The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
PHYSICS

Wednesday, June 24, 2009 — 9:15 a.m. to 12:15 p.m., only

The answer sheet for Part A and Part B–1 is the last page of this examination booklet. Turn to the last page and fold it along the perforations. Then, slowly and carefully, tear off the answer sheet and fill in the heading.

The answers to the questions in Part B–2 and Part C are to be written in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

You are to answer *all* questions in all parts of this examination according to the directions provided in the examination booklet. Record your answers to the Part A and Part B–1 multiple-choice questions on your separate answer sheet. Write your answers to the Part B–2 and Part C questions in your answer booklet. All work should be written in pen, except for graphs and drawings, which should be done in pencil. You may use scrap paper to work out the answers to the questions, but be sure to record all your answers on the answer sheet and in the answer booklet.

When you have completed the examination, you must sign the statement printed at the end of your separate answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet and answer booklet cannot be accepted if you fail to sign this declaration.

Notice. . .

A scientific or graphing calculator, a centimeter ruler, a protractor, and a copy of the *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.

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

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part A

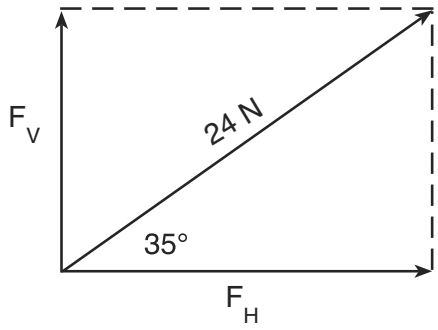
Answer all questions in this part.

Directions (1–35): For *each* statement or question, write on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question.

1 On a highway, a car is driven 80. kilometers during the first 1.00 hour of travel, 50. kilometers during the next 0.50 hour, and 40. kilometers in the final 0.50 hour. What is the car's average speed for the entire trip?

(1) 45 km/h
(2) 60. km/h
(3) 85 km/h
(4) 170 km/h

2 The vector diagram below represents the horizontal component, F_H, and the vertical component, F_V, of a 24-newton force acting at 35° above the horizontal.



What are the magnitudes of the horizontal and vertical components?

(1) F_H = 3.5 N and F_V = 4.9 N
(2) F_H = 4.9 N and F_V = 3.5 N
(3) F_H = 14 N and F_V = 20. N
(4) F_H = 20. N and F_V = 14 N

3 Which quantity is a vector?

(1) impulse
(2) power
(3) speed
(4) time

4 A high-speed train in Japan travels a distance of 300. kilometers in 3.60×10^3 seconds. What is the average speed of this train?

(1) 1.20×10^{-2} m/s
(2) 8.33×10^{-2} m/s
(3) 12.0 m/s
(4) 83.3 m/s

5 A 25-newton weight falls freely from rest from the roof of a building. What is the total distance the weight falls in the first 1.0 second?

(1) 19.6 m
(2) 9.8 m
(3) 4.9 m
(4) 2.5 m

6 A golf ball is given an initial speed of 20. meters per second and returns to level ground. Which launch angle above level ground results in the ball traveling the greatest horizontal distance? [Neglect friction.]

(1) 60.°
(2) 45°
(3) 30.°
(4) 15°

Base your answers to questions 7 and 8 on the information below.

A go-cart travels around a flat, horizontal, circular track with a radius of 25 meters. The mass of the go-cart with the rider is 200. kilograms. The magnitude of the maximum centripetal force exerted by the track on the go-cart is 1200. newtons.

7 What is the maximum speed the 200.-kilogram go-cart can travel without sliding off the track?

(1) 8.0 m/s
(2) 12 m/s
(3) 150 m/s
(4) 170 m/s

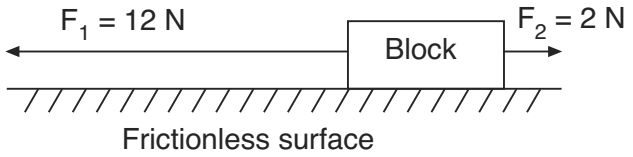
8 Which change would increase the maximum speed at which the go-cart could travel without sliding off this track?

(1) Decrease the coefficient of friction between the go-cart and the track.
(2) Decrease the radius of the track.
(3) Increase the radius of the track.
(4) Increase the mass of the go-cart.

9 A 0.50-kilogram cart is rolling at a speed of 0.40 meter per second. If the speed of the cart is doubled, the inertia of the cart is

(1) halved
(2) doubled
(3) quadrupled
(4) unchanged

10 Two forces, F_1 and F_2, are applied to a block on a frictionless, horizontal surface as shown below.



If the magnitude of the block's acceleration is 2.0 meters per second^2, what is the mass of the block?

(1) 1 kg
(2) 5 kg
(3) 6 kg
(4) 7 kg

11 Which body is in equilibrium?

(1) a satellite orbiting Earth in a circular orbit
(2) a ball falling freely toward the surface of Earth
(3) a car moving with a constant speed along a straight, level road
(4) a projectile at the highest point in its trajectory

12 What is the weight of a 2.00-kilogram object on the surface of Earth?

(1) 4.91 N
(2) 2.00 N
(3) 9.81 N
(4) 19.6 N

13 A 70.-kilogram cyclist develops 210 watts of power while pedaling at a constant velocity of 7.0 meters per second east. What average force is exerted eastward on the bicycle to maintain this constant speed?

(1) 490 N
(2) 30. N
(3) 3.0 N
(4) 0 N

14 The gravitational potential energy, with respect to Earth, that is possessed by an object is dependent on the object's

(1) acceleration
(2) momentum
(3) position
(4) speed

Note that question 15 has only three choices.

15 As a ball falls freely toward the ground, its total mechanical energy

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

16 A spring with a spring constant of 4.0 newtons per meter is compressed by a force of 1.2 newtons. What is the total elastic potential energy stored in this compressed spring?

(1) 0.18 J
(2) 0.36 J
(3) 0.60 J
(4) 4.8 J

17 A distance of 1.0 meter separates the centers of two small charged spheres. The spheres exert gravitational force F_g and electrostatic force F_e on each other. If the distance between the spheres' centers is increased to 3.0 meters, the gravitational force and electrostatic force, respectively, may be represented as

(1) $\frac{F_g}{9}$ and $\frac{F_e}{9}$
(2) $\frac{F_g}{3}$ and $\frac{F_e}{3}$
(3) $3F_g$ and $3F_e$
(4) $9F_g$ and $9F_e$

18 The electrical resistance of a metallic conductor is inversely proportional to its

(1) temperature
(2) length
(3) cross-sectional area
(4) resistivity

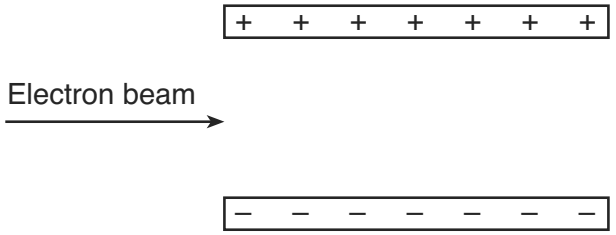
19 In a simple electric circuit, a 24-ohm resistor is connected across a 6.0-volt battery. What is the current in the circuit?

(1) 1.0 A
(2) 0.25 A
(3) 140 A
(4) 4.0 A

20 An operating 100.-watt lamp is connected to a 120-volt outlet. What is the total electrical energy used by the lamp in 60. seconds?

(1) 0.60 J
(2) 1.7 J
(3) 6.0×10^3 J
(4) 7.2×10^3 J

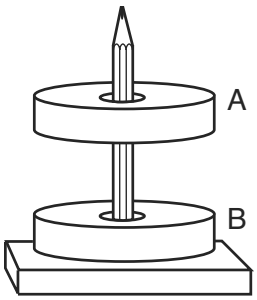
21 A beam of electrons is directed into the electric field between two oppositely charged parallel plates, as shown in the diagram below.



The electrostatic force exerted on the electrons by the electric field is directed

(1) into the page
(2) out of the page
(3) toward the bottom of the page
(4) toward the top of the page

22 When two ring magnets are placed on a pencil, magnet *A* remains suspended above magnet *B*, as shown below.



Which statement describes the gravitational force and the magnetic force acting on magnet *A* due to magnet *B*?

(1) The gravitational force is attractive and the magnetic force is repulsive.
(2) The gravitational force is repulsive and the magnetic force is attractive.
(3) Both the gravitational force and the magnetic force are attractive.
(4) Both the gravitational force and the magnetic force are repulsive.

23 Which color of light has a wavelength of 5.0×10^{-7} meter in air?

(1) blue
(2) green
(3) orange
(4) violet

24 Which type of wave requires a material medium through which to travel?

(1) sound
(2) radio
(3) television
(4) x ray

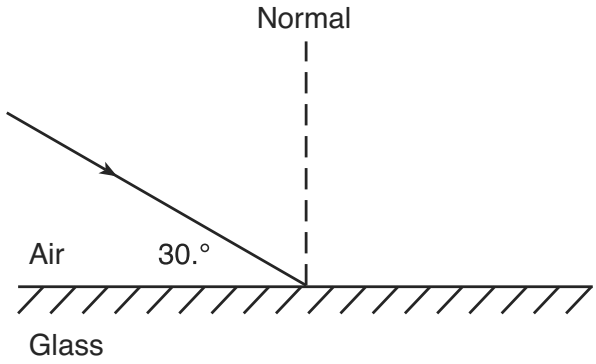
25 A periodic wave is produced by a vibrating tuning fork. The amplitude of the wave would be greater if the tuning fork were

(1) struck more softly
(2) struck harder
(3) replaced by a lower frequency tuning fork
(4) replaced by a higher frequency tuning fork

26 The sound wave produced by a trumpet has a frequency of 440 hertz. What is the distance between successive compressions in this sound wave as it travels through air at STP?

(1) 1.5×10^{-6} m
(2) 0.75 m
(3) 1.3 m
(4) 6.8×10^{5} m

27 The diagram below represents a light ray striking the boundary between air and glass.



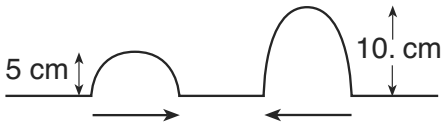
What would be the angle between this light ray and its reflected ray?

(1) 30.°
(2) 60.°
(3) 120.°
(4) 150.°

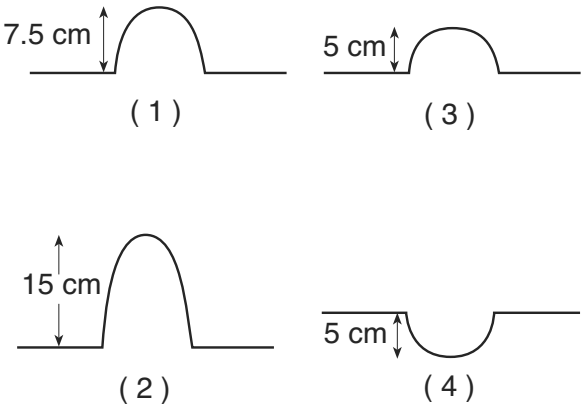
28 In which way does blue light change as it travels from diamond into crown glass?

(1) Its frequency decreases.
(2) Its frequency increases.
(3) Its speed decreases.
(4) Its speed increases.

29 The diagram below shows two pulses approaching each other in a uniform medium.



Which diagram best represents the superposition of the two pulses?



30 Sound waves strike a glass and cause it to shatter. This phenomenon illustrates

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

31 An alpha particle consists of two protons and two neutrons. What is the charge of an alpha particle?

(1) 1.25×10^{19} C
(2) 2.00 C
(3) 6.40×10^{-19} C
(4) 3.20×10^{-19} C

32 An electron in the *c* level of a mercury atom returns to the ground state. Which photon energy could *not* be emitted by the atom during this process?

(1) 0.22 eV
(2) 4.64 eV
(3) 4.86 eV
(4) 5.43 eV

33 Which phenomenon provides evidence that light has a wave nature?

(1) emission of light from an energy-level transition in a hydrogen atom
(2) diffraction of light passing through a narrow opening
(3) absorption of light by a black sheet of paper
(4) reflection of light from a mirror

34 When Earth and the Moon are separated by a distance of 3.84×10^8 meters, the magnitude of the gravitational force of attraction between them is 2.0×10^{20} newtons. What would be the magnitude of this gravitational force of attraction if Earth and the Moon were separated by a distance of 1.92×10^8 meters?

(1) 5.0×10^{19} N
(2) 2.0×10^{20} N
(3) 4.0×10^{20} N
(4) 8.0×10^{20} N

35 The particles in a nucleus are held together primarily by the

(1) strong force
(2) gravitational force
(3) electrostatic force
(4) magnetic force

Part B–1

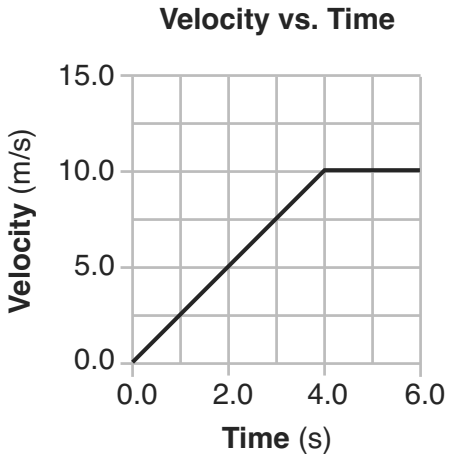
Answer all questions in this part.

Directions (36–47): For *each* statement or question, write on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question.

36 The work done in lifting an apple one meter near Earth's surface is approximately

(1) 1 J
(2) 0.01 J
(3) 100 J
(4) 1000 J

Base your answers to questions 37 and 38 on the graph below, which represents the motion of a car during a 6.0-second time interval.



37 What is the acceleration of the car at t = 5.0 seconds?

(1) 0.0 m/s^2
(2) 2.0 m/s^2
(3) 2.5 m/s^2
(4) 10. m/s^2

38 What is the total distance traveled by the car during this 6.0-second interval?

(1) 10. m
(2) 20. m
(3) 40. m
(4) 60. m

39 A person weighing 785 newtons on the surface of Earth would weigh 298 newtons on the surface of Mars. What is the magnitude of the gravitational field strength on the surface of Mars?

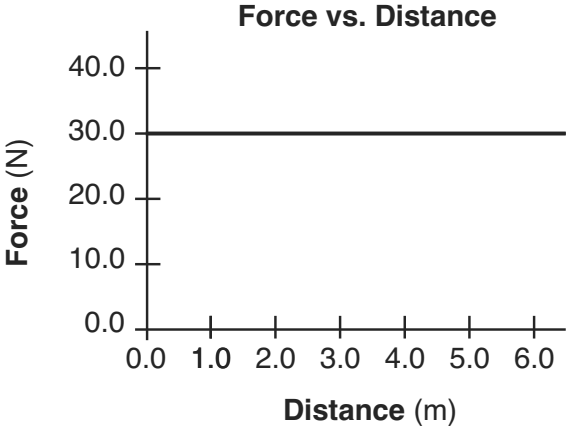
(1) 2.63 N/kg
(2) 3.72 N/kg
(3) 6.09 N/kg
(4) 9.81 N/kg

40 A motorcycle being driven on a dirt path hits a rock. Its 60.-kilogram cyclist is projected over the handlebars at 20. meters per second into a haystack. If the cyclist is brought to rest in 0.50 second, the magnitude of the average force exerted on the cyclist by the haystack is

(1) 6.0×10^1 N
(2) 5.9×10^2 N
(3) 1.2×10^3 N
(4) 2.4×10^3 N

Base your answers to questions 41 and 42 on the information below.

A boy pushes his wagon at constant speed along a level sidewalk. The graph below represents the relationship between the horizontal force exerted by the boy and the distance the wagon moves.



41 What is the total work done by the boy in pushing the wagon 4.0 meters?

(1) 5.0 J
(2) 7.5 J
(3) 120 J
(4) 180 J

42 As the boy pushes the wagon, what happens to the wagon's energy?

(1) Gravitational potential energy increases.
(2) Gravitational potential energy decreases.
(3) Internal energy increases.
(4) Internal energy decreases.

43 Which is an SI unit for work done on an object?

(1) $\frac{kg \cdot m^2}{s^2}$ (3) $\frac{kg \cdot m}{s}$

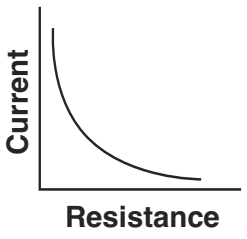
(2) $\frac{kg \cdot m^2}{s}$ (4) $\frac{kg \cdot m}{s^2}$

44 The momentum of a photon, p, is given by the equation $p = \frac{h}{\lambda}$ where h is Planck's constant and λ is the photon's wavelength. Which equation correctly represents the energy of a photon in terms of its momentum?

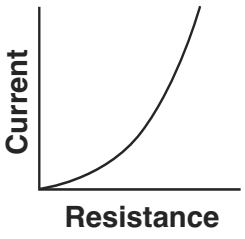
(1) $E_{photon} = phc$ (3) $E_{photon} = \frac{p}{c}$

(2) $E_{photon} = \frac{hp}{c}$ (4) $E_{photon} = pc$

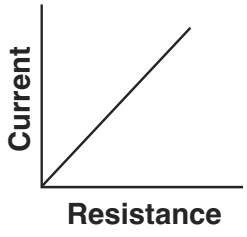
45 A constant potential difference is applied across a variable resistor held at constant temperature. Which graph best represents the relationship between the resistance of the variable resistor and the current through it?



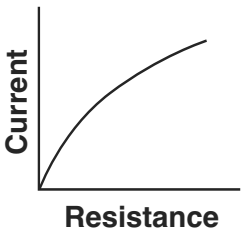
(1)



(3)



(2)



(4)

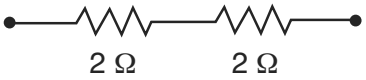
46 A 3.0-ohm resistor and a 6.0-ohm resistor are connected in series in an operating electric circuit. If the current through the 3.0-ohm resistor is 4.0 amperes, what is the potential difference across the 6.0-ohm resistor?

(1) 8.0 V (3) 12 V

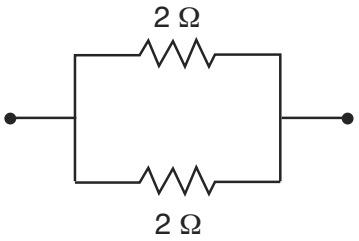
(2) 2.0 V (4) 24 V

47 Which combination of resistors has the *smallest* equivalent resistance?

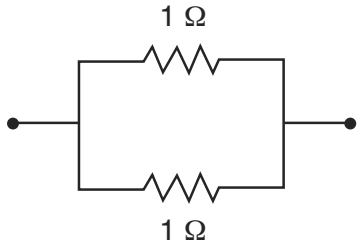
(1)



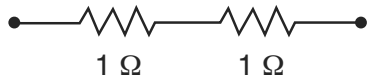
(2)



(3)



(4)



Part B–2

Answer all questions in this part.

Directions (48–59): Record your answers in the spaces provided in your answer booklet.

48 A cart travels 4.00 meters east and then 4.00 meters north. Determine the magnitude of the cart's resultant displacement. [1]

49 A 70-kilogram hockey player skating east on an ice rink is hit by a 0.1-kilogram hockey puck moving toward the west. The puck exerts a 50-newton force toward the west on the player. Determine the magnitude of the force that the player exerts on the puck during this collision. [1]

50 On a snow-covered road, a car with a mass of 1.1×10^3 kilograms collides head-on with a van having a mass of 2.5×10^3 kilograms traveling at 8.0 meters per second. As a result of the collision, the vehicles lock together and immediately come to rest. Calculate the speed of the car immediately before the collision. [Neglect friction.] [Show all work, including the equation and substitution with units.] [2]

51 A baby and stroller have a total mass of 20. kilograms. A force of 36 newtons keeps the stroller moving in a circular path with a radius of 5.0 meters. Calculate the speed at which the stroller moves around the curve. [Show all work, including the equation and substitution with units.] [2]

52 A 10.-newton force compresses a spring 0.25 meter from its equilibrium position. Calculate the spring constant of this spring. [Show all work, including the equation and substitution with units.] [2]

53 Two oppositely charged parallel metal plates, 1.00 centimeter apart, exert a force with a magnitude of 3.60×10^{-15} newton on an electron placed between the plates. Calculate the magnitude of the electric field strength between the plates. [Show all work, including the equation and substitution with units.] [2]

54 On the diagram *in your answer booklet*, sketch *at least four* electric field lines with arrowheads that represent the electric field around a negatively charged conducting sphere. [1]

55 In the space *in your answer booklet*, draw a diagram of an operating circuit that includes:

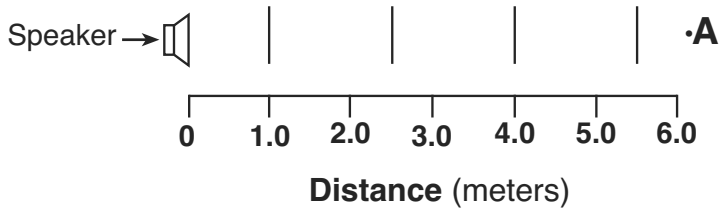
- a battery as a source of potential difference
- *two* resistors in parallel with each other
- an ammeter that reads the total current in the circuit [2]

56 Calculate the resistance of a 900.-watt toaster operating at 120 volts. [Show all work, including the equation and substitution with units.] [2]

57 A student and a physics teacher hold opposite ends of a horizontal spring stretched from west to east along a tabletop. Identify the directions in which the student should vibrate the end of the spring to produce transverse periodic waves. [1]

Base your answers to questions 58 and 59 on the information and diagram below.

The vertical lines in the diagram represent compressions in a sound wave of constant frequency propagating to the right from a speaker toward an observer at point *A*.



58 Determine the wavelength of this sound wave. [1]

59 The speaker is then moved at constant speed toward the observer at *A*. Compare the wavelength of the sound wave received by the observer while the speaker is moving to the wavelength observed when the speaker was at rest. [1]

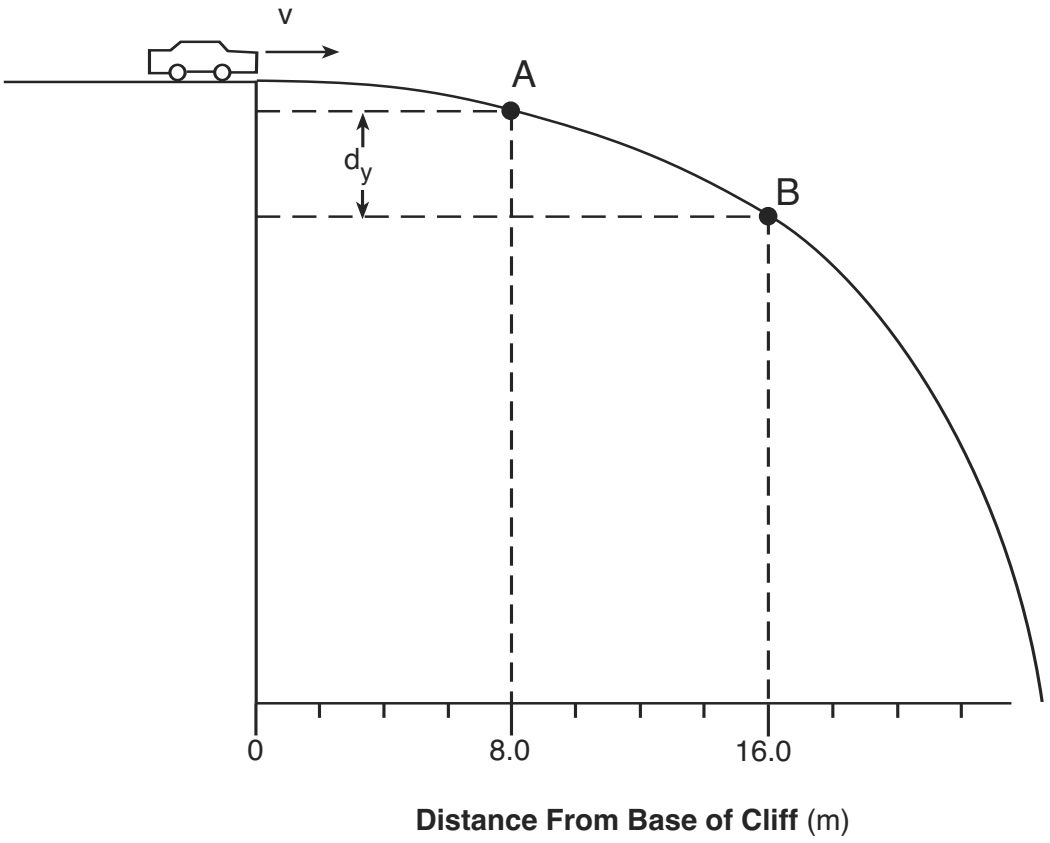
Part C

Answer all questions in this part.

Directions (60–72): Record your answers in the spaces provided in your answer booklet.

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

The path of a stunt car driven horizontally off a cliff is represented in the diagram below. After leaving the cliff, the car falls freely to point *A* in 0.50 second and to point *B* in 1.00 second.



60 Determine the magnitude of the horizontal component of the velocity of the car at point *B*. [Neglect friction.] [1]

61 Determine the magnitude of the vertical velocity of the car at point *A*. [1]

62 Calculate the magnitude of the vertical displacement, d_y, of the car from point *A* to point *B*. [Neglect friction.] [Show all work, including the equation and substitution with units.] [2]

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

A roller coaster car has a mass of 290. kilograms. Starting from rest, the car acquires 3.13×10^5 joules of kinetic energy as it descends to the bottom of a hill in 5.3 seconds.

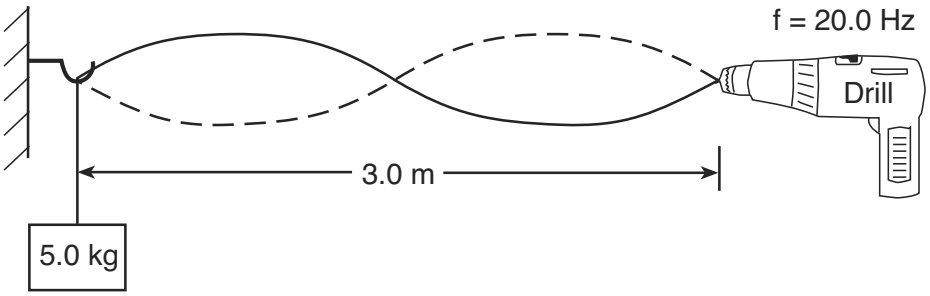
63 Calculate the height of the hill. [Neglect friction.] [Show all work, including the equation and substitution with units.] [2]

64 Calculate the speed of the roller coaster car at the bottom of the hill. [Show all work, including the equation and substitution with units.] [2]

65 Calculate the magnitude of the average acceleration of the roller coaster car as it descends to the bottom of the hill. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 66 and 67 on the information below.

One end of a rope is attached to a variable speed drill and the other end is attached to a 5.0-kilogram mass. The rope is draped over a hook on a wall opposite the drill. When the drill rotates at a frequency of 20.0 Hz, standing waves of the same frequency are set up in the rope. The diagram below shows such a wave pattern.



66 Determine the wavelength of the waves producing the standing wave pattern. [1]

67 Calculate the speed of the wave in the rope. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 68 and 69 on the information below.

A ray of monochromatic light ($f = 5.09 \times 10^{14}$ Hz) passes from air into Lucite at an angle of incidence of 30.°.

68 Calculate the angle of refraction in the Lucite. [Show all work, including the equation and substitution with units.] [2]

69 Using a protractor and straightedge, on the diagram *in your answer booklet*, draw the refracted ray in the Lucite. [1]

Base your answers to questions 70 through 72 on the information below.

A photon with a frequency of 5.48×10^{14} hertz is emitted when an electron in a mercury atom falls to a lower energy level.

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

71 Calculate the energy of this photon in joules. [Show all work, including the equation and substitution with units.] [2]

72 Determine the energy of this photon in electronvolts. [1]

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
PHYSICS

Wednesday, June 24, 2009 — 9:15 a.m. to 12:15 p.m., only

ANSWER SHEET

Student ..... Sex: ☐ Male ☐ Female Grade .....

Teacher ..... School .....

Record your answers to Part A and Part B–1 on this answer sheet.

Part A

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

Part A Score

Part B–1

36	42 .....
37	43 .....
38	44 .....
39	45 .....
40	46 .....
41	47 .....

Part B–1 Score

Write your answers to Part B–2 and Part C in your answer booklet.

The declaration below should be signed when you have completed the examination.

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination and that I have neither given nor received assistance in answering any of the questions during the examination.

Signature

Tear Here

Tear Here

PS/PHYSICS

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
PHYSICS

Wednesday, June 24, 2009 — 9:15 a.m. to 12:15 p.m., only

ANSWER BOOKLET

☐ Male

Student . . . . . Sex: ☐ Female

Teacher . . . . . .

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

Answer all questions in Part B–2 and Part C. Record your answers in this booklet.

Part	Maximum Score	Student's Score
A	35	
B–1	12	
B–2	18	
C	20	

Total Written Test Score (Maximum Raw Score: 85)

Final Score (from conversion chart)

Raters' Initials:

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

Part B–2

48 _____ **m**

49 _____ **N**

50

For Raters Only

48

49

50

For Raters Only

51

51

52

52

53

53

[2]

For Raters Only

54

54

55

55

56

56

57 _____

_____

58 _____ **m**

59 _____

_____

For Raters Only

57 ☐

58 ☐

59 ☐

☐

Total Score for Part B–2

Part C

60 _____ **m/s**

61 _____ **m/s**

62

63

For Raters Only

60 ☐

61 ☐

62 ☐

63 ☐

For Raters Only

64

64 ☐

65

65 ☐

66 _____ **m**

66 ☐

67

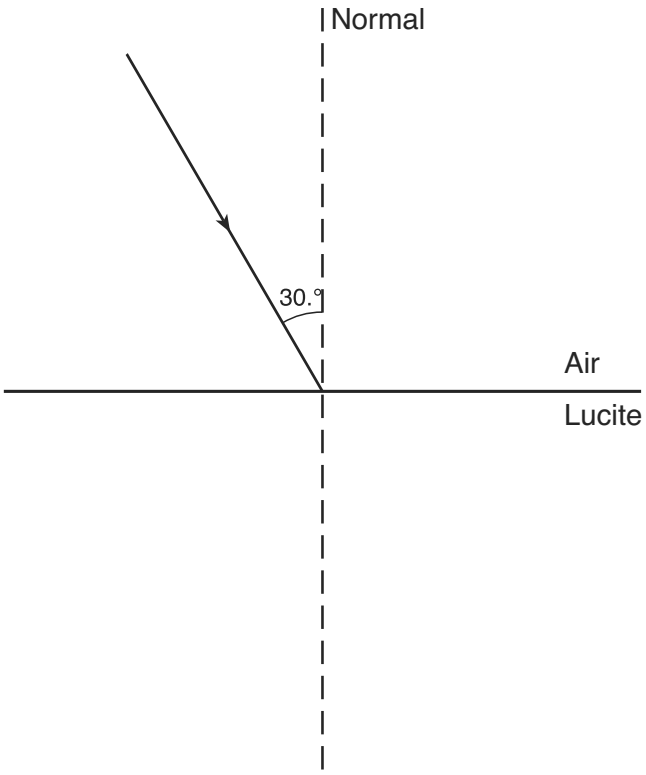
67 ☐

For Raters Only

68

68

69



69

For Raters Only

70 _____

70

71

71

72 _____ **eV**

72

Total Score for Part C

PS/PHYSICS

FOR TEACHERS ONLY

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

PS–P

PHYSICAL SETTING/PHYSICS

Wednesday, June 24, 2009 — 9:15 a.m. to 12:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 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 http://www.emsc.nysed.gov/osa/ and select the link "Examination 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 . . . . **3**	13 . . . . **2**	25 . . . . **2** . . . .
2 . . . . **4**	14 . . . . **3**	26 . . . . **2** . . . .
3 . . . . **1**	15 . . . . **3**	27 . . . . **3** . . . .
4 . . . . **4**	16 . . . . **1**	28 . . . . **4** . . . .
5 . . . . **3**	17 . . . . **1**	29 . . . . **2** . . . .
6 . . . . **2**	18 . . . . **3**	30 . . . . **1** . . . .
7 . . . . **2**	19 . . . . **2**	31 . . . . **4** . . . .
8 . . . . **3**	20 . . . . **3**	32 . . . . **4** . . . .
9 . . . . **4**	21 . . . . **4**	33 . . . . **2** . . . .
10 . . . . **2**	22 . . . . **1**	34 . . . . **4** . . . .
11 . . . . **3**	23 . . . . **2**	35 . . . . **1** . . . .
12 . . . . **4**	24 . . . . **1**	

Part B–1

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

Directions to the Teacher

Follow the procedures below for scoring student answer papers for the Physical Setting/Physics examination. Additional information about scoring is provided in the publication *Information for Scoring Regents Examinations in the Sciences*.

Use only *red* ink or *red* pencil in rating Regents papers. Do not attempt to *correct* the student's work by making insertions or changes of any kind.

On the detachable answer sheet for Part A and Part B–1, indicate by means of a check mark each incorrect or omitted answer. In the box provided at the end of each part, record the number of questions the student answered correctly for that part.

Students' responses must be scored strictly according to the Scoring Key and Rating Guide. For open-ended questions, credit may be allowed for responses other than those given in the rating guide if the response is a scientifically accurate answer to the question and demonstrates adequate knowledge as indicated by the examples in the rating guide.

Fractional credit is *not* allowed. Only whole-number credit may be given to a response. Units need not be given when the wording of the questions allows such omissions.

Raters should enter the scores earned for Part A, Part B–1, Part B–2, and Part C on the appropriate lines in the box printed on the answer booklet, and then should add these four scores and enter the total in the box labeled "Total Written Test Score." Then, the student's raw score on the written test should be converted to a scaled score by using the conversion chart that will be posted on the Department's web site: http://www.emsc.nysed.gov/osa/ on Wednesday, June 24, 2009. The student's scaled score should be entered in the labeled box on the student's answer booklet. The scaled score is the student's final examination score.

All student answer papers that receive a scaled score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions that he/she scored in the first rating of the paper. The school principal is responsible for assuring that the student's final examination score is based on a fair, accurate, and reliable scoring of the student's answer paper.

Because scaled scores corresponding to raw scores in the conversion chart may change from one examination to another, it is crucial that for each administration, the conversion chart provided for that administration be used to determine the student's final score.

Please refer to the Department publication *Regents Examination in Physical Setting/Physics: Rating Guide for Parts B–2 and C*. This publication can be found on the New York State Education Department web site http://www.emsc.nysed.gov/osa/scire/scirearch/phyratg02.pdf. Teachers should become familiar with this guide before rating students' papers.

Scoring Criteria for Calculations

For each question requiring the student to show *all calculations, including the equation and substitution with units*, apply the following scoring criteria:

- Allow 1 credit for the equation and substitution of values with units. If the equation and/or substitution with units is not shown, do *not* allow this credit.
- Allow 1 credit for the correct answer (number and unit). If the number is given without the unit, do *not* allow this credit.
- Penalize a student only once per equation for omitting units.
- Allow full credit even if the answer is not expressed with the correct number of significant figures.

Part B–2

48 [1] Allow 1 credit for 5.66 m.

49 [1] Allow 1 credit for 50 N.

50 [2] Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this rating guide.

Examples of 2-credit responses:

$p_{before} = p_{after}$

$m_1 v_1 + m_2 v_2 = 0$

$v_1 = \frac{-m_2 v_2}{m_1}$

$v_1 = \frac{-(2.5 \times 10^3 \text{ kg})(8.0 \text{ m/s})}{1.1 \times 10^3 \text{ kg}}$

$v_1 = -18 \text{ m/s}$ *or* 18 m/s

or

$m_1 v_1 = m_2 v_2$

$(1.1 \times 10^3 \text{ kg})\, v_1 = (2.5 \times 10^3 \text{ kg})(8.0 \text{ m/s})$

$v_1 = 18 \text{ m/s}$

51 [2] Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 2-credit response:

$$F_c = \frac{mv^2}{r}$$
$$v = \sqrt{\frac{F_c r}{m}}$$
$$v = \sqrt{\frac{(36\,\text{N})(5.0\,\text{m})}{20.\,\text{kg}}}$$
$$v = 3.0\,\text{m/s}$$

52 [2] Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 2-credit response:

$$F_s = kx$$
$$k = \frac{F_s}{x}$$
$$k = \frac{10.\,\text{N}}{0.25\,\text{m}}$$
$$k = 40.\,\text{N/m}$$

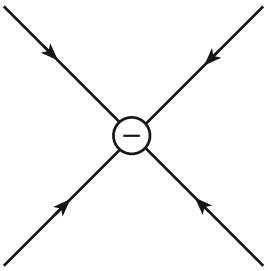
53 [2] Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 2-credit response:

$$E = \frac{F_e}{q}$$
$$E = \frac{3.60 \times 10^{-15}\ \text{N}}{1.60 \times 10^{-19}\ \text{C}}$$
$$E = 2.25 \times 10^{4}\ \text{N/C}$$

54 [1] Allow 1 credit for *at least four* straight lines drawn perpendicular to the surface of the sphere with each line having an arrowhead directed toward the sphere and ending within 0.2 cm of the sphere.

Example of a 1-credit response:

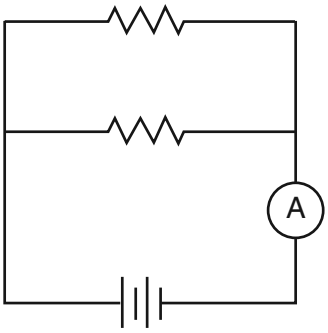


Note: Allow credit even if the lines are *not* drawn symmetrically.

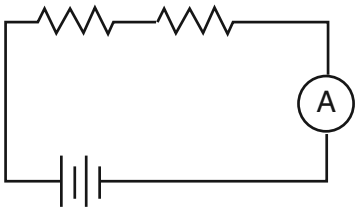
55 [2] Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for two resistors connected in parallel with the battery (or cell) in a complete circuit.
- Allow 1 credit for an ammeter connected in the circuit to measure the total current.

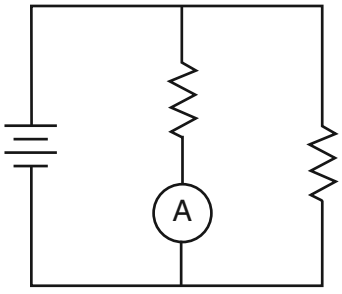
Example of a 2-credit response:



Examples of 1-credit responses:



or



Note: Allow credit for lines *not* touching the battery if the distance from the lines to the battery is ≤ the distance between the battery symbol lines.

[5]

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

Example of a 2-credit response:

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

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

$$R = \frac{(120\ \text{V})^2}{900.\ \text{W}}$$

$$R = 16\ \Omega$$

57 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— north and south

— up and down

— perpendicular to spring

— left and right

Note: Do *not* allow credit for back and forth or east and west.

58 [1] Allow 1 credit for 1.5 m.

59 [1] Allow 1 credit for indicating that the wavelength is shorter while the speaker is moving *or* for an answer that is consistent with the student's response to question 58.

Part C

60 [1] Allow 1 credit for 16 m/s.

61 [1] Allow 1 credit for 4.9 m/s.

62 [2] Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 2-credit response:

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

$d_y = (4.9 \text{ m/s})\ (0.50 \text{ s}) + \frac{1}{2}(9.81 \text{ m/s}^2)\ (0.50 \text{ s})^2$

$d_y = 3.7 \text{ m}$

Note: Allow credit for an answer that is consistent with the student's response to question 61.

63 [2] Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 2-credit response:

$\Delta KE = \Delta PE = mg\Delta h$

$\Delta h = \frac{\Delta KE}{mg}$

$\Delta h = \frac{3.13 \times 10^5 \text{ J}}{(290. \text{ kg})(9.81 \text{ m/s}^2)}$

$\Delta h = 110. \text{ m}$

64 [2] Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 2-credit response:

$$KE = \frac{1}{2}mv^2$$
$$v = \sqrt{\frac{2KE}{m}}$$
$$v = \sqrt{\frac{2(3.13 \times 10^5 \text{ J})}{290. \text{ kg}}}$$
$$v = 46.5 \text{ m/s}$$

65 [2] Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 2-credit response:

$$a = \frac{\Delta v}{t}$$
$$a = \frac{46.5 \text{ m/s}}{5.3 \text{ s}}$$
$$a = 8.8 \text{ m/s}^2$$

Note: Allow credit for an answer that is consistent with the student's response to question 64.

66 [1] Allow 1 credit for 3.0 m *or* 3 m.

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

Example of a 2-credit response:

$$v = f\lambda$$
$$v = (20.0 \text{ Hz})\ (3.0 \text{ m})$$
$$v = 60. \text{ m/s}$$

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

68 [2] Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in this rating guide.

Example of a 2-credit response:

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

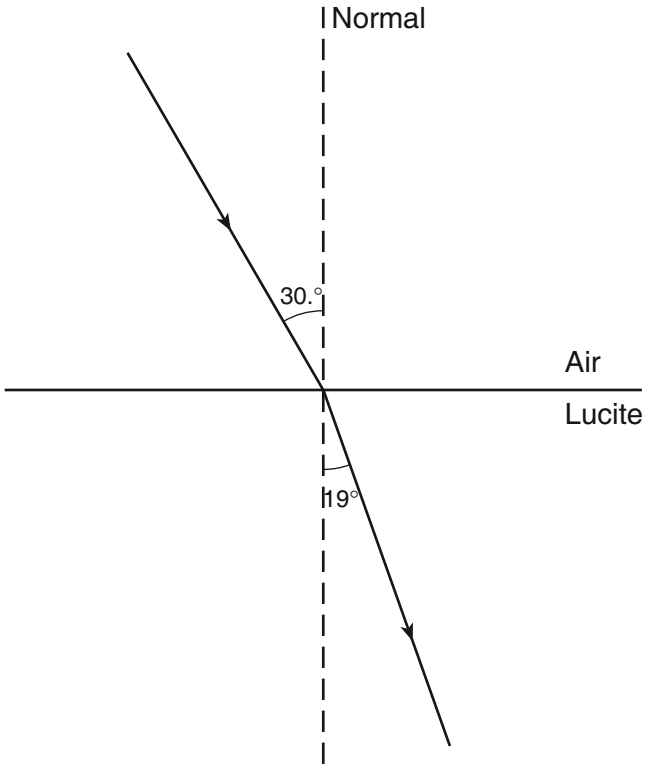
$$\sin\theta_2 = \frac{n_1 \sin\theta_1}{n_2}$$

$$\sin\theta_2 = \frac{(1.00)(\sin 30.^\circ)}{1.50}$$

$$\theta_2 = 19^\circ$$

69 [1] Allow 1 credit for a response correctly showing the refracted ray at 19° ± 2° to the normal.

Example of a 1 credit response:



Note: Allow credit even if the arrowhead is missing.
Allow credit for an answer that is consistent with the student's response to question 68.

70 [1] Allow 1 credit for green.

71 [2] Allow a maximum of 2 credits. Refer to *Scoring Criteria for Calculations* in the rating guide.

Example of a 2-credit response:

$E_{photon} = hf$

$E_{photon} = (6.63 \times 10^{-34}\ \text{J•s})(5.48 \times 10^{14}\ \text{Hz})$

$E_{photon} = 3.63 \times 10^{-19}\ \text{J}$

72 [1] Allow 1 credit for 2.27 eV.

Note: Allow credit for an answer that is consistent with the student's response to question 71.

Regents Examination in Physical Setting/Physics

June 2009

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

The *Chart for Determining the Final Examination Score for the June 2009 Regents Examination in Physical Setting/Physics* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Wednesday, June 24, 2009. 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 www.emsc.nysed.gov/osa/exameval.
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 2009 Physical Setting/Physics			
Question Numbers			
Key Ideas	Part A 1–35	Part B 36–59	Part C 60–72
Standard 1			
Math Key Idea 1	1,2,4,5,7,8,10,12,13,14,16,17,18, 19,20,26,28,32,34	39,40,41,42,43,44,45, 46,47,49,51,52,53,56	63,64,65,67,68, 71,72
Math Key Idea 2	9	54	
Math Key Idea 3			
Sci. Inq. Key Idea 1			70
Sci. Inq. Key Idea 2			
Sci. Inq. Key Idea 3	23		
Eng. Des. Key Idea 1			
Standard 2			
Key Idea 1			
Key Idea 2			
Standard 6			
Key Idea 1			
Key Idea 2			
Key Idea 3		36	
Key Idea 4			
Key Idea 5	17,18		
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
4.1		55	
4.3	29	57,58,59	66,69
5.1		37,38,48,50	60,61,62
5.3			
Standard 4			
4.1	13,14,15,16,18,19,20,21	36,41,42,43,45,46,47, 55,56	63,64
4.3	23,24,25,26,27,28,29,30	36,41,42,43,45,46,47, 57,58,59	66,67,68,69,70
5.1	1,2,3,4,5,6,7,8,9,10,11,12,17,22,34	37,38,39,40,48,49,50, 51,52,53,54	60,61,62,65
5.3	31,32,33,35,	44	71,72

University of the State of New York
State Education Department

Regents Examination in Physical Setting / Physics
June 2009

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

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 "Final Score" on the student's answer sheet.

All student answer papers that receive a scale score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions that he/she scored in the first rating of the paper. The school principal is responsible for assuring that the student's final examination score is based on a fair, accurate and reliable scoring of the student's answer paper.

Because scale scores corresponding to raw scores in the conversion chart may change from one examination to another, it is crucial that for each administration, the conversion chart provided for that administration be used to determine the student's final score. The chart above is usable only for this administration of the Physical Setting / Physics Examination.