The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING

PHYSICS

Thursday, January 26, 2006 — 1:15 to 4:15 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 answer booklet for Part B–2 and Part C is stapled in the center of this examination booklet. Open the examination booklet, carefully remove the answer booklet, and close the examination booklet. Then fill in the heading 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 *2002 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 The speed of a wagon increases from 2.5 meters per second to 9.0 meters per second in 3.0 seconds as it accelerates uniformly down a hill. What is the magnitude of the acceleration of the wagon during this 3.0-second interval?

(1) 0.83 m/s^2 (3) 3.0 m/s^2
(2) 2.2 m/s^2 (4) 3.8 m/s^2

2 A 1.0-kilogram ball is dropped from the roof of a building 40. meters tall. What is the approximate time of fall? [Neglect air resistance.]

(1) 2.9 s (3) 4.1 s
(2) 2.0 s (4) 8.2 s

3 Which is a scalar quantity?

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

4 A projectile is fired with an initial velocity of 120. meters per second at an angle, θ, above the horizontal. If the projectile's initial horizontal speed is 55 meters per second, then angle θ measures approximately

(1) 13° (3) 63°
(2) 27° (4) 75°

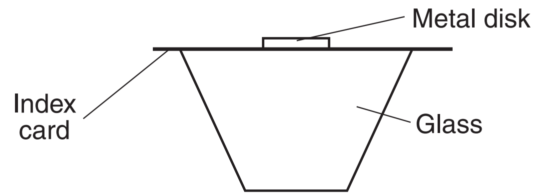
5 A 2.0-kilogram laboratory cart is sliding across a horizontal frictionless surface at a constant velocity of 4.0 meters per second east. What will be the cart's velocity after a 6.0-newton westward force acts on it for 2.0 seconds?

(1) 2.0 m/s east (3) 10. m/s east
(2) 2.0 m/s west (4) 10. m/s west

6 A 25.0-kilogram space probe fell freely with an acceleration of 2.00 meters per second^2 just before it landed on a distant planet. What is the weight of the space probe on that planet?

(1) 12.5 N (3) 50.0 N
(2) 25.0 N (4) 250. N

Base your answers to questions 7 and 8 on the diagram below, which shows a 1.0-newton metal disk resting on an index card that is balanced on top of a glass.



7 What is the net force acting on the disk?

(1) 1.0 N (3) 0 N
(2) 2.0 N (4) 9.8 N

8 When the index card is quickly pulled away from the glass in a horizontal direction, the disk falls straight down into the glass. This action is a result of the disk's

(1) inertia (3) shape
(2) charge (4) temperature

---

9 A vertical spring 0.100 meter long is elongated to a length of 0.119 meter when a 1.00-kilogram mass is attached to the bottom of the spring. The spring constant of this spring is

(1) 9.8 N/m (3) 98 N/m
(2) 82 N/m (4) 520 N/m

Note that question 10 has only three choices.

10 Compared to the force needed to start sliding a crate across a rough level floor, the force needed to keep it sliding once it is moving is

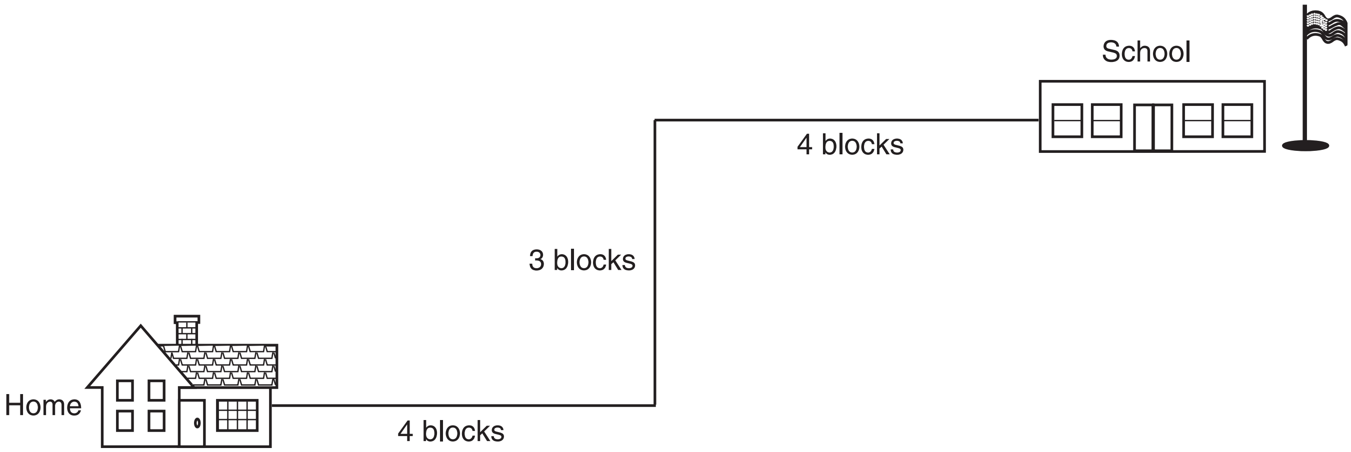
(1) less
(2) greater
(3) the same

11 A 400-newton girl standing on a dock exerts a force of 100 newtons on a 10 000-newton sailboat as she pushes it away from the dock. How much force does the sailboat exert on the girl?

(1) 25 N (3) 400 N
(2) 100 N (4) 10 000 N

Note that question 12 has only three choices.

12 A student on her way to school walks four blocks east, three blocks north, and another four blocks east, as shown in the diagram.



Compared to the distance she walks, the magnitude of her displacement from home to school is

(1) less
(2) greater
(3) the same

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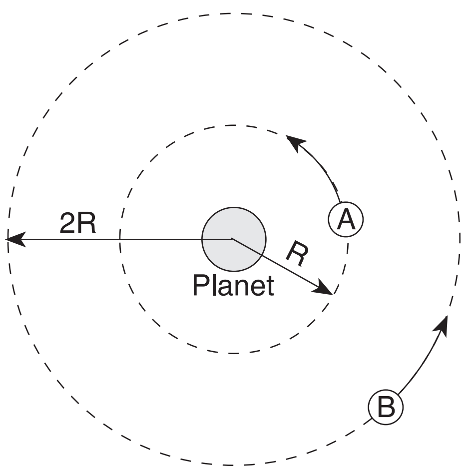
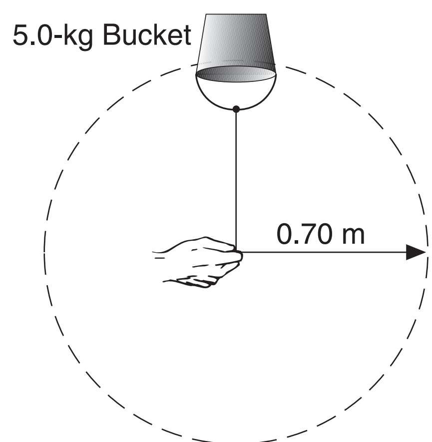
13 The diagram below represents two satellites of equal mass, *A* and *B*, in circular orbits around a planet.



Compared to the magnitude of the gravitational force of attraction between satellite *A* and the planet, the magnitude of the gravitational force of attraction between satellite *B* and the planet is

(1) half as great
(2) twice as great
(3) one-fourth as great
(4) four times as great

14 The diagram below shows a 5.0-kilogram bucket of water being swung in a horizontal circle of 0.70-meter radius at a constant speed of 2.0 meters per second.



The magnitude of the centripetal force on the bucket of water is approximately

(1) 5.7 N
(2) 14 N
(3) 29 N
(4) 200 N

15 A 6.8-kilogram block is sliding down a horizontal, frictionless surface at a constant speed of 6.0 meters per second. The kinetic energy of the block is approximately

(1) 20. J
(2) 41 J
(3) 120 J
(4) 240 J

16 Through what vertical distance is a 50.-newton object moved if 250 joules of work is done against the gravitational field of Earth?

(1) 2.5 m
(2) 5.0 m
(3) 9.8 m
(4) 25 m

17 When a mass is placed on a spring with a spring constant of 15 newtons per meter, the spring is compressed 0.25 meter. How much elastic potential energy is stored in the spring?

(1) 0.47 J
(2) 0.94 J
(3) 1.9 J
(4) 3.8 J

Note that question 18 has only three choices.

18 Two students of equal weight go from the first floor to the second floor. The first student uses an elevator and the second student walks up a flight of stairs. Compared to the gravitational potential energy gained by the first student, the gravitational potential energy gained by the second student is

(1) less
(2) greater
(3) the same

19 A 55.0-kilogram diver falls freely from a diving platform that is 3.00 meters above the surface of the water in a pool. When she is 1.00 meter above the water, what are her gravitational potential energy and kinetic energy with respect to the water's surface?

(1) PE = 1620 J and KE = 0 J
(2) PE = 1080 J and KE = 540 J
(3) PE = 810 J and KE = 810 J
(4) PE = 540 J and KE = 1080 J

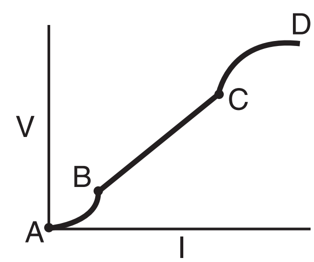
20 A 0.25-kilogram baseball is thrown upward with a speed of 30. meters per second. Neglecting friction, the maximum height reached by the baseball is approximately

(1) 15 m
(2) 46 m
(3) 74 m
(4) 92 m

21 A truck weighing 3.0×10^4 newtons was driven up a hill that is 1.6×10^3 meters long to a level area that is 8.0×10^2 meters above the starting point. If the trip took 480 seconds, what was the *minimum* power required?

(1) 5.0×10^4 W
(2) 1.0×10^5 W
(3) 1.2×10^{10} W
(4) 2.3×10^{10} W

22 The graph below represents the relationship between the potential difference (V) across a resistor and the current (I) through the resistor.



Through which entire interval does the resistor obey Ohm's law?

(1) *AB*
(2) *BC*
(3) *CD*
(4) *AD*

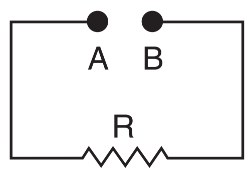
23 Aluminum, copper, gold, and nichrome wires of equal lengths of 1.0×10^{-1} meter and equal cross-sectional areas of 2.5×10^{-6} meter^2 are at 20.°C. Which wire has the greatest electrical resistance?

(1) aluminum
(2) copper
(3) gold
(4) nichrome

24 How much electrical energy is required to move a 4.00-microcoulomb charge through a potential difference of 36.0 volts?

(1) 9.00×10^6 J
(2) 144 J
(3) 1.44×10^{-4} J
(4) 1.11×10^{-7} J

25 What must be inserted between points *A* and *B* to establish a steady electric current in the incomplete circuit represented in the diagram below?

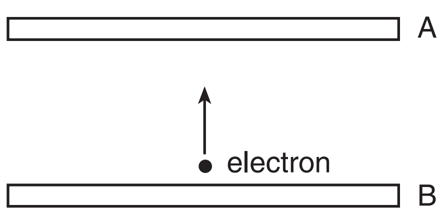


(1) switch
(2) voltmeter
(3) magnetic field source
(4) source of potential difference

26 In a series circuit containing two lamps, the battery supplies a potential difference of 1.5 volts. If the current in the circuit is 0.10 ampere, at what rate does the circuit use energy?

(1) 0.015 W
(2) 0.15 W
(3) 1.5 W
(4) 15 W

27 An electron placed between oppositely charged parallel plates *A* and *B* moves toward plate *A*, as represented in the diagram below.



What is the direction of the electric field between the plates?

(1) toward plate *A*
(2) toward plate *B*
(3) into the page
(4) out of the page

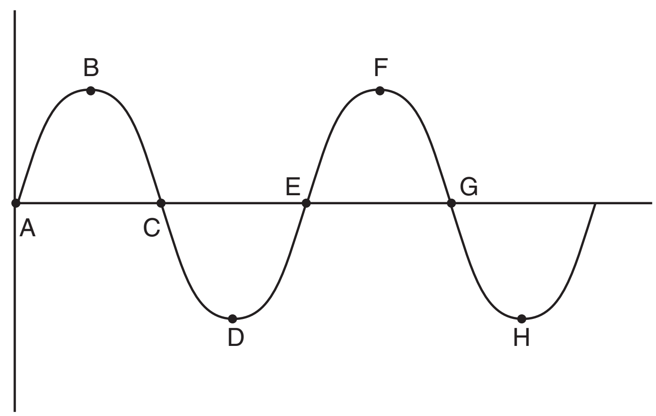
28 A sonar wave is reflected from the ocean floor. For which angles of incidence do the wave's angle of reflection equal its angle of incidence?

(1) angles less than 45°, only
(2) an angle of 45°, only
(3) angles greater than 45°, only
(4) all angles of incidence

29 How are electromagnetic waves that are produced by oscillating charges and sound waves that are produced by oscillating tuning forks similar?

(1) Both have the same frequency as their respective sources.
(2) Both require a matter medium for propagation.
(3) Both are longitudinal waves.
(4) Both are transverse waves.

30 The diagram below represents a transverse wave traveling in a string.



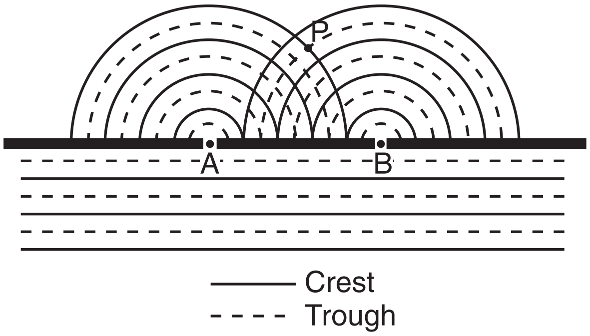
Which two labeled points are 180° out of phase?

(1) *A* and *D*
(2) *B* and *F*
(3) *D* and *F*
(4) *D* and *H*

31 When observed from Earth, the wavelengths of light emitted by a star are shifted toward the red end of the electromagnetic spectrum. This redshift occurs because the star is

(1) at rest relative to Earth
(2) moving away from Earth
(3) moving toward Earth at decreasing speed
(4) moving toward Earth at increasing speed

32 The diagram below represents shallow water waves of constant wavelength passing through two small openings, *A* and *B*, in a barrier.



Which statement best describes the interference at point *P*?

(1) It is constructive, and causes a longer wavelength.
(2) It is constructive, and causes an increase in amplitude.
(3) It is destructive, and causes a shorter wavelength.
(4) It is destructive, and causes a decrease in amplitude.

33 Oil droplets may gain electrical charges as they are projected through a nozzle. Which quantity of charge is *not* possible on an oil droplet?

(1) 8.0×10^{-19} C
(2) 4.8×10^{-19} C
(3) 3.2×10^{-19} C
(4) 2.6×10^{-19} C

34 All photons in a vacuum have the same

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

35 Which phenomenon best supports the theory that matter has a wave nature?

(1) electron momentum
(2) electron diffraction
(3) photon momentum
(4) photon diffraction

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.

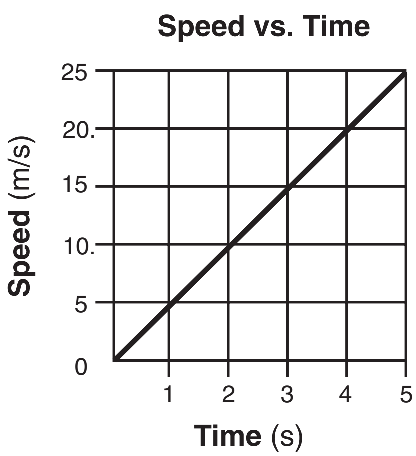
36 What is the approximate mass of an automobile?

(1) 10^1 kg (3) 10^3 kg
(2) 10^2 kg (4) 10^6 kg

37 Which pair of quantities can be expressed using the same units?

(1) work and kinetic energy
(2) power and momentum
(3) impulse and potential energy
(4) acceleration and weight

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



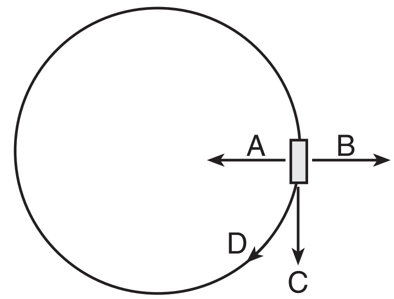
What is the total distance traveled by the object during the first 4 seconds?

(1) 5 m (3) 40 m
(2) 20 m (4) 80 m

39 An electrical generator in a science classroom makes a lightbulb glow when a student turns a hand crank on the generator. During its operation, this generator converts

(1) chemical energy to electrical energy
(2) mechanical energy to electrical energy
(3) electrical energy to mechanical energy
(4) electrical energy to chemical energy

40 In the diagram below, a cart travels clockwise at constant speed in a horizontal circle.



At the position shown in the diagram, which arrow indicates the direction of the centripetal acceleration of the cart?

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

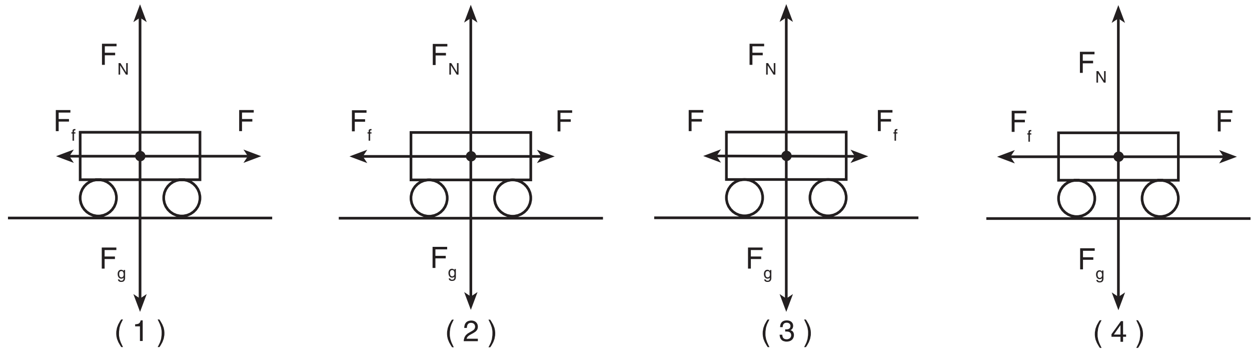
41 Which changes would cause the greatest increase in the rate of flow of charge through a conducting wire?

(1) increasing the applied potential difference and decreasing the length of wire
(2) increasing the applied potential difference and increasing the length of wire
(3) decreasing the applied potential difference and decreasing the length of wire
(4) decreasing the applied potential difference and increasing the length of wire

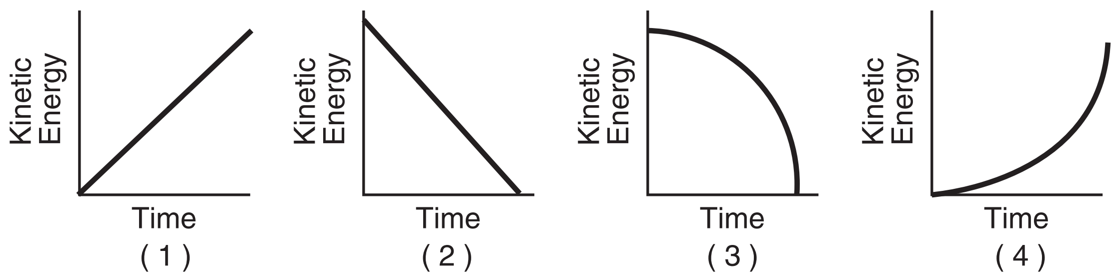
42 According to the Standard Model of Particle Physics, a meson is composed of

(1) a quark and a muon neutrino
(2) a quark and an antiquark
(3) three quarks
(4) a lepton and an antilepton

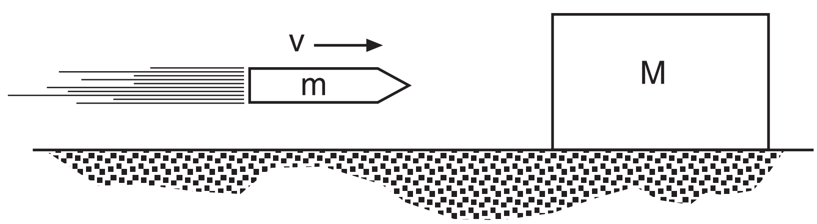
43 Which vector diagram best represents a cart slowing down as it travels to the right on a horizontal surface?



44 An object falls freely near Earth's surface. Which graph best represents the relationship between the object's kinetic energy and its time of fall?



45 In the diagram below, a block of mass M initially at rest on a frictionless horizontal surface is struck by a bullet of mass m moving with horizontal velocity v.



What is the velocity of the bullet-block system after the bullet embeds itself in the block?

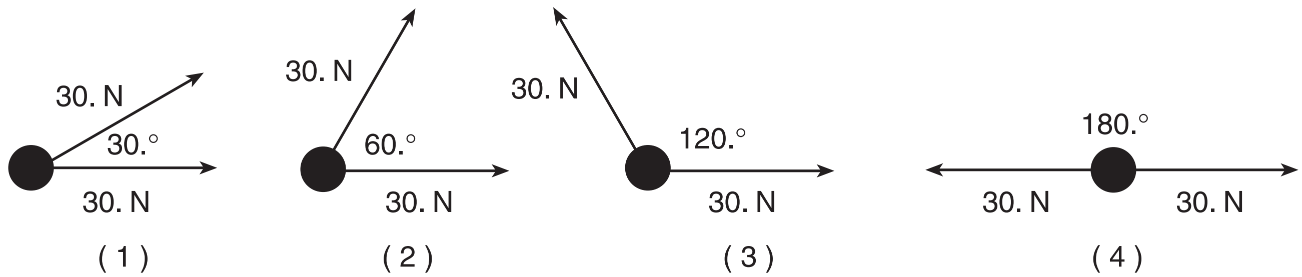
(1) $\left(\frac{M+v}{M}\right)m$

(2) $\left(\frac{m+M}{m}\right)v$

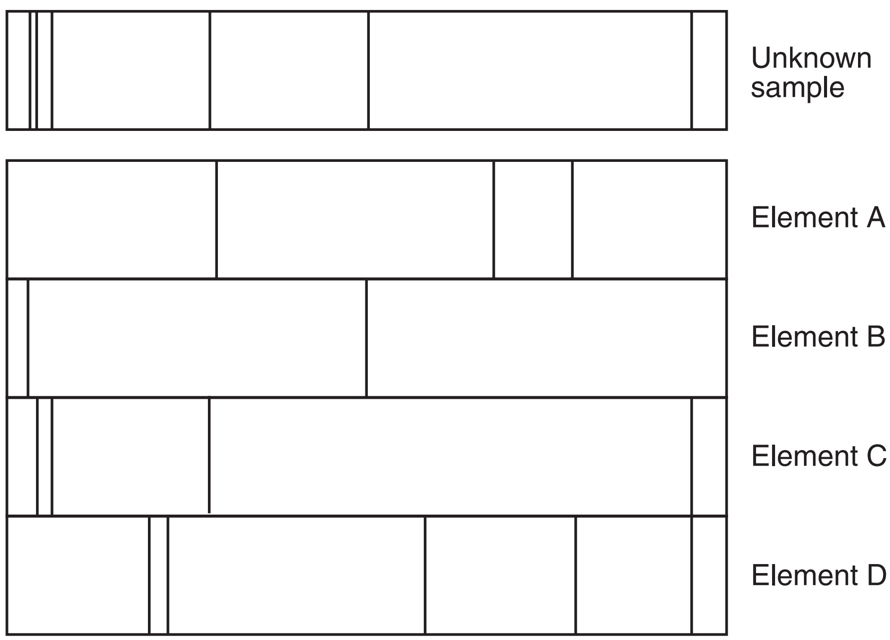
(3) $\left(\frac{m+v}{M}\right)m$

(4) $\left(\frac{m}{m+M}\right)v$

46 Two 30.-newton forces act concurrently on an object. In which diagram would the forces produce a resultant with a magnitude of 30. newtons?



47 The diagram below represents the bright-line spectra of four elements, *A*, *B*, *C*, and *D*, and the spectrum of an unknown gaseous sample.



Based on comparisons of these spectra, which two elements are found in the unknown sample?

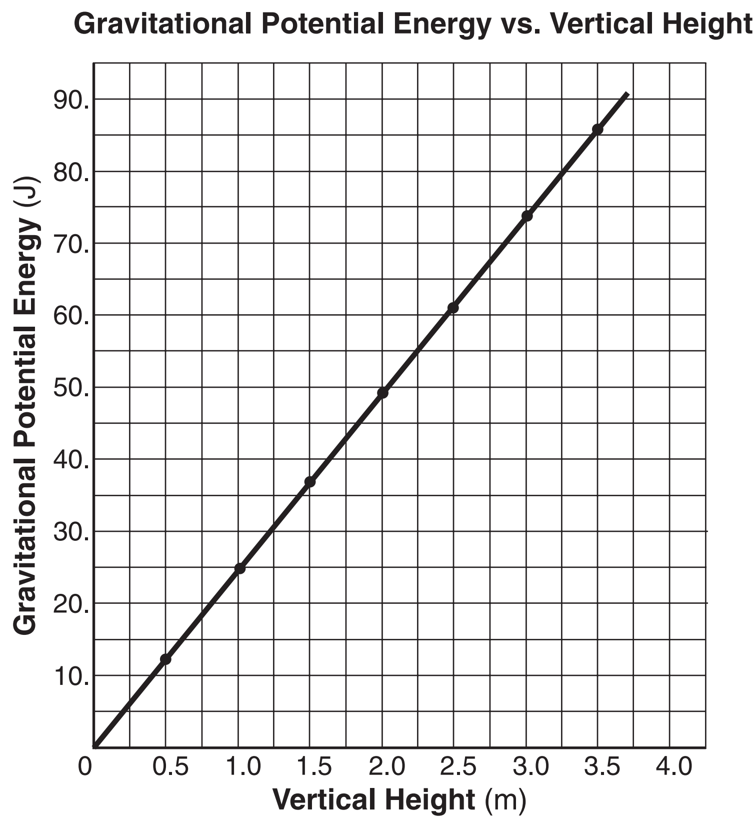
(1) *A* and *B*
(2) *A* and *D*
(3) *B* and *C*
(4) *C* and *D*

Part B–2

Answer all questions in this part.

Directions (48–61): Record your answers in the spaces provided in your answer booklet.

Base your answers to questions 48 through 51 on the graph below, which represents the relationship between vertical height and gravitational potential energy for an object near Earth's surface. (The same graph appears in your answer booklet.)



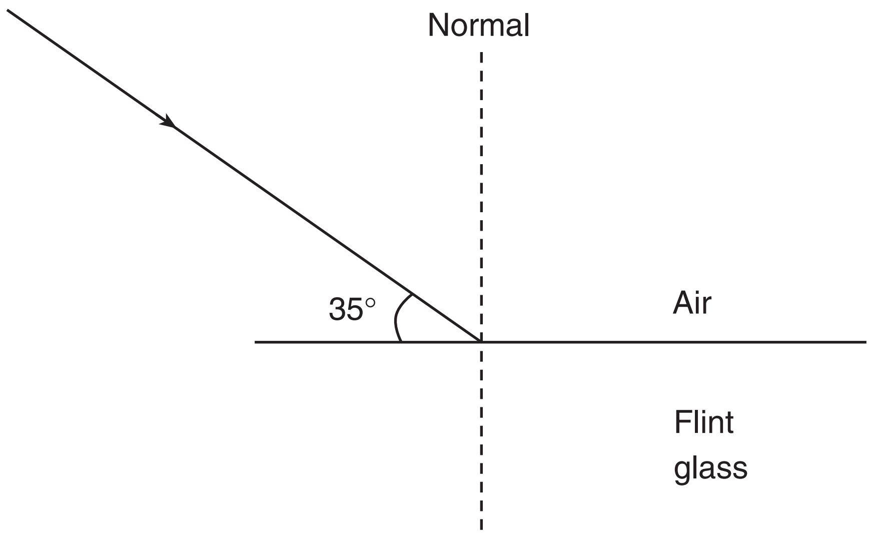
48 Based on the graph, what is the gravitational potential energy of the object when it is 2.25 meters above the surface of Earth? [1]

49 Using the graph, calculate the mass of the object. [Show all work, including the equation and substitution with units.] [2]

50 What physical quantity does the slope of the graph represent? [1]

51 Using a straightedge, draw a line on the graph *in your answer booklet* to represent the relationship between gravitational potential energy and vertical height for an object having a greater mass. [1]

Base your answers to questions 52 through 55 on the diagram below, which represents a ray of monochromatic light ($f = 5.09 \times 10^{14}$ hertz) in air incident on flint glass. (The same diagram appears in your answer booklet.)



52 Determine the angle of incidence of the light ray in air. [1]

53 Calculate the angle of refraction of the light ray in the flint glass. [Show all work, including the equation and substitution with units.] [2]

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

55 What happens to the light from the incident ray that is *not* refracted or absorbed? [1]

56 Objects in free fall near the surface of Earth accelerate downward at 9.81 meters per second^2. Explain why a feather does *not* accelerate at this rate when dropped near the surface of Earth. [1]

57 A skier on waxed skis is pulled at constant speed across level snow by a horizontal force of 39 newtons. Calculate the normal force exerted on the skier. [Show all work, including the equation and substitution with units.] [2]

58 A 1000-kilogram car traveling due east at 15 meters per second is hit from behind and receives a forward impulse of 6000 newton-seconds. Determine the magnitude of the car's change in momentum due to this impulse. [1]

59 On the diagram of a bar magnet *in your answer booklet,* draw a minimum of four field lines to show the magnitude and direction of the magnetic field in the region surrounding the bar magnet. [2]

60 After a uranium nucleus emits an alpha particle, the total mass of the new nucleus and the alpha particle is less than the mass of the original uranium nucleus. Explain what happens to the missing mass. [1]

61 An FM radio station broadcasts its signal at a frequency of 9.15×10^7 hertz. Determine the wavelength of the signal in air. [1]

Part C

Answer all questions in this part.

Directions (62–74): Record your answers in the spaces provided in your answer booklet.

Base your answers to questions 62 through 64 on the information below.

A projectile is fired from the ground with an initial velocity of 250. meters per second at an angle of 60.° above the horizontal.

62 On the diagram *in your answer booklet,* use a protractor and ruler to draw a vector to represent the initial velocity of the projectile. Begin the vector at point *P,* and use a scale of 1.0 centimeter = 50. meters per second. [2]

63 Determine the horizontal component of the initial velocity. [1]

64 Explain why the projectile has *no* acceleration in the horizontal direction. [Neglect air friction.] [1]

Base your answers to questions 65 through 67 on the information below.

An 18-ohm resistor and a 36-ohm resistor are connected in parallel with a 24-volt battery. A single ammeter is placed in the circuit to read its total current.

65 In the space *in your answer booklet,* draw a diagram of this circuit using symbols from the *Reference Tables for Physical Setting/Physics*. [Assume the availability of any number of wires of negligible resistance.] [2]

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

67 Calculate the total power dissipated in the circuit. [Show all work, including the equation and substitution with units.] [2]

Base your answers to questions 68 through 70 on the information below.

A periodic wave traveling in a uniform medium has a wavelength of 0.080 meter, an amplitude of 0.040 meter, and a frequency of 5.0 hertz.

68 Determine the period of the wave. [1]

69 On the grid *in your answer booklet,* starting at point *A*, sketch a graph of *at least one* complete cycle of the wave showing its amplitude and period. [2]

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

Base your answers to questions 71 through 74 on the Energy Level Diagram for Hydrogen in the *Reference Tables for Physical Settings/Physics.*

71 Determine the energy, in electronvolts, of a photon emitted by an electron as it moves from the $n = 6$ to the $n = 2$ energy level in a hydrogen atom. [1]

72 Convert the energy of the photon to joules. [1]

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

74 Is this the only energy and/or frequency that an electron in the $n = 6$ energy level of a hydrogen atom could emit? Explain your answer. [1]

Tear Here

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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.

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Signature

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ANSWER BOOKLET

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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

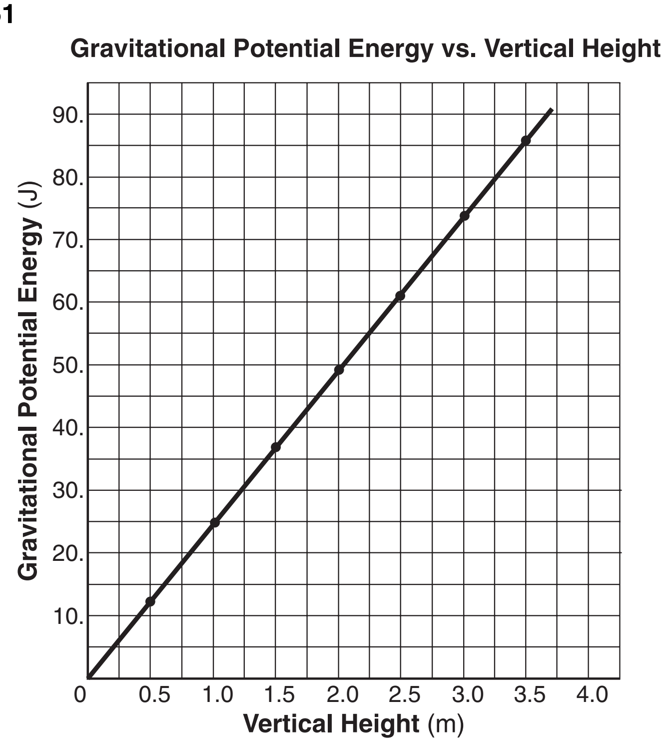
48 ________________________ **J**

49

50 ____

____

51



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53

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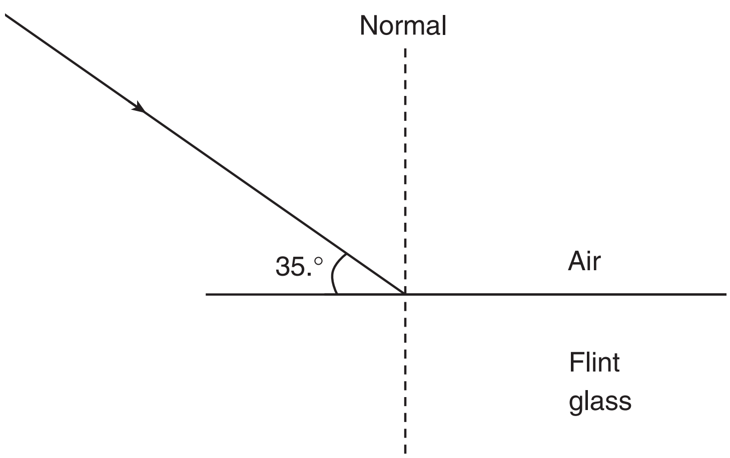


55 ____

____

56 ____

____

57

58 ____________________ $\frac{\text{kg}\bullet\text{m}}{\text{s}}$

59

60 ____

____

____

61 ________________ **m**

Part C

62

63 ____________________ m/s

64 ____

____

____

____

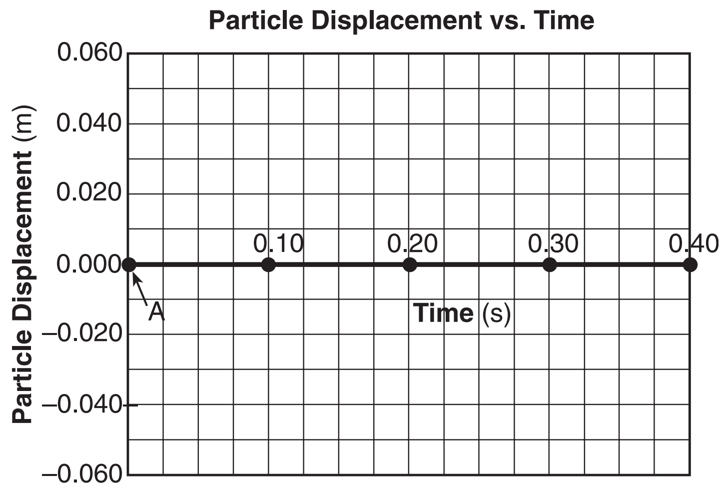
65

66

67

68 ____________________ s

69



70

71 ____________________ eV

72 ____________________ J

73

74 ____

____

____

FOR TEACHERS ONLY

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

PS–P

PHYSICAL SETTING/PHYSICS

Thursday, January 26, 2006 — 1:15 to 4:15 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 3 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. Visit the site http://www.emsc.nysed.gov/osa/ and select the link "Latest Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and at least one more time before the final scores for the examination are recorded.

Part A and Part B–1

Allow 1 credit for each correct response.

Part A

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

Part B–1

36 . . . . . **3**	42 . . . . . **2** . . . . .
37 . . . . . **1**	43 . . . . . **2** . . . . .
38 . . . . . **3**	44 . . . . . **4** . . . . .
39 . . . . . **2**	45 . . . . . **4** . . . . .
40 . . . . . **1**	46 . . . . . **3** . . . . .
41 . . . . . **1**	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 Administering and 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 checkmark 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 Thursday, January 26, 2006. 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 Allow 1 credit for 55 J.

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

Examples of 2-credit responses:

$$PE = mgh$$
$$m = \frac{PE}{gh}$$
$$m = \frac{25\,\text{J}}{(9.81\,\text{m/s}^2)(1.0\,\text{m})}$$
$$m = 2.5\,\text{kg} \quad or \quad 2.55\,\text{kg}$$

or

$$PE = mgh$$
$$m = \frac{55\,\text{J}}{(2.25\,\text{m})(9.81\,\text{m/s}^2)}$$
$$m = 2.5\,\text{kg}$$

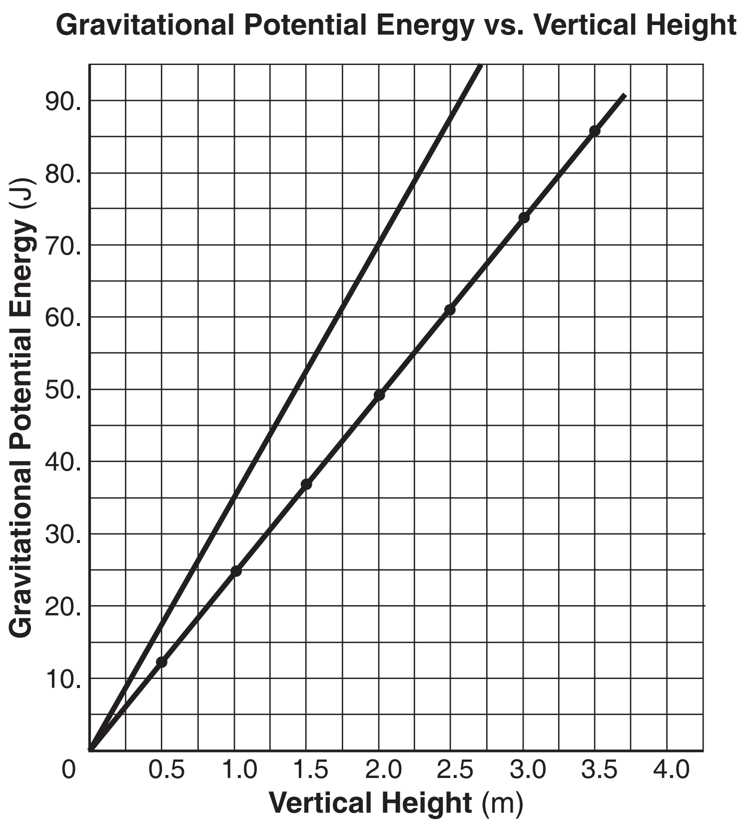
Allow credit for an answer that is consistent with the student's response to question 48.

50 Allow 1 credit. Acceptable responses include, but are not limited to:

— weight of object *or* weight
— *mg*
— force
— F_g

51 Allow 1 credit for drawing a line that would represent the relationship between gravitational potential energy and vertical height for an object having a greater mass. The line must be straight, with a slope steeper than that of the given line.

Example of a 1-credit response:



52 Allow 1 credit for 55° (±2°).

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

Example of a 2-credit response:

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

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

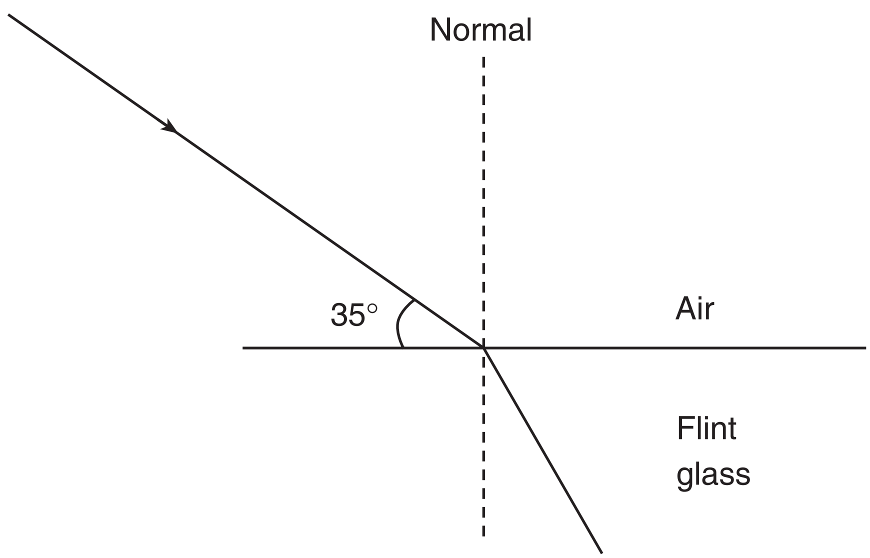
$$\sin\theta_2 = \frac{(1.00)(\sin 55°)}{1.66} = 0.493$$

$$\theta_2 = 29.6° \quad \text{or} \quad 30.°$$

Allow credit for an answer that is consistent with the student's response to question 52.

54 Allow 1 credit for drawing the refracted ray at an angle of 30.° (±2°).

Example of a 1-credit response:



Allow credit for an answer that is consistent with the student's response to question 53.

55 Allow 1 credit for stating what would happen to light from the incident ray that is not refracted or absorbed. Acceptable responses include, but are not limited to:

— reflected
— scattered

56 Allow 1 credit for indicating that a feather does not accelerate at 9.81 meters per second^2 when dropped near the surface of Earth because the net force is less than F_g. Acceptable responses include, but are not limited to:

— Air friction acts on the feather.
— The feather is not in free fall.

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

Example of a 2-credit response:

$$F_f = \mu F_N$$

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

$$F_N = \frac{39\text{ N}}{.05}$$

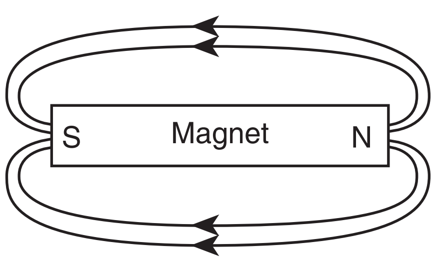
$$F_N = 780\text{ N}$$

58 Allow 1 credit for $6000\ \frac{\text{kg}\bullet\text{m}}{\text{s}}$.

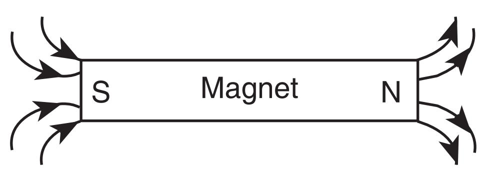
59 Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for drawing four field lines that do *not* cross and are closest together at the poles.
- Allow 1 credit for four field lines drawn from N to S.

Examples of 2-credit responses:



or



60 Allow 1 credit for indicating that mass is converted into energy.

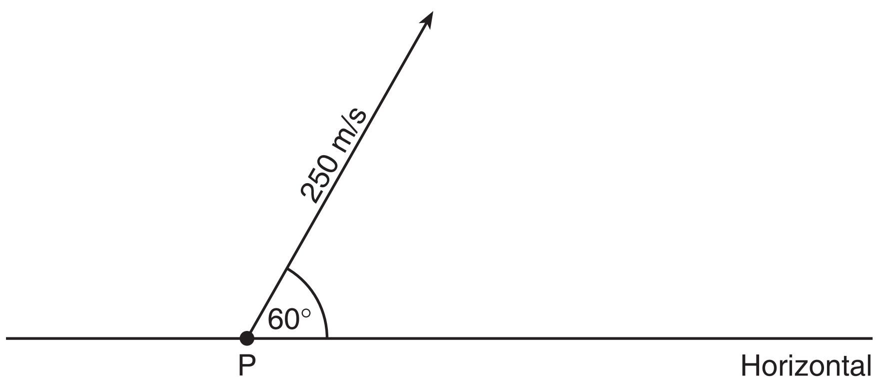
61 Allow 1 credit for 3.28 m *or* 3.3 m.

Part C

62 Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for a length of 5.0 cm (±0.2 cm) and an arrow.
- Allow 1 credit for an angle above the horizontal of 60.° (±2°).

Example of a 2-credit response:



63 Allow 1 credit for 125 m/s (± 10 m/s).

Allow credit for an answer that is consistent with the student’s response to question 62.

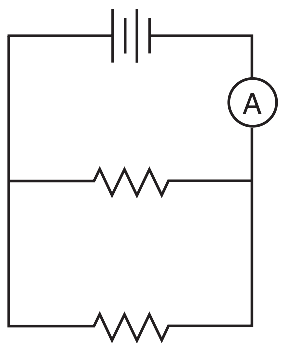
64 Allow 1 credit for explaining why the projectile has no acceleration in the horizontal direction. Acceptable responses include, but are not limited to:

— no force on object in horizontal direction
— The only force is vertical.
— Gravity acts only vertically.

65 Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for drawing a parallel circuit containing two resistors and a battery.
  Note: Do *not* allow this credit if the student draws a cell instead of a battery.
- Allow 1 credit for correct placement of the ammeter.

Example of a 2-credit response:



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

Example of a 2-credit response:

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_{eq}} = \frac{1}{18\,\Omega} + \frac{1}{36\,\Omega}$$

$$R_{eq} = 12\,\Omega$$

Allow credit for an answer that is consistent with the student's response to question 65.

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

Examples of 2-credit responses:

$$P = \frac{\mathrm{V}^2}{R}$$
$$P = \frac{(24\,\mathrm{V})^2}{12\,\Omega}$$
$$P = 48\,\mathrm{W}$$

or

$$I = \frac{\mathrm{V}}{R} = \frac{24\,\mathrm{V}}{12\,\Omega} = 2\,\mathrm{A}$$

and

$$P = VI$$
$$P = (24\,\mathrm{V})(2\,\mathrm{A})$$
$$P = 48\,\mathrm{W}$$

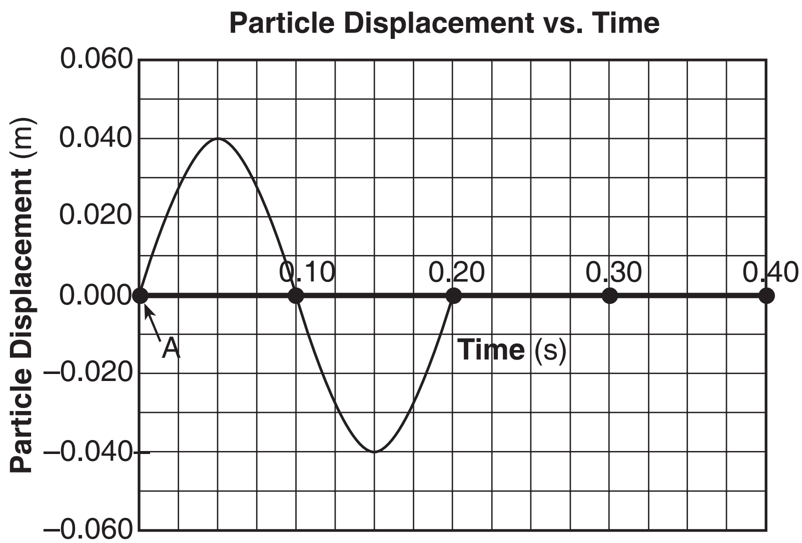
Allow credit for an answer that is consistent with the student's response to question 66.

68 Allow 1 credit for 0.20 s *or* $\frac{1}{5}$ s.

69 Allow a maximum of 2 credits, allocated as follows:

- Allow 1 credit for correct amplitude ± 0.3 grid space.
- Allow 1 credit for correct period ± 0.3 grid space.

Example of a 2-credit response:



Note: Allow credit for any periodic wave form (e.g., square or triangular) that meets these criteria.

Allow credit for an answer that is consistent with the student's response to question 68.

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

Examples of 2-credit responses:

$$v = f\lambda$$
$$v = (5.0\,\text{Hz})(0.080\,\text{m})$$
$$v = 0.40\,\text{m/s}$$

or

$$v = \frac{d}{t}$$
$$v = \frac{0.080\text{ m}}{0.2\text{ s}}$$
$$v = .4\text{ m/s}$$

71 Allow 1 credit for 3.02 eV.

72 Allow 1 credit for 4.83×10^{-19} J.

Allow credit for a response that is consistent with the student's response to question 71.

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

Example of a 2-credit response:

$$E = hf$$

$$f = \frac{E}{h}$$

$$f = \frac{4.83 \times 10^{-19}\ \text{J}}{6.63 \times 10^{-34}\ \text{J} \bullet \text{s}}$$

$$f = 7.29 \times 10^{14}\ \text{Hz}$$

Allow credit for an answer that is consistent with the student's response to question 72.

74 Allow 1 credit for explaining why this is not the only energy and/or frequency that an electron in the $n = 6$ energy level of a hydrogen atom could emit. Acceptable responses include, but are not limited to:

— No, the $n = 6$ level can return to any of the 5 lower energy levels.
— No, the electron can drop to many different energy levels.
— The electron can fall from $n = 6$ to any other level between $n = 5$ and $n = 1$.
— $6 \rightarrow 5$ $6 \rightarrow 4$ $6 \rightarrow 3$ $6 \rightarrow 1$

Note: Do *not* allow credit for "no" without a correct explanation.

Regents Examination in Physical Setting/Physics

January 2006

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

The *Chart for Determining the Final Examination Score for the January 2006 Regents Examination in Physical Setting/Physics* will be posted on the Department's web site http://www.emsc.nysed.gov/osa/ on Thursday, January 26, 2006. 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.

Map to Core Curriculum

(Corrected Edition—February 28, 2006)

January 2006 Physical Setting/Physics			
Question Numbers			
Key Ideas	Part A	Part B	Part C
Standard 1			
Math Key Idea 1	1,2,5,8,9,10,11,12,14,15,16,17,19,20,21,23,24,26	45,48,49,53,57,58,61	63,66,67,68,70,72,73
Math Key Idea 2	22	38	
Math Key Idea 3			
Sci. Inq. Key Idea 1			
Sci. Inq. Key Idea 2		55	
Sci. Inq. Key Idea 3	27,31	40,42,44,50,51	74
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			
Key Idea 6			
Standard 7			
Key Idea 1			
Key Idea 2			
Standard 4 Process Skills			
4.1		39,41,59,60	65
4.3		52,54	69
5.1		38,40,45,46,56,57,58	62,63,64
5.3		47	71
Standard 4			
4.1	15,16,17,18,19,20,21,22,23,24,25,26	37,39,41,44,48,49,50,51	65,66,67
4.3	28,29,30,31,32,34	52,53,54,55,61	68,69,70
5.1	1,2,3,4,5,6,7,8,9,10,11,12,13,14,27	38,40,43,45,46,56,57,58,59	62,63,64
5.3	33,35	42,47,60	71,72,73,74

University of the State of New York
State Education Department

Regents Examination in Physical Setting / Physics
January 2006

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

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

To determine the student’s final examination score, find the student’s total test raw score in the column labeled “Raw Score” and then locate the scaled score that corresponds to that raw score. The scaled 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 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. The chart above is usable only for this administration of the physical setting / physics examination.