3 eV
(3) 3.0×10^3 eV
(4) 4.0×10^3 eV

14 A total charge of 100. coulombs flows past a fixed point in a circuit every 500. seconds. What is the current at this point in the circuit?

(1) 0.200 A
(2) 5.00 A
(3) 5.00×10^4 A
(4) 1.25×10^{18} A

15 An aluminum wire of length 1.0 meter has a resistance of 9.0×10^{-3} ohm. If the wire were cut into two equal lengths, each length would have a resistance of

(1) 2.8×10^{-8} Ω
(2) 4.5×10^{-3} Ω
(3) 9.0×10^{-3} Ω
(4) 1.8×10^{-2} Ω

16 In an operating electrical circuit, the source of potential difference could be

(1) a voltmeter
(2) a battery
(3) an ammeter
(4) a resistor

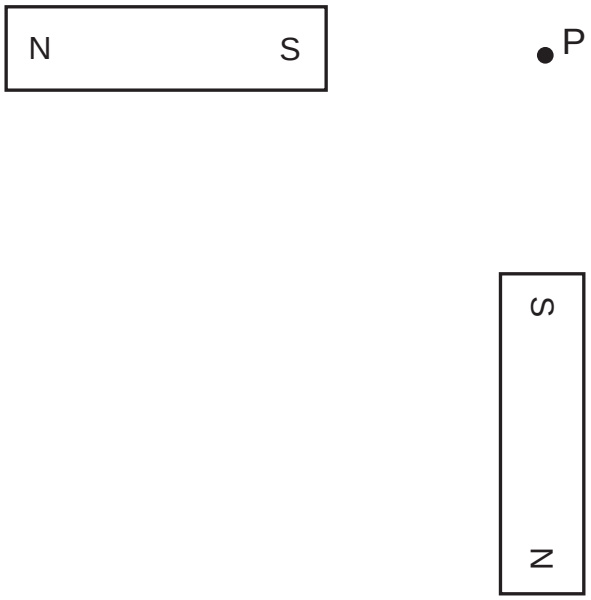
17 A lightbulb with a resistance of 2.9 ohms is operated using a 1.5-volt battery. At what rate is electrical energy transformed in the lightbulb?

(1) 0.52 W
(2) 0.78 W
(3) 4.4 W
(4) 6.5 W

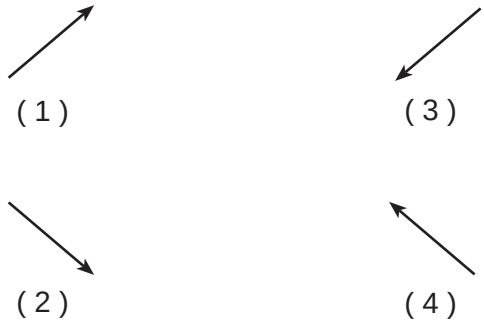
18 A 40.0-kilogram child exerts a 100.-newton force on a 50.0-kilogram object. The magnitude of the force that the object exerts on the child is

(1) 0.0 N
(2) 80.0 N
(3) 100. N
(4) 125 N

19 Two identical stationary bar magnets are arranged as shown in the diagram below.



What is the direction of the magnetic field at point *P*?



20 A student claps his hands once to produce a sudden loud sound that travels through the air. This sound is classified as a

(1) longitudinal mechanical wave
(2) longitudinal electromagnetic wave
(3) transverse mechanical wave
(4) transverse electromagnetic wave

21 A student generates water waves in a pool of water. In order to increase the energy carried by the waves, the student should generate waves with a

(1) greater amplitude
(2) higher frequency
(3) greater wavelength
(4) longer period

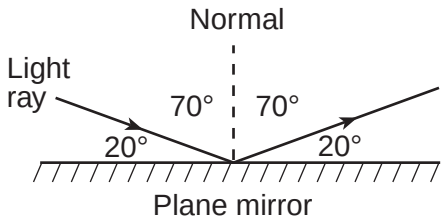
22 A wave generator produces straight, parallel wave fronts in a shallow tank of uniform-depth water. As the frequency of vibration of the generator increases, which characteristic of the wave will always decrease?

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

23 A space probe produces a radio signal pulse. If the pulse reaches Earth 12.3 seconds after it is emitted by the probe, what is the distance from the probe to Earth?

(1) 3.71×10^2 m
(2) 4.07×10^3 m
(3) 4.10×10^8 m
(4) 3.69×10^9 m

24 The diagram below represents a light ray reflecting from a plane mirror.



The angle of reflection for this light ray is

(1) 20°
(2) 70°
(3) 140°
(4) 160°

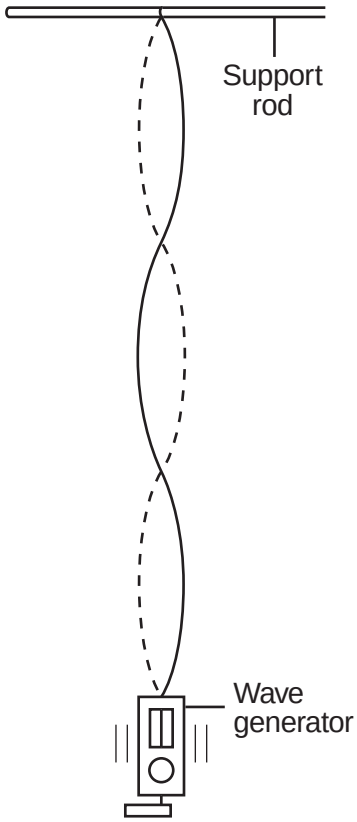
25 A light wave travels from one medium into a second medium with a greater absolute index of refraction. Which characteristic of the wave can *not* change as the wave enters the second medium?

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

26 The speed of light $\left(f = 5.09 \times 10^{14} \text{ Hz}\right)$ in glycerol is

(1) 1.70×10^6 m/s
(2) 2.04×10^8 m/s
(3) 3.00×10^8 m/s
(4) 4.41×10^8 m/s

27 The diagram below represents a standing wave produced in a string by a vibrating wave generator.



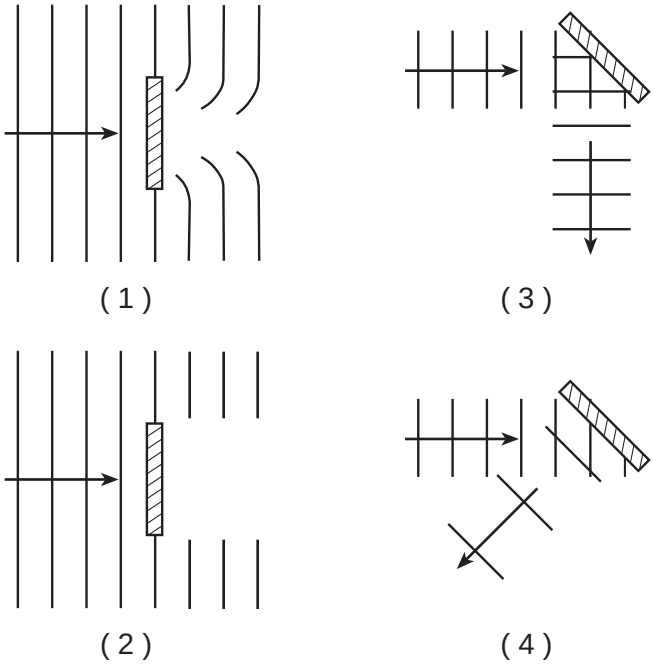
How many antinodes are shown in this standing wave?

(1) 6
(2) 2
(3) 3
(4) 4

28 The Doppler effect is best described as the

(1) bending of waves as they pass by obstacles or through openings
(2) change in speed of a wave as the wave moves from one medium to another
(3) creation of a standing wave from two waves traveling in opposite directions in the same medium
(4) shift in the observed frequency and wavelength of a wave caused by the relative motion between the wave's source and an observer

29 Which diagram represents diffraction of wave fronts as they encounter an obstacle?



30 Which types of forces exist between the two protons in a helium nucleus?

(1) a repulsive electrostatic force and a repulsive gravitational force
(2) a repulsive electrostatic force and an attractive strong nuclear force
(3) an attractive electrostatic force and an attractive gravitational force
(4) an attractive electrostatic force and an attractive strong nuclear force

31 A meson could be composed of

(1) a top quark and a bottom quark
(2) an electron and an antielectron
(3) a strange quark and an anticharm quark
(4) an up quark and a muon

32 An electron in an excited mercury atom is in energy level *g*. What is the minimum energy required to ionize this atom?

(1) 0.20 eV
(2) 0.91 eV
(3) 2.48 eV
(4) 7.90 eV

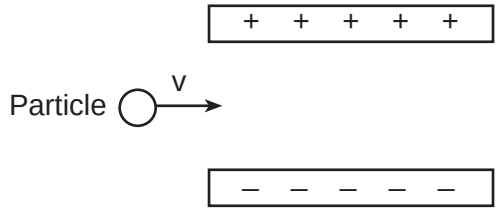
33 A student is standing in an elevator that travels from the first floor to the tenth floor of a building. The student exerts the greatest force on the floor of the elevator when the elevator is

(1) accelerating upward as it leaves the first floor
(2) slowing down as it approaches the tenth floor
(3) moving upward at constant speed
(4) at rest on the first floor

34 At the bottom of a hill, a car has an initial velocity of +16.0 meters per second. The car is uniformly accelerated at –2.20 meters per second squared for 5.00 seconds as it moves up the hill. How far does the car travel during this 5.00-second interval?

(1) 107 m
(2) 74.5 m
(3) 52.5 m
(4) 25.0 m

35 A particle enters the electric field between two oppositely charged parallel plates, as represented in the diagram below.



Which particle will be deflected toward the positive plate as it enters the electric field?

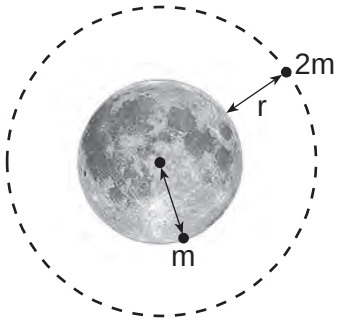
(1) photon
(2) proton
(3) electron
(4) neutrino

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 As represented in the diagram below, an object of mass m, located on the surface of the Moon, is attracted to the Moon with a gravitational force, F.

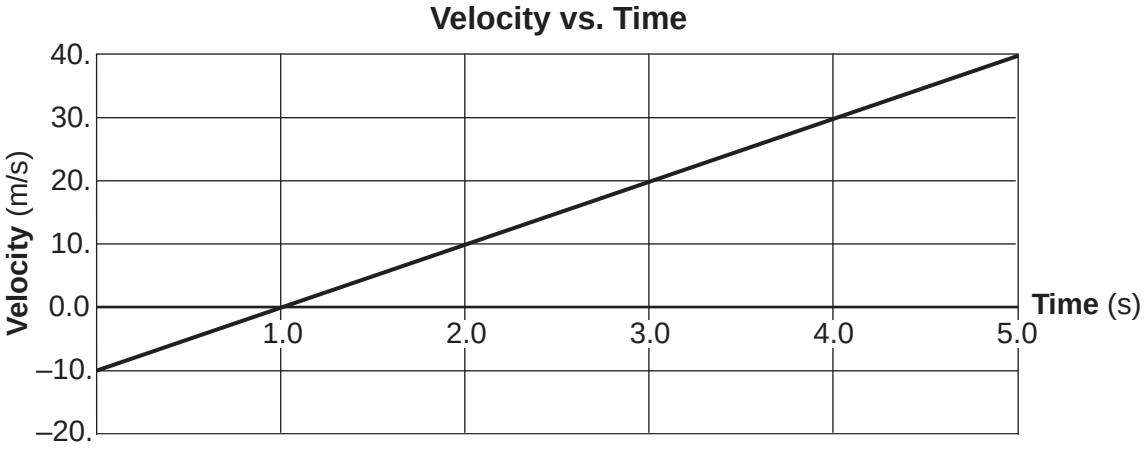


(Not drawn to scale)

An object of mass $2m$, at an altitude equal to the Moon's radius, r, above the surface of the Moon, is attracted to the Moon with a gravitational force of

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

37 The graph below represents the relationship between velocity and time for an object moving along a straight line.



What is the magnitude of the object's acceleration?

(1) 5.0 m/s^2
(2) 8.0 m/s^2
(3) 10. m/s^2
(4) 20. m/s^2

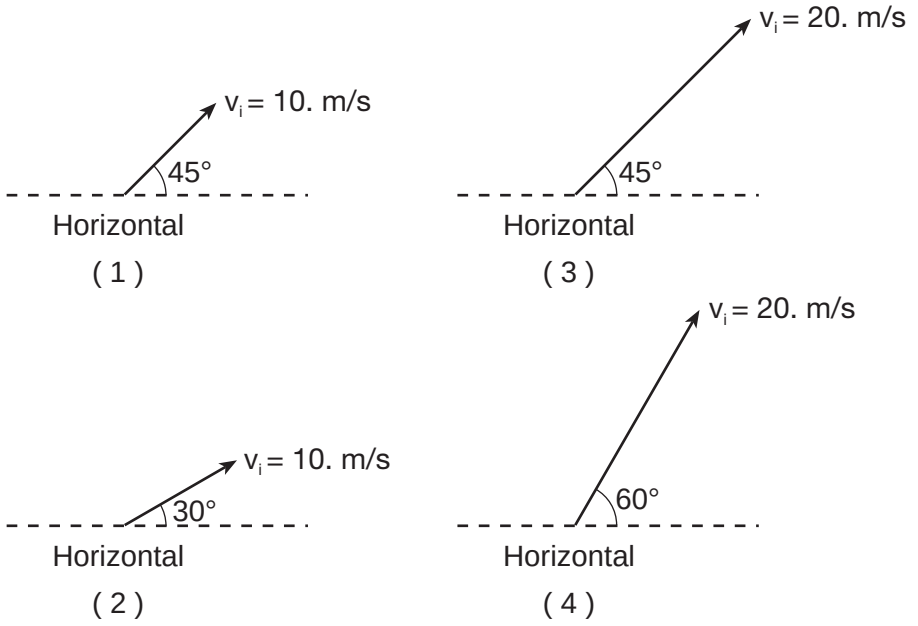
38 Two muons would have a combined charge of

(1) -3.2×10^{-19} C
(2) -1.6×10^{-19} C
(3) 0 C
(4) $+3.2 \times 10^{-19}$ C

39 A 1.47-newton baseball is dropped from a height of 10.0 meters and falls through the air to the ground. The kinetic energy of the ball is 12.0 joules the instant before the ball strikes the ground. The maximum amount of mechanical energy converted to internal energy during the fall is

(1) 2.7 J
(2) 12.0 J
(3) 14.7 J
(4) 26.7 J

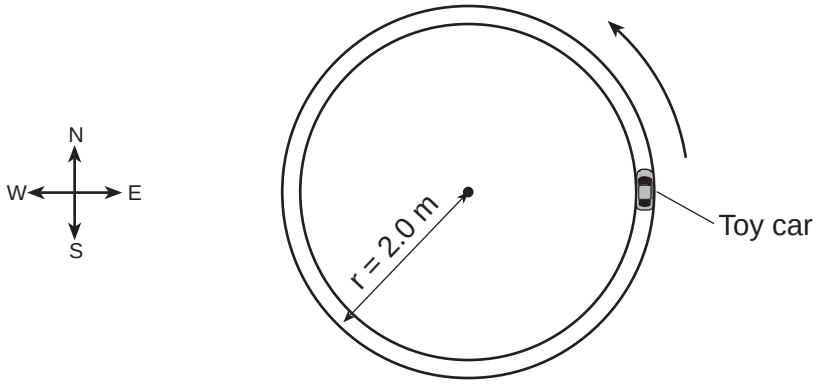
40 A projectile lands at the same height from which it was launched. Which initial velocity will result in the greatest horizontal displacement of the projectile? [Neglect friction.]



41 A 5.0-kilogram box is sliding across a level floor. The box is acted upon by a force of 27 newtons east and a frictional force of 17 newtons west. What is the magnitude of the acceleration of the box?

(1) 0.50 m/s^2
(2) 2.0 m/s^2
(3) 8.8 m/s^2
(4) 10. m/s^2

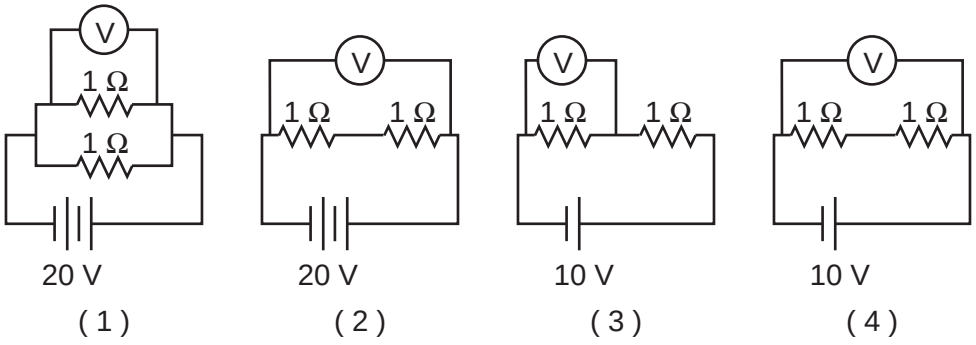
42 The diagram below represents a 2.0-kilogram toy car moving at a constant speed of 3.0 meters per second counterclockwise in a circular path with a radius of 2.0 meters.



At the instant shown in the diagram, the centripetal force acting on the car is

(1) 4.5 N north
(2) 4.5 N west
(3) 9.0 N north
(4) 9.0 N west

43 In which electric circuit would the voltmeter read 10 volts?



44 The lambda baryon has the quark composition *uds*. Which particle has the same electric charge as the lambda baryon?

(1) neutron
(2) electron
(3) proton
(4) antimuon

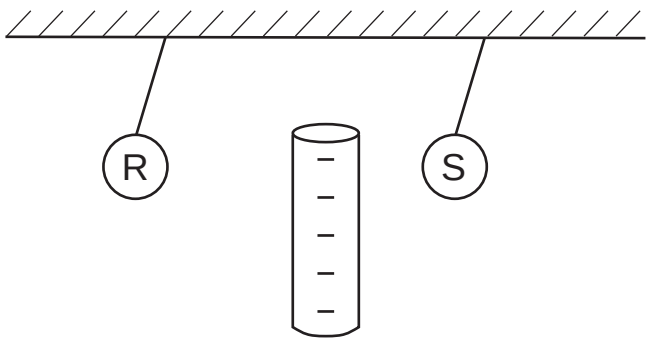
45 How many kilograms of matter would have to be converted into energy to produce 24.0 megajoules of energy?

(1) 2.67×10^{-16} kg
(2) 2.67×10^{-10} kg
(3) 8.00×10^{-8} kg
(4) 8.00×10^{-2} kg

46 A red photon in the bright-line spectrum of hydrogen gas has an energy of 3.02×10^{-19} joule. What energy-level transition does an electron in a hydrogen atom undergo to produce this photon?

(1) $n = 3$ to $n = 2$
(2) $n = 4$ to $n = 2$
(3) $n = 5$ to $n = 2$
(4) $n = 6$ to $n = 2$

47 In the diagram below, a negatively charged rod is placed between, but does not touch, identical small metal spheres *R* and *S* hanging from insulating threads.



What can be concluded if the rod repels sphere *R* but attracts sphere *S*?

(1) Sphere *R* must be negative and sphere *S* must be positive.
(2) Sphere *R* must be negative and sphere *S* may be positive or neutral.
(3) Sphere *R* must be positive and sphere *S* must be negative.
(4) Sphere *R* must be positive and sphere *S* may be negative or neutral.

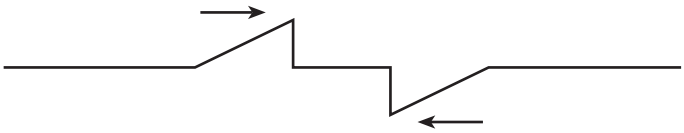
48 The amount of electric energy consumed by a 60.0-watt lightbulb for 1.00 minute could lift a 10.0 newton object to a maximum vertical height of

(1) 6.00 m
(2) 36.7 m
(3) 360. m
(4) 600. m

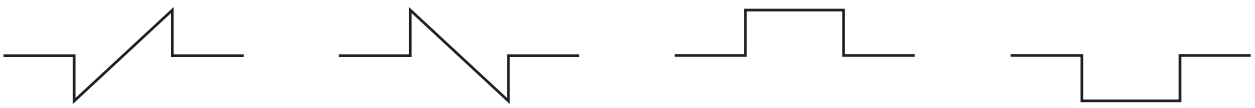
49 Microwaves can have a wavelength closest to the

(1) radius of Earth
(2) height of Mount Everest
(3) length of a football field
(4) length of a physics student's thumb

50 Two pulses approach each other in a uniform medium, as represented in the diagram below.



Which diagram best represents the superposition of the two pulses when the pulses overlap?



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 below and on your knowledge of physics.

A toy launcher that is used to launch small plastic spheres horizontally contains a spring with a spring constant of 50. newtons per meter. The spring is compressed a distance of 0.10 meter when the launcher is ready to launch a plastic sphere.

51 Determine the elastic potential energy stored in the spring when the launcher is ready to launch a plastic sphere. [1]

52-53 The spring is released and a 0.10-kilogram plastic sphere is fired from the launcher. Calculate the maximum speed with which the plastic sphere will be launched. [Neglect friction.] [Show all work, including the equation and substitution with units.] [2]

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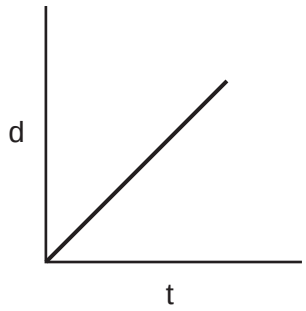
54 Two 10.-ohm resistors have an equivalent resistance of 5.0 ohms when connected in an electric circuit with a source of potential difference. Using circuit symbols found in the *Reference Tables for Physical Setting/Physics*, draw a diagram of this circuit. [1]

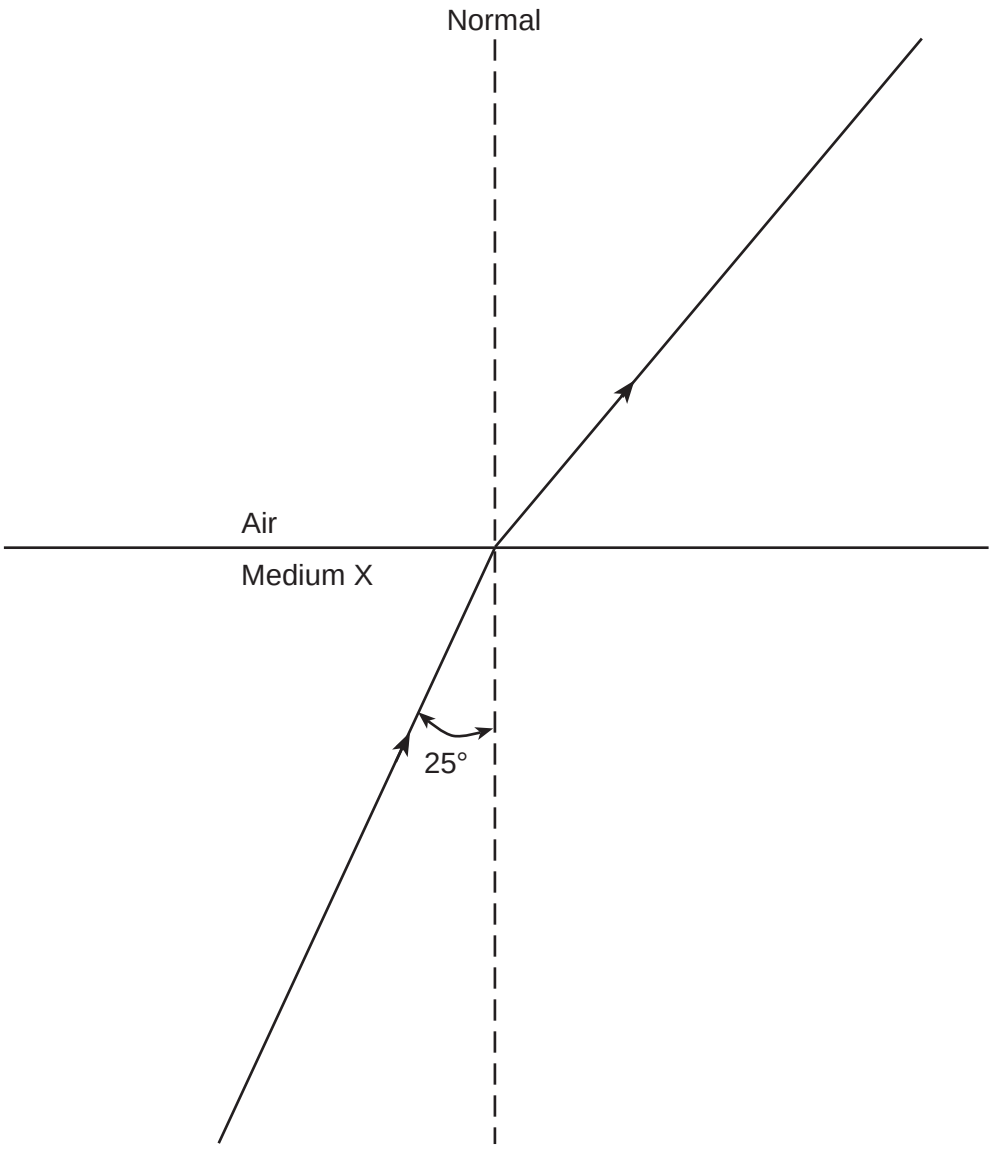
55 The graph below shows the relationship between distance, d, and time, t, for a moving object.



On the axes *in your answer booklet*, sketch the general shape of the graph that shows the relationship between the magnitude of the velocity, v, and time, t, for the moving object. [1]

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

A ray of monochromatic light ($f = 5.09 \times 10^{14}$ Hz) passes from medium *X* into air. The angle of incidence of the ray in medium *X* is 25°, as shown.

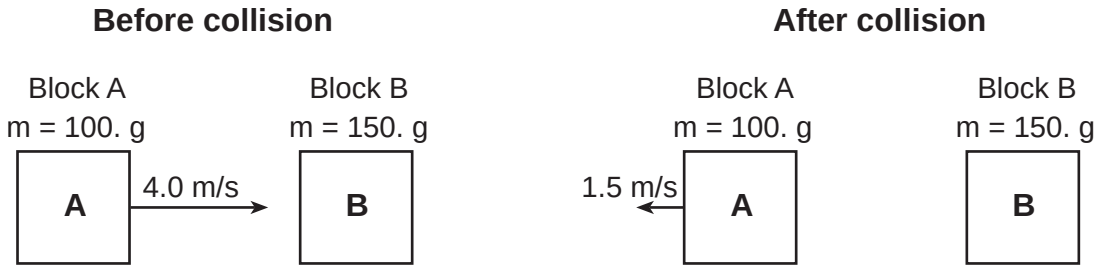


56 Using a protractor, measure and record the angle of refraction in the air, to the *nearest degree*. [1]

57-58 Calculate the absolute index of refraction of medium *X*. [Show all work, including the equation and substitution with units.] [2]

59–60 A student wishes to record a 7.5-kilogram watermelon colliding with the ground. Calculate how far the watermelon must fall freely from rest so it would be traveling at 29 meters per second the instant it hits the ground. [Show all work, including the equation and substitution with units.] [2]

61-62 As represented in the diagram below, block *A* with a mass of 100. grams slides to the right at 4.0 meters per second and hits stationary block *B* with a mass of 150. grams. After the collision, block *B* slides to the right and block *A* rebounds to the left at 1.5 meters per second. [Neglect friction.]



Calculate the speed of block *B* after the collision. [Show all calculations, including the equation and substitution with units.] [2]

Base your answers to questions 63 through 65 on the information below and on your knowledge of physics.

A 1.20×10^3-kilogram car is traveling east at 25 meters per second. The brakes are applied and the car is brought to rest in 5.00 seconds.

63-64 Calculate the magnitude of the total impulse applied to the car to bring it to rest. [Show all work, including the equation and substitution with units.] [2]

65 State the direction of the impulse applied to the car. [1]

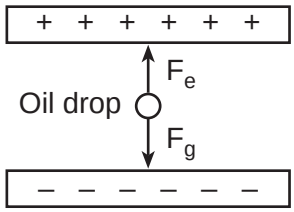
Part C

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

The diagram shows a negatively charged oil drop that is suspended motionless between two oppositely charged, parallel, horizontal metal plates. The electric field strength between the charged plates is 4.0×10^4 newtons per coulomb. The 1.96×10^{-15}-kilogram oil drop is being acted upon by a gravitational force, F_g, and an electrical force, F_e.



66–67 Calculate the magnitude of the gravitational force, F_g, acting on the oil drop. [Show all work, including the equation and substitution with units.] [2]

68 Determine the magnitude of the upward electrical force, F_e, acting on the oil drop suspended motionless between the charged metal plates. [1]

69–70 Calculate the net electric charge on the oil drop in coulombs. [Show all work, including the equation and substitution with units.] [2]

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

In a circuit, a 100.-ohm resistor and a 200.-ohm resistor are connected in parallel to a 10.0-volt battery.

71-72 Calculate the equivalent resistance of the circuit. [Show all work, including the equation and substitution with units.] [2]

73–74 Calculate the current in the 200.-ohm resistor. [Show all work, including the equation and substitution with units.] [2]

75 Determine the power dissipated by the 100.-ohm resistor. [1]

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

A wave traveling through a uniform medium has an amplitude of 0.20 meter, a wavelength of 0.40 meter, and a frequency of 10. hertz.

76-77 On the grid *in your answer booklet*, draw *one* complete cycle of the wave. [2]

78-79 Calculate the speed of the wave. [Show all work, including the equation and substitution with units.] [2]

80 Determine the period of this wave. [1]

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

In an experiment, the potential difference applied across an unmarked resistor was varied while the resistor was held at a constant temperature. The corresponding current through the resistor was measured. The data collected appear in the table below.

Potential Difference (volts)	**Current** (amperes)
1.5	0.0032
3.0	0.0059
6.0	0.0124
9.0	0.0177
12.0	0.0244

81 Mark an appropriate scale on the axis labeled "Current (A)." [1]

82 Plot the data points for current versus potential difference. [1]

83 Draw the line or curve of best fit. [1]

84-85 Using your graph, calculate the resistance of the resistor. [Show all work, including the equation and substitution with units.] [2]

PS/PHYSICS

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
PHYSICS

Tuesday, June 25, 2019 — 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.

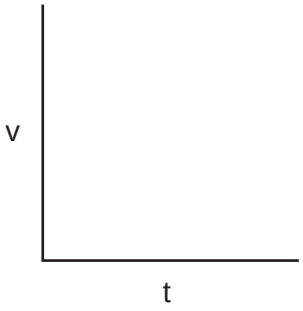
Part B–2

51 _____ **J**

52-53

54

55



56 _____ °

57–58

59-60

61–62

63-64

65 _____

Part C

66–67

68 _____ **N**

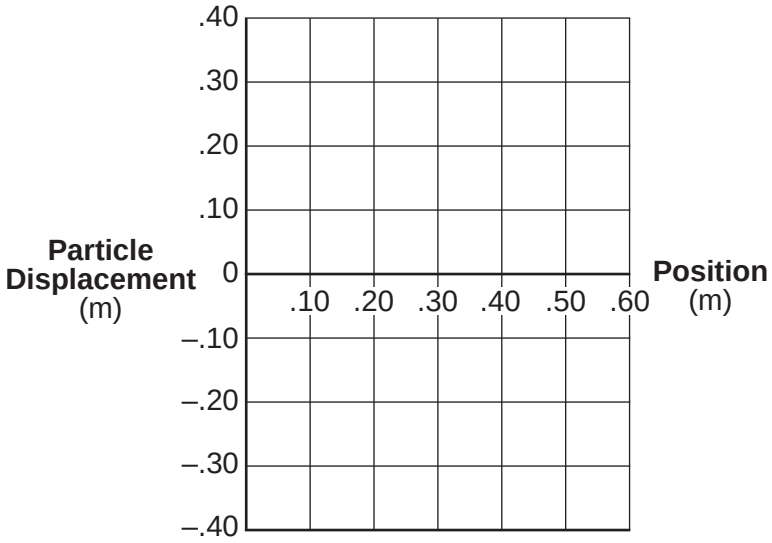
69–70

71-72

73-74

75 _____ **W**

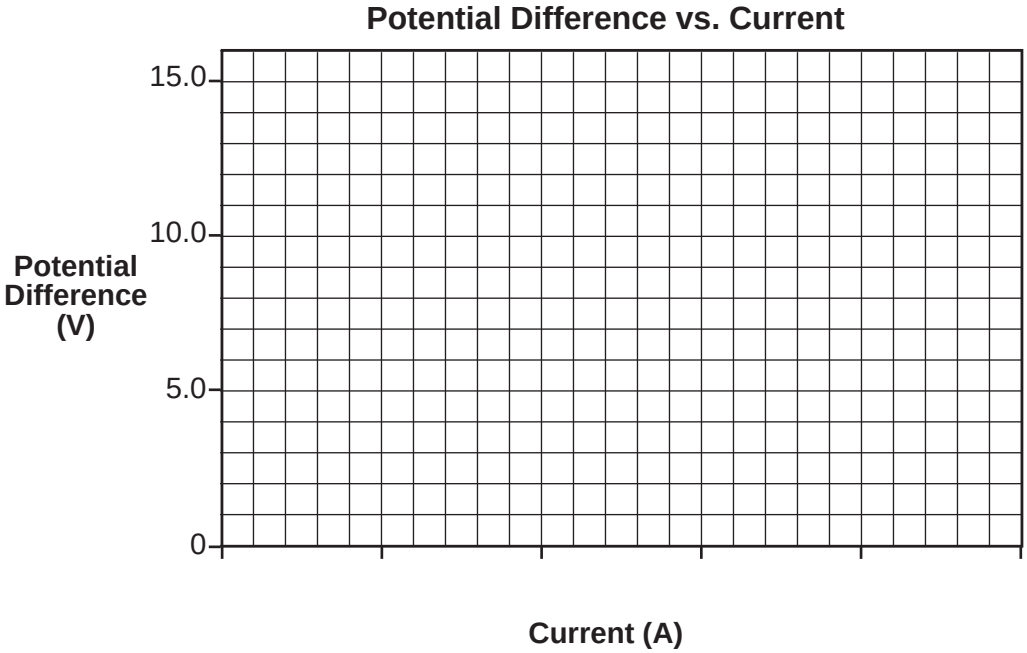
76-77



78-79

80 _____ **s**

81-83



84-85

P.S./PHYSICS

The State Education Department / The University of the State of New York

Regents Examination in Physical Setting/Physics – June 2019

Scoring Key: Parts A and B-1 (Multiple-Choice Questions)

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Physical Setting/Physics	June '19	**1**	**4**	MC	1	1
Physical Setting/Physics	June '19	**2**	**3**	MC	1	1
Physical Setting/Physics	June '19	**3**	**2**	MC	1	1
Physical Setting/Physics	June '19	**4**	**4**	MC	1	1
Physical Setting/Physics	June '19	**5**	**2**	MC	1	1
Physical Setting/Physics	June '19	**6**	**1**	MC	1	1
Physical Setting/Physics	June '19	**7**	**1**	MC	1	1
Physical Setting/Physics	June '19	**8**	**1**	MC	1	1
Physical Setting/Physics	June '19	**9**	**4**	MC	1	1
Physical Setting/Physics	June '19	**10**	**1**	MC	1	1
Physical Setting/Physics	June '19	**11**	**1**	MC	1	1
Physical Setting/Physics	June '19	**12**	**3**	MC	1	1
Physical Setting/Physics	June '19	**13**	**4**	MC	1	1
Physical Setting/Physics	June '19	**14**	**1**	MC	1	1
Physical Setting/Physics	June '19	**15**	**2**	MC	1	1
Physical Setting/Physics	June '19	**16**	**2**	MC	1	1
Physical Setting/Physics	June '19	**17**	**2**	MC	1	1
Physical Setting/Physics	June '19	**18**	**3**	MC	1	1
Physical Setting/Physics	June '19	**19**	**3**	MC	1	1
Physical Setting/Physics	June '19	**20**	**1**	MC	1	1
Physical Setting/Physics	June '19	**21**	**1**	MC	1	1
Physical Setting/Physics	June '19	**22**	**3**	MC	1	1
Physical Setting/Physics	June '19	**23**	**4**	MC	1	1
Physical Setting/Physics	June '19	**24**	**2**	MC	1	1
Physical Setting/Physics	June '19	**25**	**1**	MC	1	1
Physical Setting/Physics	June '19	**26**	**2**	MC	1	1
Physical Setting/Physics	June '19	**27**	**3**	MC	1	1
Physical Setting/Physics	June '19	**28**	**4**	MC	1	1
Physical Setting/Physics	June '19	**29**	**1**	MC	1	1
Physical Setting/Physics	June '19	**30**	**2**	MC	1	1
Physical Setting/Physics	June '19	**31**	**3**	MC	1	1
Physical Setting/Physics	June '19	**32**	**3**	MC	1	1
Physical Setting/Physics	June '19	**33**	**1**	MC	1	1
Physical Setting/Physics	June '19	**34**	**3**	MC	1	1
Physical Setting/Physics	June '19	**35**	**3**	MC	1	1
Physical Setting/Physics	June '19	**36**	**3**	MC	1	1
Physical Setting/Physics	June '19	**37**	**3**	MC	1	1
Physical Setting/Physics	June '19	**38**	**1**	MC	1	1
Physical Setting/Physics	June '19	**39**	**1**	MC	1	1
Physical Setting/Physics	June '19	**40**	**3**	MC	1	1
Physical Setting/Physics	June '19	**41**	**2**	MC	1	1
Physical Setting/Physics	June '19	**42**	**4**	MC	1	1
Physical Setting/Physics	June '19	**43**	**4**	MC	1	1
Physical Setting/Physics	June '19	**44**	**1**	MC	1	1
Physical Setting/Physics	June '19	**45**	**2**	MC	1	1
Physical Setting/Physics	June '19	**46**	**1**	MC	1	1
Physical Setting/Physics	June '19	**47**	**2**	MC	1	1
Physical Setting/Physics	June '19	**48**	**3**	MC	1	1
Physical Setting/Physics	June '19	**49**	**4**	MC	1	1
Physical Setting/Physics	June '19	**50**	**1**	MC	1	1

Regents Examination in Physical Setting/Physics – June 2019

Scoring Key: Parts B-2 and C (Constructed-Response Questions)

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Physical Setting/Physics	June '19	**51**	-	CR	1	1
Physical Setting/Physics	June '19	**52**	-	CR	1	1
Physical Setting/Physics	June '19	**53**	-	CR	1	1
Physical Setting/Physics	June '19	**54**	-	CR	1	1
Physical Setting/Physics	June '19	**55**	-	CR	1	1
Physical Setting/Physics	June '19	**56**	-	CR	1	1
Physical Setting/Physics	June '19	**57**	-	CR	1	1
Physical Setting/Physics	June '19	**58**	-	CR	1	1
Physical Setting/Physics	June '19	**59**	-	CR	1	1
Physical Setting/Physics	June '19	**60**	-	CR	1	1
Physical Setting/Physics	June '19	**61**	-	CR	1	1
Physical Setting/Physics	June '19	**62**	-	CR	1	1
Physical Setting/Physics	June '19	**63**	-	CR	1	1
Physical Setting/Physics	June '19	**64**	-	CR	1	1
Physical Setting/Physics	June '19	**65**	-	CR	1	1
Physical Setting/Physics	June '19	**66**	-	CR	1	1
Physical Setting/Physics	June '19	**67**	-	CR	1	1
Physical Setting/Physics	June '19	**68**	-	CR	1	1
Physical Setting/Physics	June '19	**69**	-	CR	1	1
Physical Setting/Physics	June '19	**70**	-	CR	1	1
Physical Setting/Physics	June '19	**71**	-	CR	1	1
Physical Setting/Physics	June '19	**72**	-	CR	1	1
Physical Setting/Physics	June '19	**73**	-	CR	1	1
Physical Setting/Physics	June '19	**74**	-	CR	1	1
Physical Setting/Physics	June '19	**75**	-	CR	1	1
Physical Setting/Physics	June '19	**76**	-	CR	1	1
Physical Setting/Physics	June '19	**77**	-	CR	1	1
Physical Setting/Physics	June '19	**78**	-	CR	1	1
Physical Setting/Physics	June '19	**79**	-	CR	1	1
Physical Setting/Physics	June '19	**80**	-	CR	1	1
Physical Setting/Physics	June '19	**81**	-	CR	1	1
Physical Setting/Physics	June '19	**82**	-	CR	1	1
Physical Setting/Physics	June '19	**83**	-	CR	1	1
Physical Setting/Physics	June '19	**84**	-	CR	1	1
Physical Setting/Physics	June '19	**85**	-	CR	1	1

Key
MC = Multiple-choice question
CR = Constructed-response question

The chart for determining students' final examination scores for the **June 2019 Regents Examination in Physical Setting/Physics** will be posted on the Department's web site at http://www.p12.nysed.gov/assessment/ on the day of the examination. Conversion charts provided for the previous administrations of the Physical Setting/Physics examination must NOT be used to determine students' final scores for this administration.

The University of the State of New York
THE STATE EDUCATION DEPARTMENT
Office of State Assessment
Albany, New York 12234

IMPORTANT NOTICE

Scoring Clarification

Regents Examination in Physical Setting/Physics

Tuesday, June 25, 2019, 1:15 p.m.

Question 21, only

This notice pertains to the scoring of multiple-choice Question 21 on the June 25, 2019 Regents Examination in Physical Setting/Physics.

Due to imprecision in its wording, Question 21 has two correct answers.

Students who selected answer choice 1, the answer indicated in the Scoring Key, or answer choice 2 should be awarded credit for this question.

We apologize for any inconvenience this may cause you, and we thank you for your hard work on behalf of the students in New York State.

FOR TEACHERS ONLY

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

PHYSICAL SETTING/PHYSICS

Tuesday, June 25, 2019 — 1:15 to 4:15 p.m., only

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.

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.

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. Do not attempt to correct the student's work by making insertions or changes of any kind. 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 25, 2019. 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 0.25 J.

52 [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 51. Refer to the *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

$\Delta KE = \Delta PE_s$

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

$v = \sqrt{\frac{kx^2}{m}}$

$v = \sqrt{\frac{(50.\ \text{N/m})(0.10\ \text{m})^2}{0.10\ \text{kg}}}$

or

$\Delta KE = \Delta PE$

$KE = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2\,KE}{m}}$

$v = \sqrt{\frac{2(0.25\ \text{J})}{0.10\ \text{kg}}}$

53 [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 52.

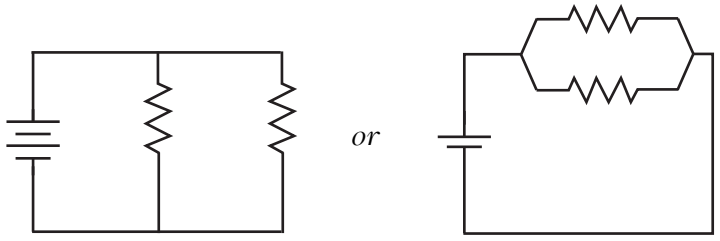
Example of a 1-credit response:

$v = 2.2$ m/s

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 52 and 53.

54 [1] Allow 1 credit for a circuit diagram showing two resistors connected in parallel with a cell or a battery.

Examples of 1-credit responses:

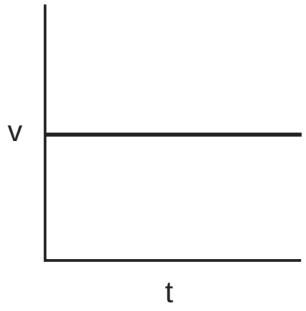


or

Note: Allow credit for lines not touching the battery if the distances from the lines to the battery is less than or equal to the distance between the battery symbol lines.

55 [1] Allow 1 credit for a line that approximates a horizontal line representing constant velocity.

Example of a 1-credit response:



56 [1] Allow 1 credit for 40.° ± 2°.

57 [1] Allow 1 credit for the equation and subsitution with units *or* for an answer, with units, that is consistent with the student's response to question 56. Refer to the *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

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

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

$$n_1 = \frac{(1.00)(\sin 40.°)}{\sin 25°}$$

58 [1] Allow 1 credit for the correct answer *or* for an answer, without units, that is consistent with the student's response to question 57.

Example of a 1-credit response:

$n_1 = 1.5$

Note: Do *not* penalize the student more than 1 credit for errors in units for questions 57 and 58.

59 [1] Allow 1 credit for the equation and substitution with units. Refer to the *Scoring Criteria for Calculations* in the rating guide.

Examples of 1-credit responses:

$v_f^2 = v_i^2 + 2ad$

$d = \frac{v_f^2 - v_i^2}{2a}$

$d = \frac{(29\ \text{m/s})^2 - (0\ \text{m/s})^2}{2(9.81\ \text{m/s}^2)}$

or

$v_f^2 = v_i^2 + 2ad$

$d = \frac{v_f^2}{2a}$

$d = \frac{(-29\ \text{m/s})^2}{2(-9.81\ \text{m/s}^2)}$

or

$\Delta PE = \Delta KE$

$mg\Delta h = \frac{1}{2}mv^2$

$\Delta h = \frac{v^2}{2g}$

$\Delta h = \frac{(29\ \text{m/s})^2}{2(9.81\text{m/s}^2)}$

60 [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 59.

Example of a 1-credit response:

$d = 43$ m

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

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

Example of a 1-credit response:

$p_{before} = p_{after}$

$(m_A v_A + m_B v_B)_{before} = (m_A v_A + m_B v_B)_{after}$

$(0.100\ \text{kg})(4.0\ \text{m/s}) + (0.150\ \text{kg})(0\ \text{m/s}) = (0.100\ \text{kg})(-1.5\ \text{m/s}) + (0.150\ \text{kg})(v_{B\ after})$

Note: Do *not* penalize the student for using grams instead of kilograms.

62 [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 61.

Example of a 1-credit response:

$v_{B\ after} = 3.7$ m/s

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 61 and 62.

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

Examples of 1-credit responses:

$J = \Delta p = m\Delta v$ $\qquad$ $J = F_{net}t$

or

$J = (1.20 \times 10^3\ \text{kg})(0\ \text{m/s} - 25\ \text{m/s})$ $\qquad$ $J = (6.0 \times 10^3\ \text{N})(5.0\ \text{s})$

64 [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 63.

Examples of 1-credit responses:

$3.0 \times 10^4\ \text{N}\bullet\text{s}$ $\quad$ *or* $\quad$ $-3.0 \times 10^4\ \text{kg}\bullet\text{m/s}$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 63 and 64. Allow credit for a correct answer with units that is positive or negative.

65 [1] Allow 1 credit for stating the direction of the impulse applied to the car. Acceptable responses include, but are not limited to:

— West

— opposite to direction of the car's motion

— backwards

Part C

66 [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:

$$g = \frac{F_g}{m}$$

$$F_g = mg$$

$$F_g = (1.96 \times 10^{-15}\ \text{kg})(9.81\ \text{m/s}^2)$$

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:

$F_g = 1.92 \times 10^{-14}$ N

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 1.92×10^{-14} N *or* for an answer that is consistent with the student's response to question 67.

69 [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 67 and 68. Refer to the *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

$$E = \frac{F_e}{q}$$

$$q = \frac{F_e}{E}$$

$$q = \frac{1.92 \times 10^{-14}\ \text{N}}{4.0 \times 10^{4}\ \text{N/C}}$$

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:

$q = 4.8 \times 10^{-19}$ C

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:

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

$\frac{1}{R_{eq}} = \frac{1}{100.\ \Omega} + \frac{1}{200.\ \Omega}$ $R = \frac{10.0\ \text{V}}{0.150\ \text{A}}$ $R_{eq} = \frac{(100.\ \Omega)(200.\ \Omega)}{100.\ \Omega + 200.\ \Omega}$

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:

$R_{eq} = 66.7\ \Omega$

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 the equation and substitution with units. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 1-credit response:

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

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

$I = \frac{10.0\ \text{V}}{200.\ \Omega}$

74 [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 73.

Example of a 1-credit response:

$I = 5.00 \times 10^{-2}$ A

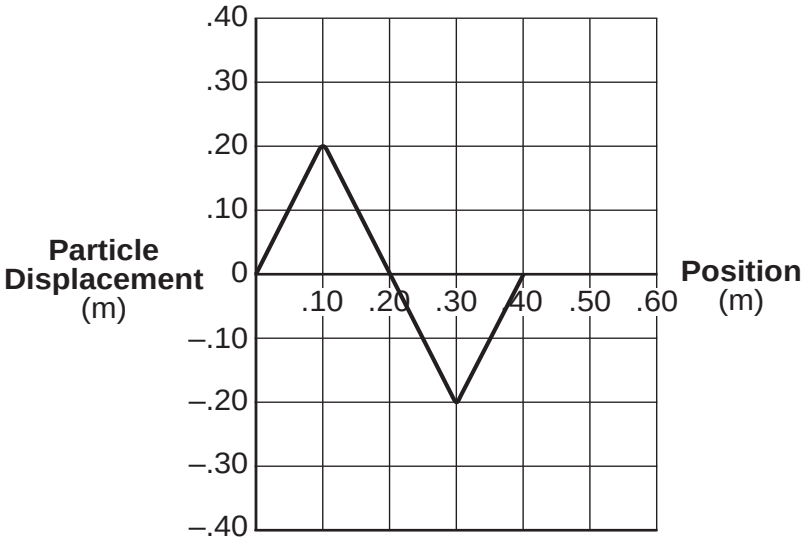
Note: Do *not* penalize the student more than 1 credit for errors in units in questions 73 and 74.

75 [1] Allow 1 credit for 1.00 W.

76 [1] Allow 1 credit for *at least one* complete wave with a wavelength of 0.40 meter regardless of phase or shape.

77 [1] Allow 1 credit for *at least one* complete wave with an amplitude of 0.20 meter regardless of phase or shape.

Example of a 2-credit response for questions 76 and 77:



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

Example of a 1-credit response:

$v = f\lambda$

v = (10. Hz)(0.40 m)

79 [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 78.

Example of a 1-credit response:

v = 4.0 m/s

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 78 and 79.

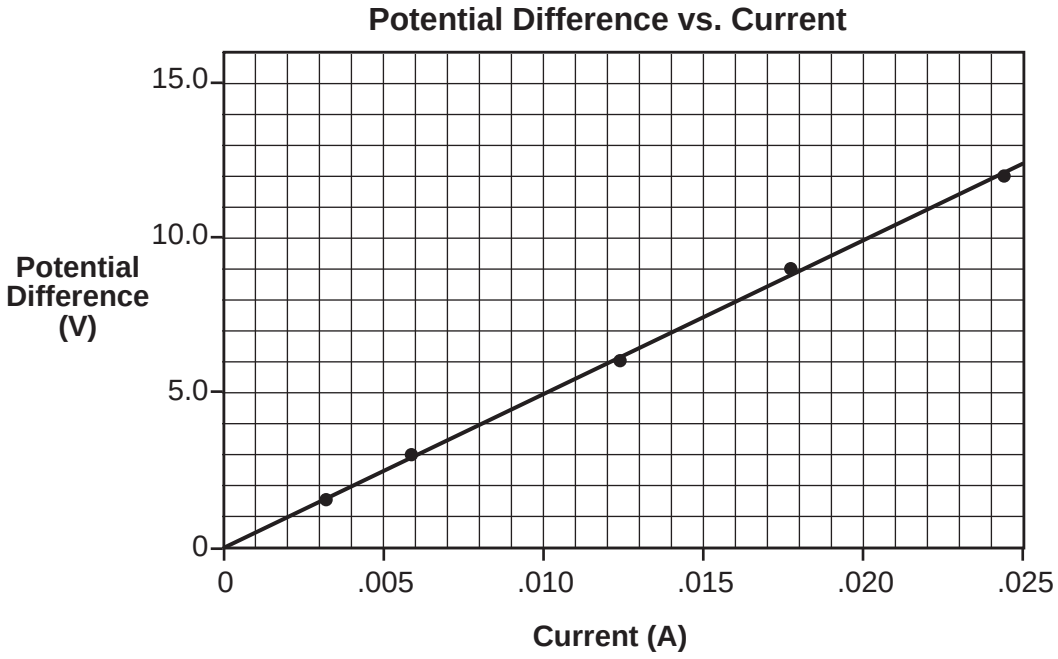
80 [1] Allow 1 credit for 0.10 s.

81 [1] Allow 1 credit for an appropriate linear scale.

82 [1] Allow 1 credit for plotting all points accurately ± 0.3 grid space.

83 [1] Allow 1 credit for drawing the best fit line or curve that is consistent with the student's responses to questions 81 and 82.

Example of a 3-credit response for questions 81 through 83:



84 [1] Allow 1 credit for the equation and substitution with units *or* for an answer, with units, that is consistent with the student's responses to question 81 through 83. Refer to the *Scoring Criteria for Calculations* in this rating guide.

Examples of 1-credit responses:

R = slope

$R = \frac{\Delta y}{\Delta x} = \frac{\Delta V}{\Delta I}$ *or* $R = \frac{V}{I}$

$R = \frac{9.0\,\text{V} - 3.0\,\text{V}}{0.018\,\text{A} - 0.006\,\text{A}}$ $R = \frac{9.0\,\text{V}}{0.018\,\text{A}}$

85 [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 84.

Example of a 1-credit response:

$R = 5.0 \times 10^2\ \Omega$

Note: Do *not* penalize the student more than 1 credit for errors in units in questions 84 and 85.

Regents Examination in Physical Setting/Physics

June 2019

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

The *Chart for Determining the Final Examination Score for the June 2019 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 25, 2019. 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 2019 Physical Setting/Physics			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	2, 7, 8, 10, 12, 13, 14, 15, 17, 23, 26, 34	38, 39, 41, 42, 43, 44, 45, 48, 51, 52, 53, 57, 58, 59, 60, 61, 62, 63, 64, 65	66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 80, 81, 82, 83, 84, 85
Math Key Idea 2	11	36, 37, 55	78, 79, 84, 85
Math Key Idea 3	32		66, 67, 69, 70
Science Inquiry Key Idea 1			68
Science Inquiry Key Idea 2			
Science Inquiry Key Idea 3		49, 56	78, 79, 82, 83
Engineering Design Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2		47	
Key Idea 3		49	
Key Idea 4	18		
Key Idea 5	11		
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
4.1	9, 19	43, 51, 52, 53, 54	71, 72
4.3	25	50, 56, 57, 58	76, 77
5.1	7, 19	37, 40, 55, 61, 62, 65	66, 67, 68
5.3	32	46	
Standard 4			
4.1	9, 10, 11, 12, 13, 14, 15, 16, 17	39, 43, 47, 48, 51, 52, 53, 54	71, 72, 73, 74, 75, 81, 82, 83, 84, 85
4.3	20, 21, 22, 23, 24, 25, 26, 27, 28, 29	49, 50, 56, 57, 58	76, 77, 78, 79, 80
5.1	1, 2, 3, 5, 6, 7, 8, 18, 19, 33, 34, 35	36, 37, 40, 41, 42, 55, 59, 60, 61, 62, 63, 64, 65	66, 67, 68, 69, 70
5.3	4, 30, 31, 32	38, 44, 45, 46	

Regents Examination in Physical Setting/Physics – June 2019

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

Raw Score	Scale Score
85	**100**
84	**99**
83	**98**
82	**98**
81	**97**
80	**96**
79	**95**
78	**94**
77	**93**
76	**92**
75	**92**
74	**91**
73	**90**
72	**89**
71	**88**
70	**87**
69	**86**
68	**85**
67	**84**
66	**83**
65	**82**
64	**81**

Raw Score	Scale Score
63	**80**
62	**79**
61	**78**
60	**77**
59	**76**
58	**75**
57	**74**
56	**73**
55	**72**
54	**71**
53	**70**
52	**69**
51	**68**
50	**67**
49	**65**
48	**64**
47	**63**
46	**62**
45	**61**
44	**60**
43	**59**
42	**58**

Raw Score	Scale Score
41	**56**
40	**55**
39	**54**
38	**53**
37	**52**
36	**51**
35	**49**
34	**48**
33	**47**
32	**46**
31	**45**
30	**43**
29	**42**
28	**41**
27	**40**
26	**38**
25	**37**
24	**36**
23	**34**
22	**33**
21	**32**
20	**30**

Raw Score	Scale Score
19	**29**
18	**28**
17	**26**
16	**25**
15	**23**
14	**22**
13	**21**
12	**19**
11	**18**
10	**16**
9	**15**
8	**13**
7	**12**
6	**10**
5	**9**
4	**7**
3	**5**
2	**4**
1	**2**
0	**0**

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.